

**Mid-West University  
Graduate School of Education  
Surkhet, Nepal**



**Bachelor of Science Education (BEd-Sc)  
Curriculum  
1<sup>st</sup> Semester**

# **Bachelor of Science Education (BEd-Sc)**

## **Curriculum**

### **1<sup>st</sup> Semester**

| <b>S. No</b> | <b>Course Code No</b> | <b>Course Name</b>              | <b>Credit Hour</b> | <b>Feature</b>       |
|--------------|-----------------------|---------------------------------|--------------------|----------------------|
| 1.           | SCED 414              | Fundamental Physics Education   | 3                  | T-2, P-1             |
| 2.           | SCED 415              | Fundamental Chemistry Education | 3                  | T-2, P-1             |
| <b>Total</b> |                       |                                 | <b>6</b>           | <b>Th-4<br/>Pr-2</b> |

Course Title: **Fundamental Physics Education**  
 Course Code: SCED 414  
 Semester: I  
 Total Credit: 2+1 (Th. + Pr.)

Full Marks: 80 (T) +20 (P)  
 Pass Marks: 40 (T) +10 (P)  
 Nature of Course: Theory + Practical  
 Total Period: 32+48 (Th. + Pr.) = 80 Periods

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The theoretical parts consists of different units of general physics. The major topics included in this course are Mechanics, Heat and optics, electricity and magnetism, Wave and sound, Modern physics and Astro science. In practical parts, different experiments to be performed which are listed in particle course, besides this experiment performed, preparation of improvised teaching materials, field visit and report writing or analyses different physics related issues are also included. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. The students are required to secure pass marks in theory as well as practical course separately.

### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                          | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Periods |
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| <ul style="list-style-type: none"> <li>Describe the need for measurement, SI Units, Fundamental and derived units.</li> <li>Define and explain the parallelogram, addition and substation of vectors,</li> <li>Elaborate the Introduction, Mechanical advantage, efficiency and velocity ratio, law of moment, moment of forces, torque</li> <li></li> </ul> | <b>Unit 1: Mechanics</b> <ul style="list-style-type: none"> <li>Unit and measurement               <ol style="list-style-type: none"> <li>need for measurement,</li> <li>SI Units,</li> <li>Fundamental and derived units.</li> <li>Relation between FPS, CGS, MKS system,</li> <li>Measurement of time, length and mass</li> <li>Error in measurement,</li> <li>Uncertainty and Significant Figures.</li> </ol> </li> <li>Scalar and vector quantities, parallelogram,               <ol style="list-style-type: none"> <li>addition and substation of vectors,</li> </ol> </li> <li>Simple machine:               <ol style="list-style-type: none"> <li>Introduction,</li> <li>Type simple machine</li> <li>Use of simple machine</li> <li>Mechanical advantage,</li> <li>efficiency and velocity ratio,</li> <li>law of moment,</li> <li>moment of forcess,</li> <li>torque</li> </ol> </li> <li>Force :               <ol style="list-style-type: none"> <li>Newton's law of motion,</li> <li>inertia,</li> <li>conservation of linear momentum,</li> <li>application of Newton's law of motion,</li> <li>Verification of Newton's law of gravitation,</li> <li>acceleration due to gravity,</li> <li>mass and weight,</li> <li>variation of value of "g",</li> <li>free fall and weightlessness,</li> <li>simple harmonic motion and its application,</li> <li>motion of satellites,</li> <li>escape velocity</li> </ol> </li> <li>Work , energy and power:</li> </ul> | 6       |

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|   | <ol style="list-style-type: none"> <li>1. work done by constant and variable force,</li> <li>2. kinetic energy,</li> <li>3. potential energy,</li> <li>4. work energy theorem,</li> <li>5. conservation of energy,</li> <li>6. relationship between work, energy and power,</li> </ol> <ul style="list-style-type: none"> <li>• Fluid mechanics and dynamics : <ol style="list-style-type: none"> <li>1. Pressure in a fluid,</li> <li>2. Law of flotation,</li> <li>3. Archimedes Principle,</li> <li>4. Application of atmospheric pressure, (measurement and use)</li> <li>5. variation in atmospheric pressure</li> <li>6. Surface tension,</li> <li>7. Newton's law of viscosity,</li> <li>8. Stokes law and its application, -</li> <li>9. Bernoulli's equation and its application</li> <li>10. Introduction of Rotational dynamics,</li> <li>11. Hook's law, and</li> </ol> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |
| • | <p><b>Unit 2: Heat and optics</b></p> <ul style="list-style-type: none"> <li>• Heat and temperature,</li> <li>• Measurement of temperature,</li> <li>• Concept of heat and temperature and its units,</li> <li>• Source of heat</li> <li>• Relation between Fahrenheit, Celcius and Kelvin scale</li> <li>• thermometry,</li> <li>• Thermal expansion,</li> <li>• liquid expansion</li> <li>• Heat capacity and Specific heat capacity,</li> <li>• Newton's law of cooling,</li> <li>• changes of phases,</li> <li>• latent heat</li> <li>• Transfer of heat :</li> <li>• conduction, convection and radiation</li> <li>• Thermal properties of matter: Equation of state, ideal gas equation, molecular properties of matter, kinetic energy of gas molecule</li> <li>• Saturated and unsaturated vapor pressure, absolute humidity, relative humidity and its determination</li> <li>• Introduction of first law and second law of thermodynamics and its application</li> </ul> <p><b>Optics</b></p> <ul style="list-style-type: none"> <li>• Reflection and refraction and light 1.4.10 Nature and propagation of light 1.4.12 Phenomenon of polarization of light ,Reflection at curve mirror,</li> <li>• concave and convex mirror,</li> <li>• mirror formula,</li> <li>• real and virtual images</li> <li>• Refraction through prism:</li> <li>• minimum deviation,</li> <li>• relationship between angle of prism,</li> <li>• minimum deviation and refractive index</li> </ul> | 6 |

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|   | <ul style="list-style-type: none"> <li>• Introduction of lens, lens maker formula, power of lens</li> <li>• Optical instruments :</li> <li>• Human eye,</li> <li>• defect of vision and its correction,</li> <li>• camera,</li> <li>• microscope,</li> <li>• telescope and binocular</li> <li>• Nature and propagation of light,</li> <li>• Huygen's principle,</li> <li>• velocity of light,</li> <li>• Phenomena of interference, coherent sources,</li> <li>• Newton's ring</li> <li>• Concept and Phenomenon of diffraction and polarization of light</li> <li>• Defects of vision and their correction</li> <li>• Nature and propagation of light</li> <li>• Refraction at plane surfaces</li> <li>• Wave nature of light</li> <li>• Numerical problems related to mechanics, heat and optics.</li> </ul>             |   |
| • | <b>Unit 3: Wave and Sound</b> <ul style="list-style-type: none"> <li>• Free, damped and forced oscillation,</li> <li>• Longitudinal and Transverse motion of waves, progressive and stationary waves</li> <li>• Vibratory motion,</li> <li>• Reflection and refraction of sound waves</li> <li>• Velocity of sound in solid, liquid and gas, Effect of temperature, pressure and humidity on velocity of sound</li> <li>• Velocity of sound in air,</li> <li>• Characteristics of sound: Intensity, loudness, pitch, quality, Doppler effect,</li> <li>• Concept of in wave and strings, law of vibration of fixed string</li> <li>• Principle of superposition; Resonance,</li> <li>• Sonometer</li> <li>• Infrasonic and ultrasonic waves,</li> <li>• sound pollution,</li> <li>• 9.1.2 Ultra and Infra sound</li> </ul> | 5 |
| • | <b>Unit 4: Electricity and Magnetism</b> <ul style="list-style-type: none"> <li>• Electric circuit</li> <li>• Ohm's law,</li> <li>• Electrical resistance, resistivity and conductivity,</li> <li>• Current - voltage relations,</li> <li>• Ohmic and non Ohmic resistance , Resistance in series and parallel</li> <li>• Consumption of electricity</li> <li>• Electromotive force and potential difference</li> <li>• Joule's law and its verification</li> <li>• Electrical circuits- Kirchhoff's laws, Wheatstone bridge circuit</li> <li>• P.O. box, meter bridge and potentiometer</li> <li>• Faraday's laws of electrolysis, verification of Faraday's law of electrolysis</li> </ul>                                                                                                                               | 4 |

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|   | <ul style="list-style-type: none"> <li>• Magnetic field of current</li> <li>• Molecular theory of magnetism</li> <li>• Methods of preparation of magnets</li> <li>• Magnetic field and magnetic lines of forces</li> <li>• Dip and dip circle</li> <li>• Relative permeability, susceptibility, hysteresis,</li> <li>• Elements of earth magnetism</li> <li>• Dia-, Para- and Ferro-magnetic materials</li> <li>• Magnetic effect of current-Oersted's experiment</li> <li>• Faraday's law of electromagnetic induction,</li> <li>• Lenz's law, eddy current</li> <li>• Generator, Dynamo and transformer</li> <li>• Introduction of alternative current, peak and RMS value of AC current and voltage</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                             |   |
|   | <b>Unit 5: Modern Physics</b> <ul style="list-style-type: none"> <li>• Milikan's oil drop experiments. Cathode rays, motion of electron in electric and magnetic field,</li> <li>• Quantum nature of radiation, Einstein photo electric effect</li> <li>• Introduction of solids and semiconductor devices</li> <li>• Quantization of energy - Bohr's theory of hydrogen atom, Uncertainty principle</li> <li>• Nature, production, properties and uses of laser,</li> <li>• Nature, production, and uses of X- rays, Bragg's law</li> <li>• Radioactivity: Alfa particles, Beta particles, Gama rays, law radioactive disintegration, half-life and decay constant,</li> <li>• radioactivity, nuclear reaction and nuclear reactions in the sun</li> <li>• Radioactivity (Meaning ,Properties and Uses)</li> <li>• Nuclear Reaction : Meaning and its Types</li> <li>• Nuclear energy : Energy released from fission and fission, thermal and hydroelectric power, wind energy, Biofuels, solar energy</li> <li>• Particle physics and cosmology : Particle and antiparticles, Quarks, leptons,baryons and mesons</li> </ul> | 6 |
| • | <b>Unit 6: The universe</b> <ul style="list-style-type: none"> <li>• Important constituents of the universe,</li> <li>• Solar system</li> <li>• Galaxies</li> <li>• Rotation of the earth</li> <li>• Phases of moon</li> <li>• Lunar and solar eclipses</li> <li>• Birth and death of stars and its significance</li> <li>• Brightness of stars</li> <li>• Pulsars and quasars</li> <li>• Identification of stars and planet</li> <li>• Heliocentric theory</li> <li>• Comets, meteors and meteorites</li> <li>• Constellations</li> <li>• Zodiac Constellation</li> <li>• Identification of stars and constellations</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 5 |

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|  | <ul style="list-style-type: none"> <li>• Natural and artificial satellites`</li> <li>• Universe : Hubble law, Big Bang, Critical density, Dark matter</li> <li>• Black hole</li> <li>• astronomical instruments,</li> </ul> |  |
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*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

**1. Course Description**

This course is designed for the students who specialize in science education at Bachelor level of Mid-West University. This course has divided in to two parts: Theory and Practical. The theoretical parts consists of different units of general chemistry or physical, inorganic and organic chemistry. The major topics included in this course are atomic structure, Chemical bonding, periodic table, chemical reactions, metallurgy and materials used in daily life, and hydrocarbon. In practical parts, different experiments to be performed which are listed in particle course, besides this experiment performed, preparation of improvised teaching materials, field visit and report writing or analyses different chemistry related issues are also included. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. The students are required to secure pass marks in theory as well as practical course separately.

**2. General Objectives**

On the completion of this course student will be able to following general objectives:

- To provide students with the general knowledge and basic aspects of physical, inorganic and organic chemistry.
- To describe the principle of atomic structure with the help of different theory and their postulates.
- To enable the students in dealing with the principle of chemical bonding, hybridization, VSEPR theory, VBT and MOT.
- To familiarize the students with different form of periodic table and periodic properties of an elements.
- To help the students analyze different types of chemical reactions.
- To acquaint the students with the basic concepts of metallurgy, extraction and chemistry of mentioned metals, and chemistry of different materials which are used in daily life.
- To enable the students familiarize with the basic concepts of mentioned hydrocarbons.
- To provide students with an opportunity to understand inquiry based chemistry education with its application on pedagogy and other various fields.
- To inculcate the knowledge and skills of chemistry through pedagogical learning experiences and practical activities.
- To enable students to prepare report on their field visit, write practical record file by using appropriate methods and approaches.
- To enable students conducting experiment on separate inorganic salts mixture, titration and detection of hetero elements.
- To help the students develop project work and making teaching learning materials.

**3. Specific Objectives and Contents****Part 1: Theory**

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                               | Contents                                                                                                                                                                                                                                 | Periods |
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| <ul style="list-style-type: none"> <li>• Describe the main postulates, limitation and modification of Dalton's atomic theory.</li> <li>• Define and explain the fundamental particles on the basis of discovery of electron, proton and neutron.</li> <li>• Elaborate the nature and structure of the nucleus of the atom.</li> <li>• Explain the Rutherford's and Bohr's atomic model</li> </ul> | <b>Unit 1: Atomic Structure</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Daltons atomic theory</li> <li>• Fundamentals particles</li> <li>• Structure of nucleus</li> <li>• Rutherford's atomic model</li> </ul> | 6       |



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| <p>and its limitation.</p> <ul style="list-style-type: none"> <li>• Elaborate the Bohr's explanation of hydrogen spectrum.</li> <li>• Explain Bohr-Bury scheme</li> <li>• Differentiate between orbit and orbitals and draw the structure of different orbitals.</li> <li>• Calculate radius of orbit and energy of an electrons in an orbit.</li> <li>• State and explain the Pauli's, Aufbau and Hund's rule of maximum multiplicity.</li> <li>• Draw energy profile diagram of multi-electron atom.</li> <li>• Construct electronic configuration of elements and ions.</li> <li>• Compare the stability of completely filled, half-filled and empty orbitals.</li> <li>• Elaborate the wave mechanical concept of atom and matter wave.</li> <li>• Deduce deBroglie's and Heisenberg's equation.</li> <li>• Solve the numerical problems on the above given topics.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>and its limitations</p> <ul style="list-style-type: none"> <li>• Bohr's atomic postulates and it's limitations</li> <li>• Hydrogen spectrum</li> <li>• Bohr-Burry scheme</li> <li>• Orbits and orbitals</li> <li>• Quantum number</li> <li>• Pauli's, and Aufbau principle</li> <li>• Hund's rule of maximum multiplicity</li> <li>• Wave mechanical concept</li> <li>• Matter wave</li> <li>• deBroglie's equation</li> <li>• Heisenberg's equation</li> <li>• Numerical problems</li> </ul>                                                                                               |   |
| <ul style="list-style-type: none"> <li>• Explain the nature and types of forces between atoms.</li> <li>• State and explain the octate and duplet rule with examples and limitation.</li> <li>• List the postulates of electronic theory of valency.</li> <li>• Define and explain the ionic, covalent and co-ordinate bond on the basis of formation, characteristics of compounds and examples.</li> <li>• Describe the covalent characteristics of ionic compounds.</li> <li>• Explain hydrogen bonding with the help of its types, theory, consequences, application and different examples.</li> <li>• Define and explain metallic bonding with example.</li> <li>• Explain VSEPR theory and identify the shape of molecules on the basis of this theory.</li> <li>• List the main postulates of VBT and MOT and its limitation.</li> <li>• Differentiate between Sigma (<math>\sigma</math>) and Pi (<math>\pi</math>) bond and describe its condition for the formation with examples.</li> <li>• Describe LCAO approach and differentiate bonding and antibonding MOT.</li> <li>• Compare VBT and MOT.</li> <li>• Define hybridization and explain SP, SP<sup>2</sup> and SP<sup>3</sup> hybridization with their characteristics and examples.</li> <li>• Define and explain the bond moment and dipole moment and their effect on properties of the compounds.</li> <li>• State and explain resonance energy with examples.</li> </ul> | <p><b>Unit 2: Chemical Bonding</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Origin of the chemical bond</li> <li>• Octate and Deplete rule</li> <li>• Electronic theory of valency</li> <li>• Ionic, covalent and co-ordinate bond</li> <li>• Hydrogen bonding</li> <li>• Metallic bonding</li> <li>• VSEPR theory</li> <li>• Valence bond theory</li> <li>• Sigma(<math>\sigma</math>) and Pi(<math>\pi</math>) bond</li> <li>• Molecular orbital theory</li> <li>• Hybridization</li> <li>• Bond moment and dipole moment</li> <li>• Resonance energy</li> </ul> | 6 |
| <ul style="list-style-type: none"> <li>• Draw the Lotther-Mayer's volume curve and describes its characteristics.</li> <li>• Define and explain Mendeleve's periodic tables and</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p><b>Unit 3: Periodic Table</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Lotther-Mayer's volume</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 5 |

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| <p>its limitations.</p> <ul style="list-style-type: none"> <li>State and explain modern periodic law, periodicity properties and table.</li> <li>Compare modern periodic table and Mendeleve's periodic table.</li> <li>List the merits and demerits of modern periodic table.</li> <li>Classify modern periodic table on the basis of electronic configuration.</li> <li>Explain the general characteristics of s, p, d and f block elements.</li> <li>Describe the features of groups and periods in modern periodic table.</li> <li>Elaborate the physical and chemical properties of elements on the basis of periods and groups.</li> <li>Describe the periodic properties of an elements such as electronegativity, electron affinity and ionization potential (including factors).</li> </ul>               | <p>curve</p> <ul style="list-style-type: none"> <li>Mendeleve's periodic table and its limitation</li> <li>Modern periodic table</li> <li>Periodicity of an elements</li> <li>Merits and Demerits of modern periodic table</li> <li>Characteristics of elements on the basis of electronic configuration</li> <li>Physical and chemical properties of an elements</li> <li>Periodic properties</li> </ul>                                                                                                  |   |
| <ul style="list-style-type: none"> <li>List the different types of chemical reactions.</li> <li>Explain photochemical and thermochemical reactions with examples.</li> <li>Differentiate between thermochemical and photochemical reactions.</li> <li>State and explain the laws of photochemistry and photochemical equivalent.</li> <li>Elaborate the photochemical gas reaction and photosynthesized reaction.</li> <li>Explain redox reaction on the basis of electronic concept of oxidation and reduction.</li> <li>State oxidation number, oxidizing and reducing agent, and calculate oxidation number of different compounds.</li> <li>Balance redox reaction by oxidation number and ion electron number methods.</li> <li>Define redox titrations with different examples.</li> </ul>                   | <p><b>Unit 4: Chemical Reactions</b></p> <ul style="list-style-type: none"> <li>Introduction</li> <li>Different types of chemical reaction <ul style="list-style-type: none"> <li>Photochemical reaction</li> <li>Thermochemical reaction</li> <li>Photochemical gas reaction</li> <li>Photosensitized reaction</li> <li>Redox reaction</li> <li>Redox titrations</li> </ul> </li> </ul>                                                                                                                   | 4 |
| <ul style="list-style-type: none"> <li>Differentiate among metals, nonmetals and metalloids on the basis of their physical and chemical properties.</li> <li>List the mineral resources of Nepal.</li> <li>Define metallurgy, describe its types and important processes.</li> <li>Explain the extraction process, important properties and uses of copper, Iron and steel, zinc, mercury, aluminium, silver and gold.</li> <li>Describe the importance of man-made materials in the context of Nepal.</li> <li>Explain the methods of preparations, properties and uses of different man- made materials such as cement, paints, glass, pesticides, soaps, detergents and ceramics.</li> <li>Write the project work on the environmental impacts of using man- made materials in the context of Nepal.</li> </ul> | <p><b>Unit 5: Metallurgy and Materials used in daily life</b></p> <ul style="list-style-type: none"> <li>Introduction</li> <li>Metals, Nonmetal and metalloids</li> <li>Mineral resources of Nepal</li> <li>Metallurgy</li> <li>Important process of metallurgy</li> <li>Extraction, properties and uses of: Copper, Iron and Steel, Zinc, Mercury, Aluminium, Silver and Gold</li> <li>Preperation, properties and uses of : Cement, Paints, Glass, Pesticides, Soaps, Detergents and Ceramics</li> </ul> | 6 |
| <ul style="list-style-type: none"> <li>Define and classify hydrocarbons.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p><b>Unit 6: Hydrocarbon</b></p> <ul style="list-style-type: none"> <li>Introduction</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                           | 5 |

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| <ul style="list-style-type: none"> <li>Differentiate between aliphatic and aromatic hydrocarbons.</li> <li>Define hetero elements and detects hetero elements presents in hydrocarbon.</li> <li>Estimates the different elements presents in hydrocarbon such as carbon and hydrogen, Nitrogen (Dumas and Kjeldahl method), halogens (Carius and Oxygen flask methods) and oxygen.</li> <li>Describe the orientation of aromatic hydrocarbon with different examples.</li> <li>Elucidate the structure of alkane, alkene, alkyne and benzene.</li> <li>Describe the methods of preparations, properties and uses of alkane, alkene, alkyne and benzene (including laboratory preparations).</li> <li>Distinguish between alkane, alkene and alkyne with references to different chemical tests.</li> <li>State and explain stereochemistry and isomerism of hydrocarbons on the basis of types and suitable examples.</li> </ul> | <ul style="list-style-type: none"> <li>Aromatic and aliphatic hydrocarbon</li> <li>Detection of hetero elements</li> <li>Estimation of elements.</li> <li>Huckel's rule of aromaticity</li> <li>Orientation of aromatic hydrocarbon</li> <li>Structure, preparation, properties and uses of : Benzene, Alkane, Alkene and Alkyne</li> <li>Stereochemistry and isomerism</li> </ul> |  |
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*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Contents                                                                                                                                                         | Periods |
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| <ul style="list-style-type: none"> <li>To analyze the given inorganic salt mixtures containing two cations and two anions (at least three mixture).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Unit 1: Salt Analysis</b> <ul style="list-style-type: none"> <li>Inorganic salt mixtures</li> <li>Cations and anions</li> </ul>                               |         |
| <ul style="list-style-type: none"> <li>To prepare primary standard solution of N/10 oxalic acid, N/10 <math>\text{KMnO}_4</math> and N/10 <math>\text{K}_2\text{Cr}_2\text{O}_7</math> solution.</li> <li>To prepare Deci normal solution of potassium permanganate and standardization of oxalic acid solution.</li> <li>To determine the strength of bench <math>\text{H}_2\text{SO}_4</math> with the help of standard <math>\text{NaOH}</math> and <math>\text{Na}_2\text{CO}_3</math> solution and express concentration in terms of normality, molarity, gm/ltr and percentage by volume.</li> </ul> | <b>Unit 2: Titration</b> <ul style="list-style-type: none"> <li>Preparation of solution</li> <li>Acid base titration</li> <li>Redox titration</li> </ul>         |         |
| <ul style="list-style-type: none"> <li>Do detect the hetero element present in the given hydrocarbons (at least four samples).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Unit III: Detection of Hetero Elements</b> <ul style="list-style-type: none"> <li>Detection of N, S, both N and S, and halogens</li> </ul>                    |         |
| <ul style="list-style-type: none"> <li>To construct the teaching learning materials for the theory part related topics (at least five materials).</li> <li>To prepare model of an atom, benzene, alkane, alkene, alkyne, ammonia molecule and water molecule (at least five).</li> <li>To prepare chart of Modern Periodic Table and Lothar-Mayer's volume curve.</li> </ul>                                                                                                                                                                                                                               | <b>Unit IV: Preparing Teaching Learning Materials</b> <ul style="list-style-type: none"> <li>Construction of materials</li> <li>Model</li> <li>Chart</li> </ul>  |         |
| <ul style="list-style-type: none"> <li>Select the chemistry related issues and planning, organizing and analyzing of the selected issues (prepare report) and present in classroom.</li> </ul> <p style="text-align: center;"><b>Or</b></p>                                                                                                                                                                                                                                                                                                                                                                | <b>Unit V: Issues and Report Witting</b> <ul style="list-style-type: none"> <li>Chemistry related issues</li> </ul> <p style="text-align: center;"><b>Or</b></p> |         |

|                                                                                                                                                                                                                     |                                                                                  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|--|
| <ul style="list-style-type: none"> <li>Visit the chemistry related industries, factories or other area than observe different chemical processes of this field and write, submit and present the report.</li> </ul> | <ul style="list-style-type: none"> <li>Field visit and Report writing</li> </ul> |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|--|

#### 4. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Group work, Report writing and presentation
- Construction of learning materials
- Individually laboratory work
- Field work

#### 5. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

##### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                         |                  |
|-----------------------------------------|------------------|
| 1) Attendance                           | 5 points         |
| 2) Participation in learning activities | 5 points         |
| 3) First assignment ( Presentation)     | 10 points        |
| 4) Second assignment (Term exam)        | 10 points        |
| 5) Third assignment (Project work)      | 10 points        |
| <b>Total</b>                            | <b>40 points</b> |

##### 5.2 Theory: External evaluation (Full marks 50)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |           |
|--------------|------------------------------------------------------------------|-----------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points |
| <b>Total</b> |                                                                  | 40 points |

**Note: All questions are compulsory**

### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination           | Area                                               | Points  | Total Points |
|-----------------------|----------------------------------------------------|---------|--------------|
| Internal              | Regularity                                         | 1.5     | 4 points     |
|                       | Practical Performance                              | 1       |              |
|                       | Record book                                        | 1.5     |              |
| External              | Experiment (at least 2 Exp.)                       | 8 (4+4) | 11 Points    |
|                       | Viva                                               | 3       |              |
| External and Internal | Construction of materials<br>Model and Chart       | 2.5     | 5 points     |
|                       | Issues <b>Or</b> Field visit and Report<br>writing | 2.5     |              |
| Total Points          |                                                    |         | 20 points    |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

### Recommended Book

**Mid-West University  
Graduate School of Education  
Surkhet, Nepal**



**Bachelor of Science Education (BEd-Sc)  
Curriculum  
2<sup>nd</sup> Semester**

# Bachelor of Science Education (BEd-Sc)

## Curriculum

### 2<sup>nd</sup> Semester

| <b>S. No</b> | <b>Course Code No</b> | <b>Course Name</b>            | <b>Credit Hour</b> | <b>Feature</b>       |
|--------------|-----------------------|-------------------------------|--------------------|----------------------|
| 1.           | SCED 424              | Teaching Science              | 3                  | T-2, P-1             |
| 2.           | SCED 425              | Fundamental Biology Education | 3                  | T-2, P-1             |
| <b>Total</b> |                       |                               | <b>6</b>           | <b>Th-4<br/>Pr-2</b> |

Course Title: **Teaching Science**  
 Course Code: SCED 424  
 Time per Credits: 2(T) +3( Pr) /Week/group (p)  
 Semester: B.Ed. / II

Full Marks: 80 (T) +20 (P)  
 Nature of Course: Theory + Practical  
 Total Credit: 2+1 (Th. + Pr.)  
 Total Period: 32+48 (Th. + Pr.) = 80 Periods

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The theoretical parts consists of different units related to nature, methods, aims and objectives, etc .

### General Objectives

On the completion of this course student will be able to following general objectives:

### 2. Specific Objectives and Contents

#### Part 1: Theory

| Specific Objectives | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Periods |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| •                   | <b>Unit 1: Nature, Issues and Trends in Science Education</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Historical development of science and science education</li> <li>• Process of science education</li> <li>• Paradigm shifts in science and science education</li> <li>• Science projects 2000+</li> <li>• Scientific temper, attitude and understanding</li> <li>• Science for all</li> <li>• Review of science in school and historical context</li> <li>• STS, STE and STL</li> <li>• Critical thinking in science education</li> <li>• Problems and issues of science teaching and learning</li> <li>• Contribution of STE in contemporary issues</li> <li>• Teaching science for the future.</li> </ul> | 6       |
| •                   | <b>Unit 2: Learning theories and it's implication</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Piaget's stages of intellectual growth</li> <li>• Bruner's model of concept learning</li> <li>• Suchman's inquiry model</li> <li>• Gagne's model of sequential learning</li> <li>• Ausubel's theory of cognitive susumption</li> <li>• Constructivism (Meaning, types, Strategies, 5e's model, role and application)</li> </ul>                                                                                                                                                                                                                                                                                    | 5       |
| •                   | <b>Unit 3: Objectives and Curriculum of Science Education</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Base of the formulation of objectives</li> <li>• Function of educational objectives</li> <li>• Bloom's taxonomy of educational objectives</li> <li>• Behavioral objectives</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                      | 5       |



|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|   | <ul style="list-style-type: none"> <li>• Critical study of secondary school science objectives</li> <li>• Importance of science curriculum</li> <li>• Principle of curriculum development</li> <li>• Steps in good science curriculum development</li> <li>• Critical analysis of present school science curriculum</li> <li>• Science curriculum project: BSCS, CHEM, CBA, PSSC and Nuffield science</li> </ul>                                                                                                                                                                                                                                                                             |   |
| • | <b>Unit 4: Approaches and Methods of Science Education</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Approaches of teaching science (Inductive and deductive, Process and Product, Research, Case-study, Multimedia Package and Modular)</li> <li>• Importance of teaching method</li> <li>• Teaching method advantage, disadvantage and application (Lecture, Demonstration, Assignment, Seminar, Panel discussion, Team teaching, Collaborative, Project, Experiment, Inquiry, Buzz group, Rubrics, Field study, Simulation and Laboratory)</li> <li>• Selection of appropriate teaching methods</li> <li>• Relationship between approaches and methods.</li> </ul> | 5 |
| • | <b>Unit 5: Construction and Management of instructional aids</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Importance of instructional aids and its selection</li> <li>• Improvised apparatus</li> <li>• Charts and Models</li> <li>• Audio-visual aids, Internets and Multimedia</li> <li>• Projected aids</li> </ul>                                                                                                                                                                                                                                                                                                                                                | 3 |
| • | <b>Unit 6: Planning of Science Education</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Micro lesson plan (Importance, steps and development)</li> <li>• Unit plan (Importance, Criteria and format)</li> <li>• Lesson Plan (Importance, steps and format)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                  | 4 |
| • | <b>Unit 7: Evaluation in Science Education</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Types of evaluation</li> <li>• Defects of present evaluation system</li> <li>• Text item</li> <li>• Analysis of test items</li> <li>• CCE model</li> <li>• Grading System</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                         | 4 |

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## **Part 2: Practical**

| Specific objectives | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Periods |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| •                   | <b>Unit 1: Preparation of Charts</b> <ul style="list-style-type: none"> <li>Life cycle of fern</li> <li>Life cycle of Mushroom</li> <li>Periodic table</li> <li>Somatic cell division</li> <li>Meiotic cell division</li> <li>Human eyes</li> <li>Domestic electric circuit</li> <li>Compound Microscope</li> <li>Solar System</li> </ul>                                                                                                                   | 6       |
| •                   | <b>Unit 2: Preparation of Modules</b> <ul style="list-style-type: none"> <li>Plant cell and animal cell</li> <li>Heart</li> <li>DNA and RNA</li> <li>Molecular model</li> <li>Structure of benzene</li> <li>Aquarium</li> <li>Human skeletal system</li> <li>Artificial greenhouse</li> <li>Ecosystem</li> </ul>                                                                                                                                            | 9       |
| •                   | <b>Unit III: Preparation of Improvised Materials</b> <ul style="list-style-type: none"> <li>Distillation of water</li> <li>Electroplating of metal</li> <li>Solar and Lunar eclipse</li> <li>Preparation of CO<sub>2</sub> gas</li> <li>Phases of Moon</li> <li>Series and parallel combination of cells</li> <li>Osmometer</li> </ul>                                                                                                                      | 9       |
| •                   | <b>Unit IV: Preparation, presentation and laboratories activities</b> <ul style="list-style-type: none"> <li>Micro Lesson Plan</li> <li>Unit Plan</li> <li>Daily Lesson Plan</li> <li>5e's Model Lesson Plan</li> <li>Preparation of permanent slide of roots, steam and leaves</li> <li>Preparation of temporary slide of Onion cells, dicot and monocot steam</li> <li>Crystallization</li> <li>Separation of mixture</li> <li>Gas preparation</li> </ul> | 15      |
| •                   | <b>Unit V: Item analysis and Report Witting</b> <ul style="list-style-type: none"> <li>Test item and item analysis</li> <li>Construction of objective and subjective test item</li> </ul>                                                                                                                                                                                                                                                                   | 9       |

### 3. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Home assignments and class participation
- Internet (web) surfing
- Group work, Report writing and presentation
- Construction of learning materials
- Individually laboratory work
- Field work

#### 4. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

##### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

- |                                         |           |
|-----------------------------------------|-----------|
| 1) Attendance                           | 5 points  |
| 2) Participation in learning activities | 5 points  |
| 3) First assignment ( Presentation)     | 10 points |
| 4) Second assignment (Term exam)        | 10 points |
| 5) Third assignment (Project work)      | 10 points |

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|       |           |
|-------|-----------|
| Total | 40 points |
|-------|-----------|

##### 5.2 Theory: External evaluation (Full marks 40)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |           |
|--------------|------------------------------------------------------------------|-----------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points |
| <b>Total</b> |                                                                  | 40 points |

**Note: All questions are compulsory**

##### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination           | Area                          | Points | Total Points |
|-----------------------|-------------------------------|--------|--------------|
| Internal              | Regularity                    | 2      | 6 points     |
|                       | Practical Performance         | 1      |              |
|                       | Record book                   | 3      |              |
| External              | Experiment (1 Exp.)           | 3      | 6 Points     |
|                       | Viva                          | 3      |              |
| External and Internal | Construction of test item and | 4      |              |

|              |               |   |           |
|--------------|---------------|---|-----------|
|              | lesson plan   |   | 8 points  |
|              | Item analysis | 4 |           |
| Total Points |               |   | 20 points |

***Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.***

Course Title: **Fundamental Biology Education**

Course Code: SCED 425

Nature of Course: Theory + Practical

Semester: B.Ed. / II

Total Period: 32+48 (Th. + Pr.) = 80 Periods

Full Marks: 80 (T) +20 (P)

Pass Marks: 40 (T) +10 (P)

Time per Credits: 2(T) +3( Pr) /Week/group (p)

Total Credit: 2+1 (Th. + Pr.)

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The theoretical parts consists of different units related to nature, methods, aims and objectives, etc .

#### Part 1: Theory

| Specific Objectives | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Periods |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
|                     | <b>Unit 1: Nature of Biology</b> <ul style="list-style-type: none"><li>• Introduction to biology</li><li>• Nature and scope of biology</li><li>• Branches and of biology with other science</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2       |
| •                   | <b>Unit 2: Classification and life cycle of Invertebrates</b> <ul style="list-style-type: none"><li>• Characterstatics and protozoa phylum, structure and reproduction of paramecium</li><li>• General characterstatics and classification of Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, and Echinodermata</li><li>• Structure, life cycle and economic importance of Hydra, Taenia,, Ascaris, Silkworm, honey bees and mosquitos</li><li>• Earthworm : Habit and habitat, digestive and reproductive system, economic importance</li><li>• Cockroach: Habit, Habitat, structure, Digestive, Respiratory, Reproductive and excretory system</li></ul> | 7       |
|                     | <b>Unit 3:Classification and life cycle of vertebrates</b> <ul style="list-style-type: none"><li>• General characteristics and Classification of pisces, Amphibia, Reptilia, Aves, and Mammalia</li><li>• Structure, life cycle and economic importance of Carp fish, Chicken, grass snake and rat</li><li>• Frog : Habit and habitat, digestive and reproductive system, economic importance</li><li>• Rabbit: Habit, habitat, structure, Digestive, Respiratory, reproductive, circulatory and</li></ul>                                                                                                                                                                                         | 8       |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|   | economic importance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |   |
| • | <b>Unit 4: Non-flowering Plant</b> <ul style="list-style-type: none"> <li>General characteristic and classification of non- flowering plants</li> <li>-Algae: Oedogoniales Charales, Fucales and Nemalionales</li> <li>- Fungi : Aspergillales, Peenosporales, Uredinales, Ustilaginales, Moniliales</li> <li>-Bryophytes: Marchantiales, Anthocerotales and Polytrichales</li> <li>-Pteridophytes: Psilotales, Lycopodiales, Equisitales and Ficales</li> <li>-Gymnosperms: Cycadales, Coniferales and Genetales</li> <li>Structure and reproduction of Mucor, Yeast, Spirogyra</li> <li>Life cycle of Marchantia, Funaria, and Dryopteris</li> <li>Morphological structure of Cycas and Pinus</li> <li>Structure and economic importance of bacteria, virus and fungi</li> </ul>                                                                                                                                                                                                                                                                                  | 6 |
|   | <b>Unit 5: Flowering Plant</b> <ul style="list-style-type: none"> <li>Taxonomy basics</li> <li>Monocot and dicot flower parts</li> <li>Features, merits and demerits of different systems of classification of flowering plants</li> <li>Vegetative, floral structure, systematic positions, economic importance and affinity of the families (Ranunculaceae, Rosaceae, Caryophyllaceae, Labiateae, Rutaceae, Cucurbitaceae, Cyperaceae and Cannaceae)</li> <li>Angiosperm : Morphology, root, stem, flower, fruit, and seed</li> <li>Plant anatomy : Types of tissues, meristematic and permanent tissue, internal structure of monocot and dicot root, stem and leaf</li> <li>Plant physiology : Water relation, photosynthesis, respiration, growth, plant movement</li> <li>Reproduction and development of angiosperms : asexual reproduction, pollination, development of male and female gametophyte, fertilization and development of embryo in monocot and dicot</li> <li>Distribution, scientific names and medicinal values of plants (Harro,</li> </ul> | 9 |

|  |                                                         |  |
|--|---------------------------------------------------------|--|
|  | Ghod tapre, Amala, Jatamanshi,<br>Titepati and Thingre) |  |
|--|---------------------------------------------------------|--|

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## Part 2: Practicle

| Specific objectives | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Periods |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| •                   | <b>Unit 1: Animal Science</b> <ul style="list-style-type: none"> <li>Study of specimens and Histological structures of important vertebrates and invertebrates</li> <li>Preparation of permanent slides and labelled diagrams of Hydra and developmental stages of Mosquito.</li> <li>Dissection: Cockroach, Earthworm and Rabbit than study its digestive, circulatory, nervous and reproductive organs and draw the label diagram.</li> </ul>                                                                                                                                                                                                        | 24      |
| •                   | <b>Unit 2: Plant Science</b> <ul style="list-style-type: none"> <li>Preparation of safranin, light green and cotton blue in aqueous and alkalin solution.</li> <li>Study of specimens and Habit, habitat and general characteristics of important flowering and Non-flowering plants.</li> <li>Preparation of temporary slides and stydy on the structure and reproduction of Spirogyra, Nostoc, Oscillatoria, Volvex, Chara, Fucus, Marchantia, Anthocerous, Lycopodium, Adiantum and Dryopterres.</li> <li>Study of external structure of cycus and pinus cones.</li> <li>Field trip: Collection, preservation and herbarium preparation.</li> </ul> | 24      |

## 5. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Group work, Report writing and presentation
- Construction of learning materials
- Individually laboratory work
- Field work

## 6. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                         |                  |
|-----------------------------------------|------------------|
| 6) Attendance                           | 5 points         |
| 7) Participation in learning activities | 5 points         |
| 8) First assignment ( Presentation)     | 10 points        |
| 9) Second assignment (Term exam)        | 10 points        |
| 10) Third assignment (Project work)     | 10 points        |
| <b>Total</b>                            | <b>40 points</b> |

### 5.2 Theory: External evaluation (Full marks 40)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |                  |
|--------------|------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points        |
| <b>Total</b> |                                                                  | <b>40 points</b> |

**Note: All questions are compulsory**

### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination | Area | Points | Total Points |
|-------------|------|--------|--------------|
|-------------|------|--------|--------------|



|                       |                                           |   |           |
|-----------------------|-------------------------------------------|---|-----------|
| Internal              | Regularity                                | 2 | 6 points  |
|                       | Practical Performance                     | 1 |           |
|                       | Record book                               | 3 |           |
| External              | Experiment (2 Exp.)                       | 4 | 6 Points  |
|                       | Viva                                      | 3 |           |
| External and Internal | Construction of test item and lesson plan | 4 | 8 points  |
|                       | Item analysis                             | 4 |           |
| Total Points          |                                           |   | 20 points |

***Note: the marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.***

### **Recommended Books**

**Mid-West University  
Graduate School of Education  
Surkhet, Nepal**



**Bachelor of Science Education (BEd-Sc)  
Curriculum  
3<sup>rd</sup> Semester**

# **Bachelor of Science Education (BEd-Sc)**

## **Curriculum**

### **3<sup>rd</sup> Semester**

| <b>S. No</b> | <b>Course Code No</b> | <b>Course Name</b>          | <b>Credit Hour</b> | <b>Feature</b>       |
|--------------|-----------------------|-----------------------------|--------------------|----------------------|
| 1.           | SCED 433              | Applied Physics Education   | 3                  | T-2, P-1             |
| 2.           | SCED 434              | Applied Chemistry Education | 3                  | T-2, P-1             |
| 3.           | SCED 435              | Applied Biology Education   | 3                  | T-2, P-1             |
| <b>Total</b> |                       |                             | <b>9</b>           | <b>Th-6<br/>Pr-3</b> |

## 1. Course Description

This is a specialized theory course designed for the students of third semester in Bachelor level of Science education. This Course has two sections: “**Applied Physics Education**” **theory and practical**. The aim of this course is to provide knowledge in the field of Mechanics, heat, optics and astronomy in Physics which can help the prospective Physics teachers teach with confidence at the secondary education level as well as to be able to pursue higher studies in the science education. This course covers Motion, surface tension and elasticity, thermal property of matter, geometrical optics and astronomy. In practical parts, different experiments to be performed which are listed in particle course. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. The students are required to secure pass marks in theory as well as practical course separately.

## 2. General Objectives

On the completion of this course student will be able to following general objectives:

- To provide the students with adequate theoretical knowledge of applied physics.
- To develop problem solving skills in Mechanics, heat, optics and astronomy of Physics.
- To make students to understand the correlation between theory and the experiment.
- To enable students in following a detailed set or sequence of instructions

## 3. Specific Objectives and Contents

### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Periods |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>• Define and explain elastic and inelastic collision with their properties.</li> <li>• Describe coefficient of restitution.</li> <li>• Define and verify principle of moment.</li> <li>• Describe moment of inertia, torque and couple.</li> <li>• Classify the equilibrium with condition.</li> <li>• Describe circular motion.</li> <li>• Distinguish between linear and angular velocity also establish the relation between them.</li> <li>• Define centripetal acceleration and centripetal force and derive their expression.</li> <li>• Derive the relation of rotational kinetic energy.</li> <li>• Solve simple related numerical problems.</li> </ul> | <b>Unit 1: Motion</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Elastic and inelastic collision</li> <li>• Coefficient of restitution</li> <li>• Principle moment</li> <li>• Moment of inertia</li> <li>• Torque and couple</li> <li>• Equilibrium</li> <li>• Circular motion</li> <li>• Linear and angular motion</li> <li>• Centripetal acceleration and force</li> <li>• Rotational kinetic energy</li> <li>• Solve numerical problem</li> </ul> | 6       |
| <ul style="list-style-type: none"> <li>• Define surface tension and explain the molecular theory of surface tension</li> <li>• Prove surface tension is numerically equal to the free surface energy</li> <li>• Explain surface tension phenomena on the basis of floating needles rest on soap film and camphor boat.</li> <li>• Define angle of contact and capillarity.</li> <li>• Explain the forces and deduce the relation for soap bubbles and air bubble interference.</li> <li>• Deduce pressure different across a spherical.</li> </ul>                                                                                                                                                     | <b>Unit 2: Surface tension and Elasticity</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Molecular theory of surface tension</li> <li>• Surface tension and free surface energy</li> <li>• Surface tension phenomena</li> <li>• Angle of contact</li> <li>• Capillarity</li> </ul>                                                                                                                                                                   | 6       |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>Define elasticity and plasticity</li> <li>State hooks law</li> <li>Define Young's modulus and explain its determination</li> <li>Deduce the expression for work done in stretching wire with suitable example</li> <li>Define Bulk and share model</li> <li>Explain properties of rubber by stress strain curve.</li> <li>Solve simple related numerical problems.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>Elasticity and plasticity</li> <li>Hook's law</li> <li>Young's modulus of elasticity</li> <li>Work done in stretching wire</li> <li>Bulk and share model</li> <li>Properties of rubber</li> <li>Solve numerical problem</li> </ul>                                                                                                                                                                                                                                                                                                                         |   |
| <ul style="list-style-type: none"> <li>Explain the working principle of constant volume gas, thermocouple and platinum resistance thermometer.</li> <li>Explain the experimental determination specific heat of solid and liquid.</li> <li>Explain the experimental determination of specific latent heat of fusion of ice by method of mixture.</li> <li>Describe the thermal equilibrium and zeroth law of thermodynamics.</li> <li>Differentiate between isothermal and adiabatic process.</li> <li>Explain work done during isothermal process.</li> <li>Deduce the equation of isothermal and adiabatic process.</li> <li>Explain work done by a gas.</li> <li>Define entropy and enthalpy.</li> <li>Explain the first and second law of thermodynamics.</li> <li>Define molar heat capacity of gas and obtain relation between them.</li> <li>Derive thermal efficiency of heat engine.</li> <li>Describe the working principles of IC engine, Otto diesel, Carnot engine and refrigerator.</li> <li>Solve simple related numerical problems.</li> </ul> | <b>Unit 3: Thermal properties of matter</b> <ul style="list-style-type: none"> <li>Different temperature scales</li> <li>Constant volume gas, thermocouple and platinum resistance thermometer</li> <li>Specific heat</li> <li>Latent heat of fusion of ice</li> <li>Thermal equilibrium and zeroth law of thermodynamics</li> <li>Isothermal and adiabatic process</li> <li>Work done by gases</li> <li>Enthalpy and entropy</li> <li>First and second law of thermodynamics</li> <li>Molar heat capacity</li> <li>Thermal efficiency of heat engine</li> <li>Solve numerical problem</li> </ul> | 7 |
| <ul style="list-style-type: none"> <li>Define parallax and find out the image location by no parallax</li> <li>Define spherical mirror and derive their formula</li> <li>Explain and draw the image diagram of convex and concave mirror</li> <li>Determine the focal length of convex and concave mirror</li> <li>Define and determine refractive index by using ray tracing method and real and apparent depth method.</li> <li>Define the total internal reflection and critical angle.</li> <li>Derive refractive index by using prism.</li> <li>Define concave and convex lens.</li> <li>Define lateral magnification.</li> <li>Elaborate the dispersion and its power on the basis of spectrometer, pure spectrum, dispersive power, achromatic lenses of contact, chromatic</li> </ul>                                                                                                                                                                                                                                                                  | <b>Unit 4: : Geometrical Optics</b> <ul style="list-style-type: none"> <li>Parallax</li> <li>Image location by no parallax</li> <li>Spherical mirror and their formula</li> <li>Image formed in convex and concave mirror</li> <li>Determination of focal length</li> <li>Refractive index and its determination</li> <li>Total internal reflection and critical angle</li> <li>Lens</li> <li>Lateral magnification</li> <li>Dispersion and its power</li> <li>Solve numerical problem</li> </ul>                                                                                                 | 7 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>aberration, spherical aberration, scattering light, blue colour of sky.</li> <li>Derive dispersive power</li> <li>Solve simple related numerical problems</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |
| <ul style="list-style-type: none"> <li>Define astronomy</li> <li>List down the general assumption related to the origin of solar system.</li> <li>Describe solar system and list out its member</li> <li>Elaborate the chief contribution to the knowledge planetary motions made by various scientist such as Tycho, Copernicus, Kepler, Galileo and Newton.</li> <li>Explain sun and its parameter such as solar constant, solar luminosity, estimating term of the sun.</li> <li>Define planet.</li> <li>List the types of planet and write their atmospheric condition.</li> <li>Discuss the role of astronomical instruments in astronomy.</li> <li>Describe the working process of astronomical instruments such as optical telescope, radio telescope, photo cell, artificial satellite and sextant.</li> <li>Determine the distance, size, mass and surface temperature of astronomical objects.</li> </ul> | <b>Unit 5: Astronomy</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Origin of solar system</li> <li>Solar system and its members</li> <li>Contribution to planetary motion</li> <li>Sun and parameter of sun (solar constant, solar luminosity, estimating term of the sun)</li> <li>planet</li> <li>types and atmosphere of the planet</li> <li>Astronomical instruments ( optical telescope, radio telescope, photo cell, artificial satellite and sextant )</li> <li>Astronomical object ( distance, size, mass and surface temperature )</li> </ul> | 6 |

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                                                                                                                                                                                            | Contents                                                                                                                                                                                | Periods |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>To determine the surface tension of water by capillary rise method.</li> <li>To determine the surface tension of water by Jaeger's method.</li> <li>To determine the Yong's modulus of elasticity by given wire</li> </ul>                                                                                                                                                                              | <b>Unit 1: Surface tension and Elasticity</b> <ul style="list-style-type: none"> <li>Surface tension of water</li> <li>Yong's modulus of elasticity</li> </ul>                          | 9       |
| <ul style="list-style-type: none"> <li>To determine the specific heat capacity of solid and liquid.</li> <li>To determine specific latent heat of fusion of ice.</li> <li>To determine the latent heat of vaporization of water.</li> </ul>                                                                                                                                                                                                    | <b>Unit 2: Thermal properties of matter</b> <ul style="list-style-type: none"> <li>Specific heat capacity of solid and liquid</li> <li>Specific latent heat of fusion of ice</li> </ul> | 9       |
| <ul style="list-style-type: none"> <li>To determine the focal length of concave and convex lens.</li> <li>To find the refractive index of the material of a given prism using a spectrometer.</li> <li>To plot a graph between the angle of incidence and the corresponding angle of deviation and to find the refractive index of the material of prism.</li> <li>To find the dispersive power of the material of the given prism.</li> </ul> | <b>Unit 3: Geometric optics</b> <ul style="list-style-type: none"> <li>Focal length of concave and convex lens</li> <li>Refractive index</li> <li>Dispersive power</li> </ul>           | 12      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                             |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|----|
| <ul style="list-style-type: none"> <li>To find the height of an inaccessible object using a sextant.</li> <li>To find the altitude or the angular elevation of the sun using a sextant.</li> <li>To find the magnifying power of a telescope by the liner method.</li> <li>To verify the expression for the resolving power of a telescope.</li> <li>Prepare the project related to the topics “Astronomy” and present in the class.</li> </ul> | <b>Unit 4: Astronomy</b> <ul style="list-style-type: none"> <li>Sextant</li> <li>Telescope</li> <li>Project work</li> </ul> | 18 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|----|

#### 4. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Group work, Report writing and presentation
- Individually laboratory work
- Field visit

#### 5. Evaluation: Internal and external Assessment

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

##### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                         |                  |
|-----------------------------------------|------------------|
| 1) Attendance                           | 5 points         |
| 2) Participation in learning activities | 5 points         |
| 3) First assignment ( Presentation)     | 10 points        |
| 4) Second assignment (Term exam)        | 10 points        |
| 5) Third assignment (Project work)      | 10 points        |
| <b>Total</b>                            | <b>40 points</b> |

##### 5.2 Theory: External evaluation (Full marks 50)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |           |
|--------------|------------------------------------------------------------------|-----------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points |
| <b>Total</b> |                                                                  | 40 points |

**Note: All questions are compulsory**

### **5.3 Practical: Evaluation (Full marks- 20 points)**

The marks allocated to practical part are given in the following table.

| Examination           | Area                         | Points   | Total Points |
|-----------------------|------------------------------|----------|--------------|
| Internal              | Regularity                   | 1.5      | 4 points     |
|                       | Practical Performance        | 1        |              |
|                       | Record book                  | 1.5      |              |
| External              | Experiment (at least 2 Exp.) | 10 (5+5) | 13 Points    |
|                       | Viva                         | 3        |              |
| External and Internal | Project work                 |          | 3 points     |
| Total Points          |                              |          | 20 points    |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

### **Recommended Books and References**

Bajaj, N.K. (2000). *Physics*. Delhi: Tata MC Graw-Hill Publishing Com. Ltd.

Gupta, S. K. & Pradhan, J. M. (2009). *A textbook of physics*. Jalandhar: Surya publication.

Huffer, C. M., Trinklein, F.E. & Bunge, M. (1973). *An introduction to astronomy*. New York: Holt, Rinehart and Winston, Inc.

Sears, F.W., Zemansky, M.W., Yong , H.D., Freedman, R. A. & Ford, A. L.(2009). *University physics*. Singapore: Pears on Education.



## 6. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The theoretical part consists of different units of general chemistry or physical, inorganic and organic chemistry. The major topics included in this course are state of matter, Acid, base and salt, catalysis, chemical and ionic equilibrium and organic reaction and their mechanism. In practical parts, different experiments to be performed which are listed in particle course, besides this experiment performed related to functional group identification, Titration, surface tension , hardness of This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. The students are required to secure pass marks in theory as well as practical course separately.

## 7. General Objectives

On the completion of this course student will be able to following general objectives:

- To enable the students in dealing with the state of matter including solid, liquid and gases.
- To familiarize the students with different forms of acid, base and salts
- To help the students analyze different types of catalysis and their role of chemical reactions.
- To acquaint the students with the basic concepts of chemical and ionic equilibrium.
- To enable the students familiarize with the basic concepts of organic reactions and their mechanism.
- To provide students with an opportunity to understand inquiry based chemistry education with its application on pedagogy and other various fields.
- To inculcate the knowledge and skills of chemistry through pedagogical learning experiences and practical activities.
- To enable students conducting experiment on the identification of functional group, titration as well as hardness of water.

## 8. Specific Objectives and Contents

### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Periods |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"><li>• List the postulates of Kinetic theory of gases and its application.</li><li>• Derive the kinetic gas equation.</li><li>• Explain average kinetic energy of gas molecules.</li><li>• Describe molecular interpretation of temperature.</li><li>• Define and derive Boyle's, Charles, Avogadro's and Combines gas law and their application.</li><li>• Differentiate real and ideal gas and express value of R in different units.</li><li>• Explain deviation from ideal gas equation by real gases.</li><li>• Justify the causes of deviation of real gas.</li><li>• Define Dalton's law of partial pressure, derive its expression.</li><li>• Define Graham's law of diffusion and derive its expression.</li></ul> | <b>Unit 1: State of matter</b><br><b>1.1 Gases state</b> <ul style="list-style-type: none"><li>• Kinetic theory of gases</li><li>• Kinetic gas equation</li><li>• Boyle's law, Charles law, Avogadro's law and Combines gas law</li><li>• Ideal gas and real gas</li><li>• Dalton's law of partial pressure</li><li>• Graham's law of diffusions</li><li>• Solve Numerical problems</li><li>• Speeds of gaseous molecules</li><li>• Van der Wall's equation</li><li>• Liquefaction of gases</li></ul> <b>1.2 Liquid state</b> <ul style="list-style-type: none"><li>• Different kinds of solution</li><li>• Concentration of solution</li></ul> | 11      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>List and explain the application of Dalton's law and Graham's law.</li> <li>Define and differentiate diffusion and effusion of gases.</li> <li>Solve numerical problems related to mention gaseous laws.</li> <li>Explain different types of speeds of gaseous molecules.</li> <li>Explain Vander Wall's equation</li> <li>Describe the critical phenomenon in liquefaction of gases.</li> <li>Explain the various methods of liquefaction of gases on the basis of Faraday's, Linden's and Claude's method.</li> <li>List and define the different types of solution, Concentration of solution,</li> <li>Explain the colligative properties of solution and its application.</li> <li>Define the condensation, Evaporation, Vapour pressure, Solubility,</li> <li>Draw the Solubility curve and explain the Solubility product principle.</li> <li>Calculate the related numerical Problems.</li> <li>Define and describe the characteristic properties of crystalline and amorphous solid.</li> <li>Define water of crystallization and list the water of crystallization of various compounds.</li> <li>Explain crystals structure and unit cell on the basis of simple, body centered and face centered cubic.</li> <li>Draw the seven types of crystals systems</li> </ul> | <ul style="list-style-type: none"> <li>Colligative properties of solution,</li> <li>Condensation, Evaporation, and Vapour pressure,</li> <li>Solubility, Solubility curve,</li> <li>Solubility product and Related numerical Problems</li> </ul> <p><b>1.3 Solid state</b></p> <ul style="list-style-type: none"> <li>Crystalline and Amorphous of solid,</li> <li>Crystal structure and unit cells</li> <li>Classification of solids</li> <li>water of crystallization</li> <li>Seven types of crystals system</li> </ul> |   |
| <ul style="list-style-type: none"> <li>Define acid, base and salt</li> <li>List the different properties, types and uses of acid, base and salts.</li> <li>State and explain Arrhenius, Lewis, and Bronsted- Lowry concept of acid and base.</li> <li>Describe the advantage and limitation of the different concept of acids and base.</li> <li>Define hard and soft acids and base and explain application of HSAB principle.</li> <li>Describe the relative strength of acids and bases and effect of substituent and solvents on them.</li> <li>Explain the hydrolysis of salt and its application</li> <li>Define <math>P^H</math> and <math>P^H</math> scale and mention its application.</li> <li>Relate <math>P^H</math> and <math>P^{OH}</math> and solved simple numerical.</li> <li>List the Application of neutralization in daily life.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p><b>Unit 2: Acid base and salt</b></p> <ul style="list-style-type: none"> <li>Introduction</li> <li>Properties, types and uses</li> <li>Arrhenius, Lewis, and Bronsted- Lowry concept of acid and base</li> <li>Hard and soft acid and base (HSAB)</li> <li>Relative strengths of acids and base</li> <li>Hydrolysis of salt</li> <li><math>P^H</math> and <math>P^H</math> scale</li> <li>Application of neutralization in daily life</li> </ul>                                                                        | 5 |
| <ul style="list-style-type: none"> <li>Define catalysis</li> <li>List and explain types of catalysis.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p><b>Unit 3: Catalysis</b></p> <ul style="list-style-type: none"> <li>Introduction</li> <li>Types of catalyst</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                  | 3 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>Describe the criteria and characteristics of catalysis.</li> <li>Define catalyst promoters, auto catalysts negative catalyst and catalysts poison with examples.</li> <li>Explain the theories of catalyst.</li> <li>State the application and role of catalysts in different chemical reaction.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>Criteria and characteristics of catalysis</li> <li>Catalyst promoters, auto catalysts, negative catalyst and catalysts poison</li> <li>Theories of catalyst</li> <li>Role of catalyst in chemical reaction</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |
| <ul style="list-style-type: none"> <li>Define and explain chemical and ionic equilibrium.</li> <li>List the characteristics of chemical equilibrium.</li> <li>Describe the characteristics and significance of equilibrium constant.</li> <li>Describe and derive law of mass action</li> <li>Elaborate the Lechateriler's principles and its application.</li> <li>Define strong and weak electrolytes with examples.</li> <li>Explain degree of ionization.</li> <li>Elaborate the auto-ionization of water and ionic product of water.</li> <li>State and explain Ostwald's dilution law and its application.</li> <li>Describe the buffer solution and buffer action.</li> <li>Differentiate acidic buffer and basic buffer.</li> <li>Elaborate the selection of indicator by acid base titration</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Unit 4: Chemical and ionic equilibrium</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Characteristics of chemical equilibrium</li> <li>Law of mass action</li> <li>Lechateriler's principles</li> <li>Strong and weak electrolytes</li> <li>Degree of ionization</li> <li>Auto-ionization of water</li> <li>Ostwald's dilution law</li> <li>Buffer solution and buffer action</li> <li>Acidic buffer and basic buffer</li> <li>Selection of indicator by acid base titration</li> </ul>                                                                                                                                                                                                                              | 5 |
| <ul style="list-style-type: none"> <li>Define organic reaction and their mechanism.</li> <li>Describe bond fission as the hemolytic and heterolytic fission with examples.</li> <li>Explain Inductive, mesomeric, electromeric and steric effect of reaction and its application.</li> <li>Define and illustrate carbonium ion, carbene and free radicals with examples.</li> <li>Define electrophilic and nucleophilic reagents with examples.</li> <li>Explain electrophilic substitution reaction and their mechanism on the basis of Halogenation, Nitration, Sulphonation, Fridel craft acylation and alkylation.</li> <li>Explain the mechanism and orientation of free radical addition reaction with examples.</li> <li>Describe the mechanism and orientation of electrophilic addition reaction with examples.</li> <li>Explain the mechanism, orientation, stereo chemistry of E1, E2 and E1cB reaction.</li> <li>Differentiate between elimination and substitution reaction.</li> <li>Describe mechanism and orientation of free radical substuation reaction with examples.</li> <li>State and elaborate the mechanism of named reaction such as Claisen, Perkins and Aldol condensation reactions, Manich, Canizzaro and</li> </ul> | <b>Unit 5: Organic reaction and their mechanism</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Bond fission</li> <li>Inductive, mesomeric electromeric and steric effect</li> <li>Carbonium, carbene, free radicals</li> <li>Reagents</li> <li>Electrophilic substitution reaction and their mechanism</li> <li>Mechanism and orientation of Free radical addition reaction and electrophilic addition reaction</li> <li>Mechanism, orientation, stereo chemistry of E1, E2 and E1cB reaction</li> <li>Mechanism and orientation of free radical substitution reaction</li> <li>Mechanism of named reaction Claisen, Perkins and Aldol condensation reactions, Manich, Canizzaro and Reimer Tiemann Reaction</li> </ul> | 8 |

|                                                                 |                                       |  |
|-----------------------------------------------------------------|---------------------------------------|--|
| Reimer Tiemann Reaction and Wolf-Kishner's reduction reaction . | and Wolf-Kishner reduction reaction ) |  |
|-----------------------------------------------------------------|---------------------------------------|--|

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Periods |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>Develop observational, manipulative, calculative and inference drawing skills.</li> <li>Develop in student's ability to perform experiments having due regards safety.</li> <li>Maintain record base of the performed experiments.</li> </ul> | <ul style="list-style-type: none"> <li>To identify the functional group present in the given organic compound (at least 5 sample )</li> <li>To estimate the components of mixture of NaOH and Na<sub>2</sub>CO<sub>3</sub> solution by the change of indicator.</li> <li>To estimate the amount of sulphuric acid and oxalic acid in grams per liter in given mixture of solution.</li> <li>To estimate the amount of CaCO<sub>3</sub> in given sample of marble.</li> <li>To obtain hydrated calcium sulphate from the given marble chips.</li> <li>To determine solubility of given solute in room temperature.</li> <li>To determine the relative surface tension of unknown liquid by drop count method.</li> <li>To determine the surface tension of liquid by using Stalgometer.</li> <li>To determine permanent and temporary hardness of water.</li> <li>To prepare a saturated solution of blue vitriol at lab temperature and to recover pure crystal of the salt.</li> <li>To determine the enthalpy of neutralization of a strong acid and strong base.</li> </ul> | 48      |

## 2 Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Individually laboratory work
- Field work

## 3 Evaluation: Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                         |                  |
|-----------------------------------------|------------------|
| 6) Attendance                           | 5 points         |
| 7) Participation in learning activities | 5 points         |
| 8) First assignment ( Presentation)     | 10 points        |
| 9) Second assignment (Term exam)        | 10 points        |
| 10) Third assignment (Project work)     | 10 points        |
| <b>Total</b>                            | <b>40 points</b> |

### 5.2 Theory: External evaluation (Full marks 40)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |                  |
|--------------|------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points        |
| <b>Total</b> |                                                                  | <b>40 points</b> |

**Note: All questions are compulsory**

### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination  | Area                         | Points   | Total Points |
|--------------|------------------------------|----------|--------------|
| Internal     | Regularity                   | 2        | 6 points     |
|              | Practical Performance        | 2        |              |
|              | Record book                  | 2        |              |
| External     | Experiment (at least 2 Exp.) | 11 (5+6) | 14 Points    |
|              | Viva                         | 3        |              |
| Total Points |                              |          | 20 points    |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

### Recommended Books and References

- Bahl, A., & Bhal, B.S. (2008). *A textbook of organic chemistry*. New Delhi: S. Chanda and company limited.
- Bahl, A., Bhal, B.S. & Tuli, G. D. (2008). *Essential of physical chemistry*. New Delhi: S. Chanda and company limited.
- Dhaubdel, S.P., Pradhan, K.P., & Joshi, S.M. (n.d.). *Practical chemistry guide*. Nepal: Kathmandu.
- Khadka, N.M., Gautam, S.D. & Yadav, P.N. (n.d.). *A core experimental chemistry*. Kathmandu: Kedeas Book Center.
- March, J. (2012). *Advanced Organic Chemistry*. New Delhi: A Wiley Inter-science Publication.
- Pandit, C.N., Subedi, R.R. & Tiwari, P. (2074 B.S.). *A text book of Chemistry*, Kathmandu: K. P. Pustak Bhandar.
- Prakash, S., Tuli, G.D., Basu, S. K. & Madan, R.D. (2008). *Advanced inorganic chemistry*. New Delhi: S. Chanda and company limited.
- Sanyal, S.N (2009 ). *Reactions, Rearrangements and Reagents*. India: Bharati Bhawan, Patana.
- Sthapit, M.K. & Pradhananga R.R. (2065 B.S.) *A text book of physical chemistry*, Kathmandu: Taleju Prakashan
- Vishnoi, N.K. (1985). *Advanced practical organic chemistry*. India: Vikas Publishing House Pvt. Ltd.

## 9. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The theoretical parts consist of different units related to Applied Biology. The major topics included in this course are cell biology, Cytogenesis and breeding, Evolution, Life processes and Economic and applied biology. In practical parts, different experiments to be performed which are listed in particle course, besides this experiment performed, field visit and report writing. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. The students are required to secure pass marks in theory as well as practical course separately.

## 10. General Objectives

On the completion of this course student will be able to following general objectives:

- To provide students with the in-depth knowledge of plant and animal cell, tissues, mitosis and meiosis.
- To acquaint the students with the Cytogenesis, physiological feature animal and plants.
- To enable the students in elaborating the evolution process of animals and plans.
- To familiarize the students with life processes such as photosynthesis, respiration, adaptation etc. process of plants and animals.
- To make the students familiarize with the physiological system of human.
- To impact knowledge to the students on applied aspect of animal and plant science and their application.
- To enable students to prepare report on their field visit, write practical record file by using appropriate methods and approaches.

## 11. Specific Objectives and Contents

### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Contents                                                                                                                                                                                                                                                                                                   | Periods |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"><li>• Describe the cell is a unit of life.</li><li>• Draw and explain the structure of plant and animal cell including prokaryotic and eukaryotic cell.</li><li>• Elaborate the structure and functions of cell organelles and inclusions.</li><li>• Describe the process of cell division on the basis of amitosis, mitosis and meiosis.</li><li>• List the types of plant tissues and describe meristematic and permanent tissues.</li><li>• Describe animal tissues on the basis of epithelial, connective, muscular and nervous tissues.</li></ul> | <b>Unit 1: Cell Biology</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Structure of plant and animal cell</li><li>• Cell division</li><li>• Animal and plant tissue</li><li>• Structure of dicot and monocot root, steam and leaf.</li><li>• Secondary growth of dicot stem.</li></ul> | 5       |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                             |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• Draw and explain the dicot and monocot root, stem and leaf.</li> <li>• Describe the process of secondary growth in dicot stem.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                             |   |
| <ul style="list-style-type: none"> <li>• Explain the morphology and chemical nature of chromosome.</li> <li>• List the chromosomes number of some plants and animals.</li> <li>• Define nucleic acid on the basis of DNA and RNA.</li> <li>• Differentiate between DNA and RNA.</li> <li>• Draw the chart of Mendal's law of inheritance. On the basis of monohybrid and dihybrid crosses.</li> <li>• Describe the process of linkage and its significance.</li> <li>• Explain mutation its types and polyploidy.</li> <li>• Describe sex linked inheritance on the basis of X-linked gene for eye colour of Drosophila and colour-blindness in man.</li> <li>• List down different types of plant and animal breeding.</li> <li>• Point out the general principles of plants and animal breeding and their advantage and disadvantage.</li> <li>• Explain inbreeding, outbreeding and hybrid vigor and genetic effect of animal breeding.</li> </ul> | <b>Unit 2: Cytogenesis and Breeding</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Chromosomes</li> <li>• Nucleic acid</li> <li>• Genetics</li> <li>• Mendal's law of inheritance</li> <li>• Linkage process</li> <li>• Mutation</li> <li>• Sex linked inheritance</li> <li>• General process of animal and plant breeding</li> </ul> | 6 |
| <ul style="list-style-type: none"> <li>• Explain different views supporting origin of life.</li> <li>• Describe the theories of origin of life on the basis of Oparin and Haldane's theory.</li> <li>• Explain Miler and Urey's experiment.</li> <li>• Describe different types of evidences such as Biological, Anatomical, Embryological, Palentological, physiological, genetic and evidences of geographical distribution.</li> <li>• Elaborate the theory of Lemarckism, Darwinism and Neo-Darwinism or modern synthesis of evolution.</li> <li>• Describe the process of human evolution.</li> </ul>                                                                                                                                                                                                                                                                                                                                            | <b>Unit 3: Evolution</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Theories of origin of life</li> <li>• Biochemical conception of evolution</li> <li>• Different view of organic evolution</li> <li>• Evidences of evolution</li> <li>• Lemarckism, Darwinism and Neo Darwinism</li> <li>• Human evolution</li> </ul>               | 5 |
| <ul style="list-style-type: none"> <li>• Show the mechanism of photosynthesis.</li> <li>• List the factor affecting photosynthesis.</li> <li>• Describe the mechanism of aerobic and anaerobic respiration.</li> <li>• List the factor affecting respiration.</li> <li>• Describe the adaptation process of animals and plants on the basis of aquatic, amphibious and terrestrial.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Unit 4: Life processes</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Photosynthesis</li> <li>• Respiration</li> <li>• Adaption</li> <li>• Physiological system of human <ul style="list-style-type: none"> <li>- Nutrition</li> </ul> </li> </ul>                                                                                 | 8 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• Draw the digestive organs and describe the digestion process of food on human being.</li> <li>• Describe the respiratory organs and mechanism of human.</li> <li>• Elaborate circulatory system on the basis of hearts and its action, arterial and venous system, blood groups, Rh-factor, blood pressure and lymph (only definition).</li> <li>• Explain excretory organs, mechanism of urine formation, osmoregulation and homeostatic mechanism.</li> <li>• List the types of nervous system and function of brain.</li> <li>• Draw the structure of brain.</li> <li>• Describe endocrinology on the basis of structures, functions and disorders of pituitary, thyroid, parathyroid, pancreas and adrenal glands.</li> <li>• Explain the reproductive organs and their function of human being.</li> <li>• Draw the structure of eye and ear and list its function.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>- Respiratory</li> <li>- Circulatory</li> <li>- Excretion</li> <li>- Nervous Co-ordination</li> <li>- Endocrinology</li> <li>- Reproduction</li> <li>- Sense organs</li> </ul>                                                                                                                                                                                                                       |   |
| <ul style="list-style-type: none"> <li>• Describe apiculture on the basis of types and life cycle of honey bee.</li> <li>• Discuss the modern techniques of bee keeping.</li> <li>• Explain the economic importance of bee.</li> <li>• Collect information on the development of fish farming.</li> <li>• Identify salient features of culturable fishes.</li> <li>• Collect information about various types of fishes available in Nepal.</li> <li>• Describe different types of ponds necessary for pisciculture.</li> <li>• Point out the importance of sericulture.</li> <li>• Describe the different diseases and parasites of honey bee and silkworm.</li> <li>• Explain the different types of poultry breeds and the breeding methods.</li> <li>• List the importance of products and by-products of poultry farming.</li> <li>• Explain the principle of animal husbandry.</li> <li>• List the different economical plants on the basis of medicinal, timber and oil yielding.</li> <li>• Introduce biotechnology of plants on the basis of tissue culture, breeding techniques, disease resistant plants and green manures.</li> <li>• Describe fermentation technology on the basis of alcoholic and antibiotic fermentation.</li> <li>• List the different types of antibiotic vaccines and its application.</li> </ul> | <p><b>Unit 5: Economic and applied biology</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Apiculture</li> <li>• Pisciculture</li> <li>• Sericulture</li> <li>• Poultry farming</li> <li>• Animal husbandry</li> <li>• Economic plants</li> <li>• Biotechnology</li> <li>• Fermentation technology</li> <li>• Antibiotic vaccines</li> <li>• Tissue and organ transplantation</li> <li>• Test-tube baby</li> </ul> | 8 |



|                                                                                                                                |  |  |
|--------------------------------------------------------------------------------------------------------------------------------|--|--|
| <ul style="list-style-type: none"> <li>Introduce the process of tissue and organ transplantation and test-tube baby</li> </ul> |  |  |
|--------------------------------------------------------------------------------------------------------------------------------|--|--|

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                                                                                                                                                               | Contents                                                                                                                                                                      | Periods |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>To prepare temporary slides and study the structure of plant cell.</li> <li>To prepare the temporary slide of dicot and monocot stem and study the different types of tissues.</li> <li>To prepare the temporary slide of dicot root and monocot leaf and study the different types of tissues.</li> <li>To prepare permanent slides of anatomy of plant parts.</li> </ul> | <b>Unit 1: Anatomy</b> <ul style="list-style-type: none"> <li>Plant cell</li> <li>Dicot and monocot stem, root, and leaves</li> <li>Secondary growth of dicot stem</li> </ul> | 15      |
| <ul style="list-style-type: none"> <li>To study the permanent slides of different stages of mitosis and meiosis cell division.</li> <li>To observe, draw and label diagram of mitotic and meiotic cell division</li> </ul>                                                                                                                                                                                        | <b>Unit 2: Mitosis and meiosis</b> <ul style="list-style-type: none"> <li>Different stages</li> </ul>                                                                         | 6       |
| <ul style="list-style-type: none"> <li>To observe the rate of photosynthesis under different condition of light (red, blue and green light).</li> <li>To observe and find out that chlorophyll is essential for photosynthesis.</li> </ul>                                                                                                                                                                        | <b>Unit 3: Photosynthesis</b> <ul style="list-style-type: none"> <li>Effect of light and rate of photosynthesis</li> <li>Role of chlorophyll</li> </ul>                       | 9       |
| <ul style="list-style-type: none"> <li>To perform an experiment on anaerobic respiration.</li> </ul>                                                                                                                                                                                                                                                                                                              | <b>Unit 4: Respiration</b> <ul style="list-style-type: none"> <li>Anaerobic respiration by germinated seeds</li> </ul>                                                        | 6       |
| <ul style="list-style-type: none"> <li>To observe, draw label diagrams for the structure and life cycle of honeybee, fish and silkworm.</li> </ul>                                                                                                                                                                                                                                                                | <b>Unit 5: Life cycle</b> <ul style="list-style-type: none"> <li>Honey bee</li> <li>Fish</li> <li>Silkworm</li> </ul>                                                         | 6       |
| <ul style="list-style-type: none"> <li>Visit the agricultural farms and laboratories for studying plants or animal breeding process or experiment their habit and habitus, life cycle process etc., of this field and write, submit and present the report.</li> </ul>                                                                                                                                            | <b>Unit V: Field Visit and Report Writing</b> <ul style="list-style-type: none"> <li>Visit to agricultural farms and laboratories</li> <li>Report writing</li> </ul>          | 6       |

## 12. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method

- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Group work, Report writing and presentation
- Individually laboratory work
- Field visit

### 13. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

#### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                          |                  |
|------------------------------------------|------------------|
| 11) Attendance                           | 5 points         |
| 12) Participation in learning activities | 5 points         |
| 13) First assignment ( Presentation)     | 10 points        |
| 14) Second assignment (Term exam)        | 10 points        |
| 15) Third assignment (Project work)      | 10 points        |
| <b>Total</b>                             | <b>40 points</b> |

#### 5.2 Theory: External evaluation (Full marks 50)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |                  |
|--------------|------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points        |
| <b>Total</b> |                                                                  | <b>40 points</b> |

**Note: All questions are compulsory**

#### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination | Area | Points | Total Points |
|-------------|------|--------|--------------|
|-------------|------|--------|--------------|

|                       |                                |         |           |
|-----------------------|--------------------------------|---------|-----------|
| Internal              | Regularity                     | 1.5     | 4 points  |
|                       | Practical Performance          | 1       |           |
|                       | Record book                    | 1.5     |           |
| External              | Experiment (at least 2 Exp.)   | 9 (4+5) | 12 Points |
|                       | Viva                           | 3       |           |
| External and Internal | Field visit and Report writing |         | 4 points  |
| Total Points          |                                |         | 20 points |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

### **Recommended and References Books**

Bhattarai, T. (2007). *Plant physiology*. Kathmandu: Bhudipuran Prakasan.

Dutta, A.C. (2007). *Botany for degree students*. Oxford University Press. **(For units 1 and 2)**

Pandey B. P. (2009). *Modern practical botany Vol I and Vol II*. New Delhi: S. Chand and Company Ltd. **(For Practical)**

Pandey, B. P. (2009). *Plant anatomy*. New Delhi: S. Chand and Company Ltd. **(For Unit 1)**

Pandey, S. N & Sinha, B. K. ( 2006). *Plant physiology*. New Delhi: Bikash Publishing House Pvt. Ltd. **(For Unit 4)**

Sukla, R.S. & Chandel, P.S. (2007). *Cytogenetics, evolution and plant breeding*. New Delhi: S. Chand and Company Ltd. **(For Unit 2 and 3)**

Verma, P.S. (1995). *A manual of practical zoology*. New Delhi: S. Chand and Company Ltd. **(For Practical)**

Verma, P.S. & Agarwal, V. K. (2006). *Cell Biology, Genetics, molecular biology, evolution and ecology*. New Delhi: S. Chand and Company Ltd. **(For Unit 1, 2, 3 and 4)**

Vidyarthi, R.D. & Pandey, P.N. (2008). *A text book of zoology*. New Delhi: S. Chand and Company Ltd. **(For Unit all unit)**

Viswapremi, K. & Chandra, K. (1995). *Economic zoology*. New Delhi: Anomol Publication Pvt. Ltd. **(For Unit 5)**

**Mid-West University  
Graduate School of Education  
Surkhet, Nepal**



**Bachelor of Science Education (BEd-Sc)  
Curriculum  
4<sup>th</sup> Semester**

# **Bachelor of Science Education (BEd-Sc)**

## **Curriculum**

### **4<sup>th</sup> Semester**

| <b>S. No</b> | <b>Course Code No</b> | <b>Course Name</b>       | <b>Credit Hour</b> | <b>Feature</b>       |
|--------------|-----------------------|--------------------------|--------------------|----------------------|
| 1.           | SCED 443              | Essential Chemistry      | 3                  | T-2, P-1             |
| 2.           | SCED 444              | Essential Biology        | 3                  | T-2, P-1             |
| 3.           | SCED 445              | ICT in Science Education | 3                  | T-2, P-1             |
| <b>Total</b> |                       |                          | <b>9</b>           | <b>Th-6<br/>Pr-3</b> |

Course Title: **Essential Chemistry**  
 Course Code: SCED 443  
 Nature of Course: Theory + Practical  
 Semester: B.Ed. /IV  
 Total Period: 32+48 (Th. + Pr.) = 80 Periods

Full Marks: 80 (T) +20 (P)  
 Pass Marks: 40 (T) +10 (P)  
 Time per Credits: 2(T) +3( Pr) /Week/group (p)  
 Total Credit: 2+1 (Th. + Pr.)

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The theoretical parts consists of different units of essential chemistry which are essential in daily life. The major topics included in this course are Carbohydrate, Vitamin, Minerals, Protein and amino acids, Petroleum and petrochemicals, and Dyes and purines. In practical parts, different experiments to be performed which are listed in particle course. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching and learning process. The students are required to secure pass marks in theory as well as practical course separately.

### 2. General Objectives

On the completion of this course student will be able to following general objectives:

- To enable the students in dealing with the carbohydrate chemistry, their sources and functions.
- To familiarize the students with different forms vitamins their sources, function and deficiency.
- To help the students analyze different types of minerals their sources and function.
- To acquaint the students with the basic concepts amino acids and proteins, their chemistry, sources and function.
- To enable the students familiarize with the concepts of petroleum and petrochemical and their application.
- To provide students with an opportunity to understand the important dyes and purines.
- To inculcate the knowledge and skills of chemistry through pedagogical learning experiences and practical activities.
- To enable students conducting experiment on the identification carbohydrates, minerals, protein amino acid and estimation of vitamin.

### 3. Specific Objectives and Contents

#### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Periods |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>• Define carbohydrate with examples</li> <li>• List out the different sources of carbohydrates.</li> <li>• Classify and naming the carbohydrates on the basis of hydrolysis, reducing behavior, solubility and number of carbon atoms.</li> <li>• Elaborate the general reactions of monosaccharides on the basis of oxidation, reduction, acetylation, phenylhydrazine, alkali, glycoside formation and epimerization.</li> <li>• Describe the configuration of monosaccharide (Aldotrioses and aldohexoses)</li> <li>• Define and describe the conformation of monosaccharides (Aldohexoses)</li> <li>• Relate configuration and molecular rotation.</li> <li>• Draw the Fischer and Haworth projection formula of D-glucose.</li> <li>• List out the some important monosaccharides.</li> <li>• Define and classify the natural glycoside with examples.</li> <li>• Draw the structure of sucrose, lactose, maltose, raffinose, and gentianose.</li> </ul> | <b>Unit 1: Carbohydrates</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Sources of carbohydrates</li> <li>• Nomenclature and Classification</li> <li>• General reaction of mono saccharides</li> <li>• Configuration of mono saccharides</li> <li>• Conformation of mono saccharides</li> <li>• Relationship between configuration and molecular rotation</li> <li>• Projection formula of monosaccharides</li> <li>• Some important mono saccharides</li> <li>• Natural glycosides</li> <li>• Disaccharides : Structure of sucrose, lactose, and maltose</li> </ul> | 7       |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• Draw the structure of cellulose and starch amylopectin.</li> <li>• Point out the main function of carbohydrates.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li>• Tri-saccharides : Structure of raffinose, and gentianose</li> <li>• Polysaccharides: Structure of cellulose, and starch</li> <li>• Function of carbohydrates</li> </ul>                                                                                                                                                                                                                                                                     |   |
| <ul style="list-style-type: none"> <li>• Define vitamin.</li> <li>• Classify vitamin on the basis of solubility and list out characteristics.</li> <li>• Point out the sources, biochemical function and deficiency of fat soluble vitamin A, D, E and K.</li> <li>• List the different sources, biochemical function and deficiencies of water soluble vitamin C and B complex (Vitamin B<sub>1</sub>, B<sub>2</sub>, niacin, biotin, folic acid and B<sub>12</sub>).</li> <li>• Draw the structure of vitamin A<sub>1</sub> (retinol) and C (Ascorbic acid)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                        | <b>Unit 2: Vitamins</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Classification</li> <li>• Biochemical functions and role of fat soluble vitamin (A, D, E and K)</li> <li>• Biochemical functions and role of water soluble vitamin C and B complex <ul style="list-style-type: none"> <li>- B Complex (Vitamin B<sub>1</sub>, B<sub>2</sub>, niacin, biotin, folic acid and B<sub>12</sub>).</li> </ul> </li> <li>• Structure of vitamin A and C</li> </ul> | 5 |
| <ul style="list-style-type: none"> <li>• Define catalysis</li> <li>• Define minerals</li> <li>• Classify minerals with examples.</li> <li>• Tabulated the sources and function of macro and micro minerals.</li> <li>• Differentiate between macro and micro minerals.</li> <li>• Classify metal ions on the basis of their properties, requirements, and concentrations.</li> <li>• Discuss the biological importance of Na<sup>+</sup>, K<sup>+</sup>, Ca<sup>2+</sup>, Mg<sup>2+</sup>, Zn, Fe, and Cu.</li> <li>• List out the symptoms of elemental deficiency of humans.</li> <li>• Describe the metal poisoning of some elements such as Cr, Pb, Hg, Fe, and As.</li> </ul>                                                                                                                                                                                                                                                              | <b>Unit 3: Minerals</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Classification with example</li> <li>• Source and functions of macro and micro minerals</li> <li>• Classification of metal ions</li> <li>• Biological importance of metal and metals ions.</li> <li>• Symptoms of elemental deficiency in humans</li> <li>• Metal poisoning</li> </ul>                                                                                                      | 4 |
| <ul style="list-style-type: none"> <li>• Define amino acid.</li> <li>• List out the different sources of proteins and amino acids.</li> <li>• Classify amino acid on the different basis with examples.</li> <li>• Point out the physical properties of amino acids.</li> <li>• Describe the chemical properties such as reactions of amino and carboxyl group, and reactions involving both the carboxyl and amino group.</li> <li>• Define and explain the peptide and peptide linkage (Dipeptide, tripeptide and polypeptide).</li> <li>• Define Zwitter ion and isoelectric points with examples.</li> <li>• Define protein and point out its characteristics.</li> <li>• Define denaturation of protein and list out the causes of denaturation.</li> <li>• Classify protein on the basis of increasing complexity in their structure and their molecular structure with examples.</li> <li>• List out the function of protein.</li> </ul> | <b>Unit 4: Protein and amino acids</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Sources of protein and amino acids</li> <li>• Classification of amino acids</li> <li>• Physical and chemical properties</li> <li>• Poly peptide</li> <li>• Zwitter ions and isoelectric points</li> <li>• Protein and its characteristics</li> <li>• Denaturation of protein</li> <li>• Classification of protein</li> <li>• Function of protein</li> </ul>                  | 5 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |   |
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| <ul style="list-style-type: none"> <li>Discuss the origin of petroleum and petrochemicals.</li> <li>Define and describe the thermal and catalytic cracking.</li> <li>Draw out the figure of thermal and catalytic cracking and describe their process.</li> <li>Define reforming with examples.</li> <li>Explain the properties of motor and aviation fuel on the basis of octane number, cetane number, knocking and gasoline additives.</li> <li>Describe the different process used for the synthesis of high octane hydrocarbons from refinery gasses such as polymerization, alkylation, isomerization and dehydrogenation</li> <li>Discuss the process for the aromatic hydrocarbons from coal.</li> <li>Define petrochemicals and describe the different raw materials for petrochemicals.</li> <li>Explain the process for the production of petrochemicals from olefins, acetylene, alkane, cycloalkane, and aromatic hydrocarbon</li> <li>Describe the methods for preparing synthetic petrol on the basis of Bergius and Fischer-tropsch process</li> <li>Point out the importance of petroleum.</li> </ul> | <b>Unit 5: Petroleum, and petrochemicals</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Cracking (thermal and catalytic)</li> <li>Reforming</li> <li>Properties of motor and aviation fuel (polymerization, alkylation, isomerization and dehydrogenation)</li> <li>Aromatic hydrocarbons from coal</li> <li>Petro chemicals <ul style="list-style-type: none"> <li>-Raw materials for petrochemicals</li> <li>-Production of petrochemicals from olefins, acetylene, alkane, cycloalkane, and aromatic hydrocarbon</li> </ul> </li> <li>Synthetic petrol <ul style="list-style-type: none"> <li>-Bergius and Fischer-tropsch process</li> </ul> </li> <li>Importance of petroleum</li> </ul> | 6 |
| <ul style="list-style-type: none"> <li>Define dye.</li> <li>Classify dyes on the basis of occurrence, chemical structure and application with examples.</li> <li>List out the characteristics of dyes.</li> <li>Define the terms chromophore, auxochrome and chromagin with examples</li> <li>Explain the classical approach and modern theories of dying.</li> <li>Draw the structure of azo, indigotin and alizarin dye.</li> <li>Point out the main application of dye.</li> <li>Define purines with examples.</li> <li>Classify purines.</li> <li>Describe the process for the synthesis of purines.</li> <li>Illustrate the isolation of uric acid and caffeine.</li> <li>Draw the structure of uric acid and caffeine.</li> <li>Point out the main application of purines.</li> </ul>                                                                                                                                                                                                                                                                                                                            | <b>Unit 6: Dyes and Purine</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Classification of dye</li> <li>Characteristics of dye</li> <li>Chromophor, chromagin and auxochrome</li> <li>Dyeing</li> <li>Structure of dyes (azo, indigotin, and alizarin dyes)</li> <li>Application of dyes</li> <li>Purines</li> <li>Classification of purines</li> <li>Synthesis of purine</li> <li>Structure and isolation of uric acid, and caffeine</li> <li>Application of purines</li> </ul>                                                                                                                                                                                                             | 5 |

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

#### **Part 2: Practical**

| <b>Specific objectives</b>                                                                                                                                                   | <b>Contents</b>                                                                                                                                                                                                                                                                                                                                                | <b>Periods</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <ul style="list-style-type: none"> <li>Diagnose the given Carbohydrate</li> <li>Find out the purity of Sugar</li> <li>Detect the vitamin C present in fruit juice</li> </ul> | <ul style="list-style-type: none"> <li>To identify the given carbohydrate(at least 3 carbohydrate)</li> <li>Determination of percentage purity of sugar</li> <li>Determination of Vitamin C in given fruit juice</li> <li>To perform simple test of protein (milk and egg sample)</li> <li>To perform simple test of fat and oils in a given sample</li> </ul> | 48             |



|                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                          |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <ul style="list-style-type: none"> <li>Perform the test of amino acids and proteins in different samples.</li> <li>Diagnose and estimate the minerals matter in provided food sample.</li> </ul> | <ul style="list-style-type: none"> <li>To separate lactose from the given sample of milk.</li> <li>To determine the ash and minerals matter in different food items: Total ash, acid soluble and insoluble ash, alkalinity of ash, calcium, iron, and copper.</li> </ul> |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

## 2 Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Individually laboratory work

## 3 Evaluation: Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                         |                  |
|-----------------------------------------|------------------|
| 1) Attendance                           | 5 points         |
| 2) Participation in learning activities | 5 points         |
| 3) First assignment ( Presentation)     | 10 points        |
| 4) Second assignment (Term exam)        | 10 points        |
| 5) Third assignment (Project work)      | 10 points        |
| <b>Total</b>                            | <b>40 points</b> |

### 5.2 Theory: External evaluation (Full marks 40)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |                  |
|--------------|------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points        |
| <b>Total</b> |                                                                  | <b>40 points</b> |

**Note: All questions are compulsory**

### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination | Area                         | Points   | Total Points |
|-------------|------------------------------|----------|--------------|
| Internal    | Regularity                   | 2        | 6 points     |
|             | Practical Performance        | 2        |              |
|             | Record book                  | 2        |              |
| External    | Experiment (at least 2 Exp.) | 11 (5+6) | 14 Points    |

|              |      |   |           |
|--------------|------|---|-----------|
|              | Viva | 3 |           |
|              |      |   |           |
| Total Points |      |   | 20 points |

**Note:** *The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.*

#### **Recommended and References Books**

Agarwal, O. P. (2004). *Chemistry of Organic Natural Products (Vol. 1)*. Meerut: Goel Publishing house.

Bahl, A., & Bhal, B.S. (2008). *A textbook of organic chemistry*. New Delhi: S. Chanda and company limited.

Chatwal, G. R. (2007), *Organic Chemistry of Natural Products Vol I and II*, India: Himalaya publishing house

Dhaubdel, S.P., Pradhan, K.P., & Joshi, S.M. (n.d.). *Practical chemistry guide*. Nepal: Kathmandu.

Finar, I. L. (2008). *Organic Chemistry, Volume: 2 Stereochemistry and the Chemistry of Natural Products*. India: Pearson Education.

Khadka, N.M., Gautam, S.D. & Yadav, P.N. (n.d). *A core experimental chemistry*. Kathmandu: Kedeas Book Center.

March, J. (2012). *Advanced Organic Chemistry*. New Delhi: A Wiley Inter-science Publication.

Pandit, C.N., Subedi, R.R. & Tiwari, P.(2074 B.S.). *A text book of Chemistry*, Kathmandu: K. P. Pustak Bhandar.

Vishnoi, N.K. (1985). *Advanced practical organic chemistry*. India: Vikas Publishing House Pvt. Ltd.

Course Title: **Essential Biology**  
Course Code: SCED 444  
Nature of Course: Theory + Practical  
Semester: B.Ed. /IV

Full Marks: 80 (T) +20 (P)  
Pass Marks: 40 (T) +10 (P)  
Time per Credits: 2(T) +3( Pr) /Week/group (p)  
Total Credit: 2+1 (Th. + Pr.)  
Total Period: 32+48 (Th. + Pr.) = 80 Periods

#### 4. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The theoretical parts consists of different unit related to essential of living organism. The major topics included in this course are Ecology and environment, Conservation biology and vegetation, Patterns of evolution and biogeography, Neurobiology, Behavioral biology, and Immunology and microbial disease. In practical parts, different experiments to be performed which are listed in particle course, besides this experiment performed, field visit and report writing. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. The students are required to secure pass marks in theory as well as practical course separately.

#### 5. General Objectives

On the completion of this course student will be able to following general objectives:

- To provide students with the in-depth knowledge of ecology and environment and way of ecological adaptation in living organism.
- To acquaint the students with the concept of biodiversity and their conservation techniques.
- To enable the students in elaborating the patterns of evolution and biogeography.
- To familiarize the students with nervous system and brain function related to neurobiology.
- To make the students familiarize with the mechanisms and development of different animal behavior such as learning and memory (bees, birds, primates), feeding behavior and mating systems and ecology of parental care etc.
- To acquaint the students with the concept of Immunology and microbial disease and their preventive methods.
- To impact knowledge to the students on essential aspect of animal and plant science and their application.
- To enable students to prepare report on their field visit, write practical record file by using appropriate methods and approaches.

#### 6. Specific Objectives and Contents

##### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Contents                                                                                                                                                                                                                                                                                                                 | Periods |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"><li>• Define ecosystem and ecology.</li><li>• List and describe different types of ecosystem and their ecological factors.</li><li>• Relate the interdependence of ecosystem and ecological factors.</li><li>• Elaborate the primary and secondary process of ecological adaption in animals and plants.</li><li>• List out the main factors causes ecological imbalance and discuss with classroom.</li><li>• Illustrate the microbiota, mesobiota and macrobiota.</li><li>• Show the relationship between biota and environment.</li><li>• Describe the various ways of animal adaption on the biospheres.</li><li>• Classify pesticides and describes their effects on animal adaption.</li></ul> | <b>Unit 1: Ecology and environment</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Ecosystem and ecology</li><li>• Ecological adaptation</li><li>• Ecological imbalances.</li><li>• Biota and Environment</li><li>• Animal adaptations</li><li>• Pesticides and their effects on adaptation</li></ul> | 5       |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• Explain the concept of biodiversity on the basis of ecosystem, species and genetic biodiversity.</li> <li>• Point out the today gradual loss of biodiversity.</li> <li>• Describe the need and forms of conservation.</li> <li>• List out the methods of plant conservations.</li> <li>• Elaborate the biodiversity of Nepal and its conservation.</li> <li>• Discuss the National policy and conservation measures taken by the government of Nepal.</li> <li>• Describe the National parks, Wildlife reserve, and different conservation areas of Nepal.</li> <li>• Discuss the biodiversity hotspots, watershed, wetland, Ramsar sites and their importance.</li> <li>• Illustrate the causes of extinction of biodiversity and conservation strategies adopted by government of Nepal.</li> <li>• List out the different types of vegetation in Nepal and discuss it.</li> <li>• Elaborate the concept of In-situ (protected areas) and Ex-situ (botanical garden, seed bank) conservation and their importance.</li> </ul> | <b>Unit 2: Conservation Biology and vegetation</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Concept of biodiversity</li> <li>• Biodiversity conservation</li> <li>• National parks,</li> <li>• Wildlife reserves</li> <li>• Conservation areas</li> <li>• Biodiversity hotspots</li> <li>• Wetland and Ramsar sites</li> <li>• Causes of extinction and conservation strategies</li> <li>• Types of vegetation in Nepal</li> <li>• Concept of In-situ (protected areas) and Ex-situ (botanical garden, seed bank) conservation.</li> </ul>                                                                                                                                                | 6 |
| <ul style="list-style-type: none"> <li>• Describe the basic patterns of evolution on the basis of Sequential and divergent evolution, Micro, macro, mega and quantum evolution.</li> <li>• Explain the modern synthetic theory of evolution</li> <li>• Illustrate the Gene pool and gene frequency on the basis of evolution patternsd.</li> <li>• Elaborate the Hardy Weinberg Law on the basis of evolution patterns.</li> <li>• Define biogeography and its importance.</li> <li>• Describe the process of biogeographic distribution.</li> <li>• Explain the biogeographic patterns and process.</li> <li>• Illustrate the different zoogeographic realm and their significance.</li> <li>• Describe theory of island biogeography.</li> <li>• Explain zoogeographic affinities of fauna with its example and their importance.</li> </ul>                                                                                                                                                                                                                           | <b>Unit 3: patterns of Evolution and Biogeography</b> <ul style="list-style-type: none"> <li>• Basic patterns of evolution: <ul style="list-style-type: none"> <li>- Sequential and divergent evolution</li> <li>- Micro, macro, mega and quantum evolution</li> <li>- Modern synthetic theory of evolution</li> <li>- Gene pool and gene frequency</li> <li>- Hardy Weinberg Law</li> </ul> </li> <li>• Biogeography: <ul style="list-style-type: none"> <li>- Introduction</li> <li>- Biogeography and distribution</li> <li>- Biogeographic patterns and process</li> <li>- Zoogeographic realms</li> <li>- Theory of island biogeography,</li> <li>- Zoogeographic affinities of fauna</li> </ul> </li> </ul> | 5 |
| <ul style="list-style-type: none"> <li>• Define neurobiology and its importance.</li> <li>• Draw the chart of nervous system.</li> <li>• Explain the organization of nervous system,</li> <li>• Figure out the cells and connection of the nervous system.</li> <li>• Describe the neurotransmitters and neuropeptides on the basis of their role and functions.</li> <li>• Elaborate the meaning and process of neural regulation of complex function.</li> <li>• Describe the brain Functions on the basis of consciousness, biorhythm and its regulatory</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Unit 4: Neurobiology</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Organization of the nervous system</li> <li>• cells and connection of the nervous system</li> <li>• Neurotransmitters and neuropeptides</li> <li>• Neural regulation of complex functions</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                 | 5 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| genes/circadian timekeeping, sleep, dreaming and wakefulness, reward, addiction, and emotion.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>brain Functions ; consciousness, biorhythm and its regulatory genes/circadian timekeeping, sleep, dreaming and wakefulness, reward, addiction, and emotion</li> </ul>                                                                                                                                                                                                                                                                                                                                                         |   |
| <ul style="list-style-type: none"> <li>Introduce behavioral biology and their needs.</li> <li>Explain the principles of behavioral biology.</li> <li>Describes the different mechanisms and development process of animal behavior with suitable examples.</li> <li>Illustrate the stimuli and communication and their importance.</li> <li>Explain the learning process and memory of bees, birds and primates.</li> <li>Elaborate the ecology of feeding behavior, mating system and parental care with different examples.</li> </ul>                                                                                                                                                                                                                                                                                                                                                         | <b>Unit 5: Behavioral Biology:</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Principles</li> <li>Mechanisms and development of animal behavior</li> <li>Stimuli and communication</li> <li>learning and memory (bees, birds, primates),</li> <li>Ecology of feeding behavior, mating systems and parental care.</li> </ul>                                                                                                                                                                                                                        | 5 |
| <ul style="list-style-type: none"> <li>Define immunology.</li> <li>Define and explain immune system and receptors with examples.</li> <li>Describe the nature of antigen and antibody.</li> <li>Illustrate the immune effectors mechanism.</li> <li>Discuss the major histocompatibility complex (MHC) genes and products with examples.</li> <li>List out the risk and hazard group of microorganism.</li> <li>Illustrate the different microbial disease and their causative agents.</li> <li>Point out the different symptoms, preventive measures and controlling procedure of different microbial disease such as tuberculosis, HIV, SARS, COVID-19 and hepatitis.</li> <li>Discuss the concepts of immunology-vaccines and practices of Nepal in their application.</li> <li>Prepare a report on the topic “World pandemic situation of COVID-19’ and present in the classroom.</li> </ul> | <b>Unit 6: Immunology and Microbial Diseases</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Immune system</li> <li>Receptors</li> <li>Nature of antigen and antibody,</li> <li>Immune effectors mechanisms</li> <li>Major histocompatibility complex (MHC) genes and products</li> <li>Risk and hazard group of microorganisms</li> <li>Causative agents</li> <li>Symptoms, prevention and control measures of selected human diseases (tuberculosis and HIV, SARS, COVID-19, hepatitis)</li> <li>Basic concepts of immunology–vaccines</li> </ul> | 6 |

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

### Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                                                                                             | Contents                                                                                                                                                       | Periods |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>To study the different components in a grassland ecosystem.</li> <li>To study the different components in a pond ecosystem.</li> </ul>                                                                                                                                                                   | <b>Unit 1: Ecosystem</b> <ul style="list-style-type: none"> <li>Grassland ecosystem</li> <li>Pond ecosystem</li> </ul>                                         | 6       |
| <ul style="list-style-type: none"> <li>To collect and prepare herbarium specimens of some available medicinal plants which treat microbial diseases.</li> <li>To study the structure of bacterium and its types.</li> <li>To study the structure of virus and its types</li> <li>To prepare temporary slides on any fungal diseases.</li> </ul> | <b>Unit 2: Microbial disease</b> <ul style="list-style-type: none"> <li>Preparation of temporary slides of fungi using lactophenol and cotton blue.</li> </ul> | 24      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <ul style="list-style-type: none"> <li>To identify viral, bacterial and fungal diseases from permanent slides.</li> <li>To carry out the seed germination test by blotter method and rolled paper towel method.</li> <li>To prepare culture media of fungi.</li> <li>Study of specimens and Histological Structures of different disease causing viruses.</li> </ul>                                                                                                                                          | <ul style="list-style-type: none"> <li>Identification of some viral, bacterial and fungal diseases.</li> </ul>                                                                 |    |
| <ul style="list-style-type: none"> <li>To prepare a model of human brain and demonstrate it.</li> <li>To prepare the model of pond and grassland ecosystem.</li> </ul>                                                                                                                                                                                                                                                                                                                                        | <b>Unit 3: Preparation of model</b>                                                                                                                                            | 6  |
| <ul style="list-style-type: none"> <li>Collection, preservation and herbarium preparation.</li> <li>Submission of field trip report (individual).</li> <li>To visit fields and agricultural laboratories for studying learning and memory, Ecology of feeding behavior, mating systems and parental care at least two animals and submission of field Report in a proper format.</li> <li>Study field visits of biodiversity conservation areas and submission of field Report in a proper format.</li> </ul> | <b>Unit 4: Field Trip and report writing.</b> <ul style="list-style-type: none"> <li>Field trip</li> <li>Agricultural laboratories/ Biodiversity conservation areas</li> </ul> | 12 |

## 7. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Group work, Report writing and presentation
- Construction of learning materials
- Individually laboratory work
- Field visit

## 8. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

- |                                         |           |
|-----------------------------------------|-----------|
| 6) Attendance                           | 5 points  |
| 7) Participation in learning activities | 5 points  |
| 8) First assignment ( Presentation)     | 10 points |

|                                     |                  |
|-------------------------------------|------------------|
| 9) Second assignment (Term exam)    | 10 points        |
| 10) Third assignment (Project work) | 10 points        |
| <b>Total</b>                        | <b>40 points</b> |

## 5.2 Theory: External evaluation (Full marks 50)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |                  |
|--------------|------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points        |
| <b>Total</b> |                                                                  | <b>40 points</b> |

**Note: All questions are compulsory**

## 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination           | Area                           | Points  | Total Points |
|-----------------------|--------------------------------|---------|--------------|
| Internal              | Regularity                     | 1.5     | 4 points     |
|                       | Practical Performance          | 1       |              |
|                       | Record book                    | 1.5     |              |
| External              | Experiment (at least 2 Exp.)   | 9 (4+5) | 12 Points    |
|                       | Viva                           | 3       |              |
| External and Internal | Field visit and Report writing |         | 4 points     |
| Total Points          |                                |         | 20 points    |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

## Recommended and References Books

- DPR (2067 BS). *Nepalko Aarthik Bikaskalagi Prathamikta Prapta 30 Jadibutiharuko Pahichan Pustika*. Department of Plant Resources, Ministry of Forests and Soil Conservation. Government of Nepal, Kathmandu.
- DPR(2016). *Medicinal Plants of Nepal*. Department of Plant Resources. Ministry of Forests and Soil Conservation. Government of Nepal, Kathmandu
- Dutta, A. C. (2007). *Botany for Degree Students*. New Delhi: Oxford University press.
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- Ranjitkar, H.D. (2005). *A hand book of practical botany*. Kathmandu: Sewa printing press
- Sateesh, M.K. (2003). *Biotechnology (Animal Cell Biotechnology, Immunology, Plant Biotechnology)*. New Delhi: New Age Int. Pvt. Ltd.
- Sinha, U. & Sinha, S. (2004). *Cytogenetics, Plant breeding and Evolution*. New Delhi: Bikash Publishing House.
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- Thomas Y., Karki, M., and Parajuli D. eds (2002). *Himalayan Medicinal and Aromatic Plants. Balancing Use and Conservation*. Proceedings of the Regional Workshop on Wise Practices and Experimental Learning in Conservation and Management of Himalaya Medicinal Plants (December 15-20, 2002, Kathmandu, Nepal. Ministry of Forests and Soil Conservation. HMG of Nepal, Kathmandu.
- Vasistha, B. R. & Sinha, A. K. (2007). *Botany for degree student -fungi*. New Delhi: S. Chand & Comp. Ltd.
- Verma, P.S. & Agarwal, V. K. (2006). *Cell Biology, Genetics, molecular biology, evolution and ecology*. New Delhi: S. Chand and Company Ltd.

Course Title: **ICT in Science Education**  
Course Code: SCED 445  
Nature of Course: Theory + Practical  
Semester: B.Ed. /IV

Full Marks: 80 (T) +20 (P)  
Pass Marks: 40 (T) +10 (P)  
Time per Credits: 2(T) +3( Pr) /Week/group (p)  
Total Credit: 2+1 (Th. + Pr.)  
Total Period: 32+48 (Th. + Pr.) = 80 Periods

## 9. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The theoretical parts consists of different units related to ICT and ICT in Science Education. The major topics included in this course are ICT and ICT in science education, Policy and Practices of ICT education, Computer based teaching, Computer hardware and operating system, ICT tools and apparatus in science teaching and learning, Digital literacy for science teacher, Web 2.0 technology and LMS in education, and Ethical consideration of ICT use. In practical parts, different experiments to be performed which are listed in particle course related to ICT, besides this computer based experiment performed, preparation of ICT class and report writing. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. The students are required to secure pass marks in theory as well as practical course separately.

## 10. General Objectives

On the completion of this course student will be able to following general objectives:

- To provide students with the in-depth knowledge of ICT and use of ICT in science education, ICT resources, and role of ICT in personality and career development.
- To provide knowledge of policy and practices in ICT education.
- To enable the students in elaborating the computer based teaching and learning, as well as computer hardware and operating system.
- To apply and work with basic digital literacy skills in science teaching learning.
- To familiarize and use the students with ICT tools and apparatus for science teaching and learning.
- To apply and work with Web 2.0 technology and LMS in education in science education.
- To familiarize the students with security and ethical consideration of ICT use.
- To enable students to prepare report on policy and practice in ICT education, prepare ICT class, demonstrate ICT related practice and keeping the record by using appropriate methods and approaches.

## 11. Specific Objectives and Contents

### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Contents                                                                                                                                                                                                                                                                                                                   | Periods |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"><li>• Elaborate the meaning of ICT and ICT in science education.</li><li>• Point out the use of ICT in teaching and learning.</li><li>• List out the advance made possible by ICT including different example of science related topics.</li><li>• Tabulated the content and ICT activities in secondary level science topics.</li><li>• Describe the various types of ICT resources which support in science teaching and learning.</li><li>• List the importance of ICT in science education.</li><li>• Elaborate the role of ICT in personality development and career building.</li></ul> | <b>Unit 1: ICT and ICT in science education</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Use of ICT in teaching and learning</li><li>• Advance made possible by ICT in science topics at secondary level</li><li>• ICT resources</li><li>• Role and importance of ICT in science education</li></ul> | 5       |
| <ul style="list-style-type: none"><li>• Analyze the ICT policy in 2015, Period of Covid-19 and ICT education master plan 2013 in Nepal</li><li>• Describe the ICT practices in Nepalese education.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Unit 2: Policy and practices in ICT</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• ICT education in Nepal</li></ul>                                                                                                                                                                                 | 4       |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                             |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>Discuss the role and practice of ICT in the period of Covid-19 pandemic situation in teaching and learning</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>Practice of ICT in Nepal</li> <li>Role of ICT in teaching and learning</li> </ul>                                                                                                                                                                                                                                                                                                    |   |
| <ul style="list-style-type: none"> <li>List out the major elements of ICT and describe these elements.</li> <li>Describe the using computer for teaching and learning on the basis of Drill and practice, Tutorial mode, Simulation mode and Gaming mode.</li> <li>Point out the steps of integrating computers into the instructional process.</li> <li>Point out the uses of internet for science instruction and list out the some useful science websites for school students.</li> <li>Discuss the computer based learning on the basis of Web assisted classroom instruction and Individual learning.</li> <li>Discuss and prepare the computer based teaching such as Microsoft teams, Google meet, Zooms and others</li> <li>List out the merits and demerits of computers based teaching in the context of Nepal.</li> <li>Point out the sources of e-learning and their limitation in science teaching and learning.</li> <li>Comment “how the web will change the classroom teaching and learning”.</li> </ul> | <b>Unit 3: Computer-based teaching</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Elements of ICT</li> <li>Using computer for teaching and learning</li> <li>Steps of integrating computers into the instructional process</li> <li>Internet based learning</li> <li>Computer based teaching</li> <li>E-learning</li> </ul>                                                                               | 7 |
| <ul style="list-style-type: none"> <li>Characterize the computer</li> <li>List out the functionalities of computer</li> <li>Differentiate between hardware and software</li> <li>Introduce different computer system and computer memory.</li> <li>Introduce different input and output devices.</li> <li>Discuss and apply computer hardware and installation.</li> <li>Introduce mobile learning.</li> <li>Handle computer and use them learning facilitation.</li> <li>Enhance skill to operate the operating system.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Unit 4: Computer hardware and operating system</b> <ul style="list-style-type: none"> <li>Introduction <ul style="list-style-type: none"> <li>Characteristics, functionalities and basic components of computer</li> </ul> </li> <li>Computer system</li> <li>Computer memory</li> <li>Input and output device</li> <li>Computer hardware and installation</li> <li>Mobile learning</li> <li>Operating system</li> </ul> | 5 |
| <ul style="list-style-type: none"> <li>Classify digital literacy according to the principles of use, understand and create.</li> <li>Introduce and apply word processor.</li> <li>Introduce and enhance the skill of preparation of spread sheet and power point.</li> <li>Elaborate internet and email on the basis of use and advantage of teaching science.</li> <li>Introduce and elaborate the importance of search engine, social media and cloud computing in educational institutions.</li> <li>Discuss the feature of cloud computing.</li> <li>Explain multimedia on the basis of their elements and advantage.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                      | <b>Unit 5: Digital literacy and communication tools</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Word processor</li> <li>Spread sheet (MS-Excel)</li> <li>Power point</li> <li>Internet and email</li> <li>Search engine</li> <li>Social media</li> <li>Cloud computing</li> <li>Multimedia</li> </ul>                                                                                                  | 7 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                      |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• Introduce video conference and webinar tools, blog and moodle with their importance.</li> </ul>                                                                                                                                                                                                                                                                                                                               | <ul style="list-style-type: none"> <li>• Blog</li> <li>• Video conference and webinar tools</li> <li>• Moodle</li> </ul>                                                                                                                                                                                                                                             |   |
| <ul style="list-style-type: none"> <li>• Discuss information security and its main areas.</li> <li>• Define computer virus and discuss critical steps to protect computer.</li> <li>• Point out the importance of computer security.</li> <li>• Discuss the cyber security, cybercrime and cyber law.</li> <li>• Use ICTs with full ethical consideration.</li> <li>• Create awareness program for students in security, ethics and use and misuse of ICTs.</li> </ul> | <b>Unit 6: Computer Security</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Information security</li> <li>• Computer virus</li> <li>• Importance of computer security</li> <li>• Cyber security and Cyber crime</li> <li>• Ethics in using digital documents</li> <li>• ICT use and communication</li> <li>• Use and misuse of ICTs</li> </ul> | 4 |

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

### **Part 2: Practical**

| <b>Specific objectives</b>                                                                                                                                                                                                                                                                                    | <b>Contents</b>                                                                                                                                                                                                                                                                                          | <b>Periods</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <ul style="list-style-type: none"> <li>• To demonstrate of PC components and installation.</li> <li>• To prepare specification of PC system.</li> <li>• To perform activities using window based operating system.</li> <li>• To demonstrate of the mobile operating system</li> </ul>                        | <b>Unit 1: Computer operating system</b> <ul style="list-style-type: none"> <li>• Working with files and folders</li> <li>• Working with windows application programs.</li> <li>• Customizing the taskbar and desktops.</li> <li>• Customizing windows.</li> <li>• Working with control panel</li> </ul> | 15             |
| <ul style="list-style-type: none"> <li>• To perform the word processing activities using office.</li> <li>• To perform the spread sheet activities using office automation software like MS Excel.</li> <li>• To perform the presentation activities using office automation like MS Power point.</li> </ul>  | <b>Unit 2: Digital literacy</b> <ul style="list-style-type: none"> <li>• Word processing activities</li> <li>• Spread sheet and MS Excel</li> <li>• Powder point</li> </ul>                                                                                                                              | 15             |
| <ul style="list-style-type: none"> <li>• To create an email Account and creating a blog of Science Education.</li> <li>• To search and design teaching learning materials using given websites.</li> </ul>                                                                                                    | <b>Unit 3: Tools and apparatus for science teaching</b> <ul style="list-style-type: none"> <li>• Email account and website</li> </ul>                                                                                                                                                                    | 6              |
| <ul style="list-style-type: none"> <li>• To prepare a summary report of ICT Policy and policy master plan.</li> <li>• To analyses the role of ICT in education for pandemic situation (like Covid-19) and make a report.</li> <li>• To demonstrate Zoom class and Google meet Class within groups.</li> </ul> | <b>Unit 4: Report writing and presentation</b> <ul style="list-style-type: none"> <li>• Report writing</li> <li>• Zoom class and Google meet class.</li> </ul>                                                                                                                                           | 12             |

### **12. Instructional Techniques**

Depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration, Blogging
- Project method
- Inquiry method

- Collaborative method
- Heuristic method
- Develop multimedia presentation
- Concept mapping and brain storming
- Internet (web) surfing
- Group work, Report writing

### 13. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

#### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                          |                  |
|------------------------------------------|------------------|
| 11) Attendance                           | 5 points         |
| 12) Participation in learning activities | 5 points         |
| 13) First assignment ( Presentation)     | 10 points        |
| 14) Second assignment (Term exam)        | 10 points        |
| 15) Third assignment (Project work)      | 10 points        |
| <b>Total</b>                             | <b>40 points</b> |

#### 5.2 Theory: External evaluation (Full marks 50)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |                  |
|--------------|------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points        |
| <b>Total</b> |                                                                  | <b>40 points</b> |

**Note: All questions are compulsory**

#### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination           | Area                                        | Points  | Total Points     |
|-----------------------|---------------------------------------------|---------|------------------|
| Internal              | Regularity                                  | 1.5     | 4 points         |
|                       | Practical Performance                       | 1       |                  |
|                       | Record book                                 | 1.5     |                  |
| External              | Demonstrate experiment (at least 2 Exp.)    | 9 (4+5) | 12 Points        |
|                       | Viva                                        | 3       |                  |
| External and Internal | Report writing and Power Point presentation |         | 4 points         |
| <b>Total Points</b>   |                                             |         | <b>20 points</b> |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

#### Recommended and References Books

Acharya, U. & Upadhayaya, P. R. (2076 B.S). *ICT in Science Education*. Kathmandu: Read publication and distributors pvt. Ltd.

Cox, J., Lambart, J., & Frye, C. (2011). *Microsoft Office Professional 2010 step by step*. Redmond, Wash: Microsoft.

Leon, A. & Leon, M. (2009). *Fundamentals of Information Technology* (2<sup>nd</sup> Ed.). New Delhi: Vikash Publishing House.

Ministry of Communication and Information Technology (2072). *National Information Communication Technology Policy 2072*, Nepal: Author.

Ministry of Education (2014). *ICT Education Master Plan 2013-2018*, Nepal: Author.

Schwartz, S. (2010). *Visual quick start guide Microsoft office 2010 for windows*. Berkeley: Peachpit Press.

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**Mid-West University  
Graduate School of Education  
Surkhet, Nepal**



**Bachelor of Science Education (BEd-Sc)  
Curriculum  
5<sup>th</sup> Semester**

# **Bachelor of Science Education (BEd-Sc)**

## **Curriculum**

### **5<sup>th</sup> Semester**

| <b>S. No</b> | <b>Course Code No</b> | <b>Course Name</b> | <b>Credit Hour</b> | <b>Feature</b>        |
|--------------|-----------------------|--------------------|--------------------|-----------------------|
| 1.           | SCED 451              | Physics            | 3                  | T-2, P-1              |
| 2.           | SCED 452              | Chemistry          | 3                  | T-2, P-1              |
| 3            | SCED 453              | Economic Biology   | 3                  | T-2, P-1              |
| 4            | SCED 454              | Teaching Physics   | 3                  | T-2, P-1              |
| 5            | SCED 455              | Teaching Chemistry | 3                  | T-2, P-1              |
| <b>Total</b> |                       |                    | <b>15</b>          | <b>Th-10<br/>Pr-5</b> |

Course Title: **Physics**  
Course Code: SCED 451  
Semester: B.Ed. / V  
Total Credit: 2+1 (Th. + Pr.)

Full Marks: 80 (T) +20 (P)  
Pass Marks: 40 (T) +10 (P)  
Nature of Course: Theory + Practical  
Total Period: 32+48 (Th. + Pr.) = 80 Periods

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-West University. This course has divided in to two parts: Theory and Practical. The theoretical parts consist of different units of physics. The major topics included in this course are: elasticity, change of state, diffraction of light, optical phenomena, chemical effect of current, and ballistic galvanometer. In practical parts, different experiments to be performed which are listed in particle course. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching and learning process. The students are required to secure pass marks in theory as well as practical course separately.

### 2. General Objectives

On the completion of this course student will be able to following general objectives:

- Familiarize the students with elasticity and develop the capacity to solve the numerical problems of concerns topics.
- Enable the students to understand the concepts of change of state.
- Make them able to understand the diffraction of light and solve numerical problems.
- Enable students in dealing with different concepts of optical phenomena
- To make students familiar with chemical effect of current.
- Provide in-depth knowledge about the ballistic galvanometer.

### 3. Specific Objectives and Contents

#### Part 1: Theory

| Specific objectives                                                                                                                                                                                                                                                                                                                                                         | Contents                                                                                                                                                                                                                             | Periods  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <ul style="list-style-type: none"><li>• Elaborate the concept of Elasticity</li><li>• Describe the force in a rigid body</li><li>• Explain the rotation of a rigid body</li><li>• Explain the hydrostatics</li><li>• Explain the fluid mechanics</li><li>• Describe the concept of surface tension</li><li>• Determine the surface tension by using stalgotometer</li></ul> | <b>Unit: 1. Elasticity</b> <ul style="list-style-type: none"><li>• Forces in a rigid body</li><li>• Rotation of a rigid body</li><li>• Hydrostatics</li><li>• Fluid Mechanics</li><li>• Surface Tension</li></ul>                    | <b>6</b> |
| <ul style="list-style-type: none"><li>• Elaborate the concept of change of state</li><li>• Describe the hygrometry</li><li>• Explain the transfer of heat</li><li>• Explain the concepts of radiation</li><li>• Describe the concept thermal conductivity of copper and rubber</li><li>• Explain the thermal conductivity in terms Lee's methods</li><li>• of</li></ul>     | <b>Unit: 2. Change of state</b> <ul style="list-style-type: none"><li>• Hygrometry</li><li>• Transfer of heat</li><li>• Radiation</li><li>• Thermal conductivity (copper and rubber)</li><li>• Lee's methods</li></ul>               | <b>6</b> |
| <ul style="list-style-type: none"><li>• Elaborate the concept of diffraction of light</li><li>• Discuss and derive the diffraction at a narrow wire</li><li>• Describe the diffraction grating</li><li>• Explain the resolving power of telescope</li><li>• Explain the magnifying power of telescope</li></ul>                                                             | <b>Unit: 3. Diffraction of light</b> <ul style="list-style-type: none"><li>• Diffraction at a narrow wire</li><li>• Diffraction grating</li><li>• Resolving power of a telescope</li><li>• Magnifying power of a telescope</li></ul> | <b>5</b> |
| <ul style="list-style-type: none"><li>• Elaborate the concept of optical phenomena</li><li>• Discuss the dispersion of light</li><li>• Describe the velocity of light</li></ul>                                                                                                                                                                                             | <b>Unit: 4. Optical phenomena</b> <ul style="list-style-type: none"><li>• Dispersion</li><li>• Velocity of light</li></ul>                                                                                                           | <b>5</b> |

|                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                          |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• Explain the wave theory of light</li> <li>• Explain the physical optics</li> </ul>                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>• Wave theory of light</li> <li>• Physical optics</li> </ul>                                                                                                                                                                                      |   |
| <ul style="list-style-type: none"> <li>• Define chemical effect of current</li> <li>• Discuss the reduction factors</li> <li>• Describe the chemical equivalent</li> <li>• Explain the conductivity of electrolyte</li> <li>• Explain the A. C. Measurements</li> <li>• State the impedance and inductance</li> <li>• Explain the Frequency of A. C.</li> </ul> | <b>Unit: 5. Chemical effects of current</b> <ul style="list-style-type: none"> <li>• Reduction factors</li> <li>• Chemical equivalent</li> <li>• Conductivity of electrolytes</li> <li>• A. C. Measurements</li> <li>• Impedance and inductance</li> <li>• Frequency of A. C.</li> </ul> | 5 |
| <ul style="list-style-type: none"> <li>• Define ballistic galvanometer</li> <li>• Discuss the ballistic constant</li> <li>• Describe the current sensitivity</li> <li>• Explain the comparison of capacitance</li> <li>• Explain the comparison of Emf</li> <li>• Explain the high resistance by leakage</li> </ul>                                             | <b>Unit: 6. Ballistic galvanometer</b> <ul style="list-style-type: none"> <li>• Ballistic constant</li> <li>• Current sensitivity</li> <li>• Comparisons of capacitances</li> <li>• Comparison of Emf.</li> <li>• High resistance by leakage</li> </ul>                                  | 5 |

### Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Contents                                                                                                                                                                                                                                                  | Periods |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>• To determine the specific gravity and the length of the given tangle of wire</li> <li>• To determine the specific gravity of solid and liquid by using specific gravity bottle</li> <li>• To verify Archimedes principle</li> <li>• To determine the surface tension of liquid by capillary tube method</li> <li>• To study graphically the stress to strain relationship and determine the young's modulus of elasticity of a wire by vernier apparatus</li> <li>• To determine the frequency of A. C. mains using a sonometer</li> <li>• To convert the given galvanometer into an ammeter of given range and a voltmeter of a given range</li> <li>• To determine the reduction factor of tangent galvanometer</li> <li>• To determine the latent heat of fusion of ice</li> <li>• To determine the melting point of a solid</li> <li>• To determine optically the angle of a given prism and the angle of minimum deviation by symmetric method and determine the refractive index of prism</li> <li>• Study the different reference materials about the ballistic galvanometer and diffraction of light and prepare the report to submission</li> </ul> | <ul style="list-style-type: none"> <li>• Hydrostatics</li> <li>• Surface tension</li> <li>• Elasticity</li> <li>• Frequency of A. C.</li> <li>• Galvanometer</li> <li>• Change of state</li> <li>• Optical phenomena</li> <li>• Report writing</li> </ul> | 48      |

#### 4. Instructional Techniques

Depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration, Blogging
- Project method
- Inquiry method
- Collaborative method
- Heuristic method

- Develop multimedia presentation
- Concept mapping and brain storming
- Internet (web) surfing
- Group work, Report writing and presentation
- Individually laboratory work
- Home assignment and class participation

## 5. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                         |                  |
|-----------------------------------------|------------------|
| 1) Attendance                           | 5 points         |
| 2) Participation in learning activities | 5 points         |
| 3) First assignment ( Presentation)     | 10 points        |
| 4) Second assignment (Term exam)        | 10 points        |
| 5) Third assignment (Project work)      | 10 points        |
| <b>Total</b>                            | <b>40 points</b> |

### 5.2 Theory: External evaluation (Full marks 50)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |                  |
|--------------|------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points        |
| <b>Total</b> |                                                                  | <b>40 points</b> |

**Note: All questions are compulsory**

### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination           | Area                                                                                  | Points | Total Points     |
|-----------------------|---------------------------------------------------------------------------------------|--------|------------------|
| Internal              | Regularity                                                                            | 2      | 6 points         |
|                       | Practical Performance                                                                 | 1      |                  |
|                       | Record book                                                                           | 3      |                  |
| External              | Demonstrate experiment (at least 1 Exp.)                                              | 3      | 6 Points         |
|                       | Viva                                                                                  | 3      |                  |
| External and Internal | Overall Report writing + Presentation + Lab design + Making improvised materials etc. |        | 8 Points         |
| <b>Total Points</b>   |                                                                                       |        | <b>20 points</b> |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

## 6. Recommended and References Books

- Arora, C.L. (1988). B.Sc Practical Physics. New Delhi: S. Chand & Company, Ltd.
- Bajaj, N.K. (2000). *Physics*. Delhi: Tata MC Graw-Hill Publishing Com. Ltd.
- Gupta, S. K. and Pradhann, J. M. (1995). *A text book of physics part 1*. Jalandhar city: Surya Publication.
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- Huffer, C. M., Trinklein, F.E. & Bunge, M. (1973). *An introduction to astronomy*. New York: Holt, Rinehart and Winston, Inc.
- Sears, F.W., Zemansky, M.W., Yong , H.D., Freedman, R. A. & Ford, A. L.(2009). *University physics*. Singapore: Pears on Education.
- Shretha, U. P. (2049 BS). *A Physics practical guide*. Kathmandu: RatnaPustakkBhandar.
- Subrahmanyam, N. and Brij, L.(1996). *Principles of physics*. New Delhi: S. chanda and company Ltd.



Course Title: **Chemistry**  
Course Code: SCED 452  
Nature of Course: Theory + Practical  
Total Credit: 2+1 (Th. + Pr.)

Full Marks: 80 (T) +20 (P)  
Pass Marks: 40 (T) +10 (P)  
Semester: B.Ed. / V  
Total Period: 32+48 (Th. + Pr.) = 80 Periods

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-West University. This course has divided in to two parts: Theory and Practical. The theoretical parts consists of different units of essential chemistry which are essential in daily life. The major topics included in this course are: Nuclear chemistry, Coordination compounds, Thermodynamics and thermochemistry, Electrochemistry, Chemistry of S, P and d- block elements and Modern chemical manufactures. In practical parts, different experiments to be performed which are listed in particle course. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching and learning process. The students are required to secure pass marks in theory as well as practical course separately.

### 2. General Objectives

On the completion of this course student will be able to following general objectives:

- Familiarize the students with radioactivity, nuclear reactions and develop the capacity to solve the numerical problems of concerns topics.
- Enable the students to understand Werner's theory, Sidgwick model of coordination compounds and the factors affecting the stability of coordination compounds.
- Make them able to understand the different principles, theories, laws, phenomenon and systems related with thermodynamics and thermochemistry and solve numerical problems.
- Enable students in dealing with different concepts of electrochemistry
- To make students familiar with entropy and laws and equations related to energy change
- Develop the capacity to understand s-and p-block elements and their compounds.
- Provide in-depth knowledge about the general trends of periodic properties in 3d and 4d series of transition elements and their biologically important compounds.
- Understand the raw materials, sources of raw materials, principle and Flow-sheet diagram for the modern chemical manufacture such as  $\text{NH}_3$ ,  $\text{HNO}_3$ ,  $\text{H}_2\text{SO}_4$ , Washing soda, Urea and paper.
- Perform the practical activities related to  $\text{P}^{\text{H}}$ , titration, electrochemistry, thermochemistry and inorganic chemistry.
- Develop observational, manipulative, calculative and interference drawing skills.
- Enable students to prepare report on their field visit by chemical industry and their impact on environment, by using appropriate methods and approaches.
- Maintain record base of the performed experiments.

### 3. Specific Objectives and Contents

#### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                               | Periods |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"><li>• Describe the composition of nucleus on the basis of nucleon and nuclide</li><li>• Explain the stability of nucleus based on mass defect, binding energy, and packing fraction.</li><li>• Define binding energy and describe the relative stability of isotopes.</li><li>• Elaborate natural and artificial radioactivity</li><li>• Explain <math>\alpha</math>-, <math>\beta</math>- and <math>\gamma</math>- rays and explain radioactivity is a nuclear property.</li><li>• List out and elaborate the different units of radioactivity.</li><li>• Define and differentiate Nuclear fission and Nuclear fusion</li><li>• Describe mean life and half-life period of</li></ul> | <b>Unit 1: Nuclear Chemistry</b> <ul style="list-style-type: none"><li>• Composition of nucleus</li><li>• Mass defect</li><li>• Binding energy</li><li>• Packing fraction</li><li>• Nuclear stability</li><li>• Radioactivity</li><li>• Units of radioactivity</li><li>• Nuclear reaction</li><li>• Mean life and half-life period.</li><li>• Nuclear power and nuclear weapons</li><li>• Uses of radioactivity</li><li>• Radiocarbon dating</li></ul> | 5       |

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| <ul style="list-style-type: none"> <li>radioactive elements.</li> <li>Elaborate the nuclear power and nuclear weapons.</li> <li>Explain the industrial and medical uses of radioactivity.</li> <li>Define and explain the radiocarbon dating.</li> <li>Point out the various harmful effect of nuclear radiations.</li> <li>Solve the simple numerical problems related with mean life and half-life period.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>Harmful effect of nuclear radiations</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |
| <ul style="list-style-type: none"> <li>Explain Werner's theory of coordination compounds.</li> <li>Explain electronic interpretation of coordination on basis of Sidgwick model.</li> <li>Define E.A.N. and determine E.A.N. of different metal ions (<math>\text{Fe}^{2+}</math>, <math>\text{Co}^{3+}</math>, <math>\text{Cu}^{+}</math>, <math>\text{Cr}^{3+}</math>, <math>\text{Fe}^{3+}</math>, <math>\text{Ni}^{3+}</math>, <math>\text{Ni}^{2+}</math>)</li> <li>Name the coordination compounds and complex ions.</li> <li>Explain the factors that affecting the stability of complex compounds.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Unit 2: Coordination Compounds</b> <ul style="list-style-type: none"> <li>Werner's co-ordination theory</li> <li>Electronic interpretation of coordination (Sidgwick Model)</li> <li>Effective Atomic Number (E.A.N.)</li> <li>Nomenclature of coordination compounds and complex ions</li> <li>Factors affecting the stability of complex compounds.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4 |
| <ul style="list-style-type: none"> <li>Define different terms related with thermodynamics and classify different types of thermodynamic systems.</li> <li>Compare extensive and intensive properties.</li> <li>Explain equilibrium and non- equilibrium states</li> <li>Explain thermodynamic processes.</li> <li>Compare reversible and irreversible processes</li> <li>Explain internal energy</li> <li>State and explain the first law of thermodynamics</li> <li>Explain the enthalpy of system</li> <li>Explain enthalpy of reactions</li> <li>Differentiate exothermic and endothermic reactions.</li> <li>Explain thermo-chemical equations</li> <li>Classify and explain types of enthalpy of reactions.</li> <li>Explain heat of combustion and its applications.</li> <li>Explain the heat of solution, neutralization, vaporization, sublimation and transition.</li> <li>Define and explain Hess's law of constant heat of summation and its application.</li> <li>Describe bond energy.</li> <li>Explain molar heat capacity at constant pressure and volume.</li> <li>Relate and deduce the equation between <math>C_p</math> and <math>C_v</math>.</li> <li>Describe calorific value of fuel and food.</li> <li>Solve the related numerical problems.</li> </ul> | <b>Unit 3: Thermodynamics and thermochemistry</b> <ul style="list-style-type: none"> <li>Some thermodynamic terms and definitions</li> <li>Extensive and Intensive properties</li> <li>Thermodynamic processes</li> <li>Internal energy</li> <li>First law of thermodynamics</li> <li>Enthalpy of system</li> <li>Enthalpy of reaction, exothermic and endothermic reactions.</li> <li>Heat of combustion and its applications.</li> <li>Heat of solution, neutralization, vaporization, sublimation and transition.</li> <li>Hess's law of constant heat of summation and its applications.</li> <li>Bond energy</li> <li>Molar heat capacity at constant pressure volume</li> <li>Relation between <math>C_p</math> and <math>C_v</math></li> <li>Calorific value of fuel and food</li> <li>Related numerical problems</li> </ul> | 6 |
| <ul style="list-style-type: none"> <li>Define conductor and non-conductor.</li> <li>Classify conductor and differentiate between metallic and electrolytic conductor.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Unit 4: Electrochemistry</b> <ul style="list-style-type: none"> <li>Conductor and non-conductor</li> <li>Electrolytes and non-</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 6 |

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| <ul style="list-style-type: none"> <li>• Define and classify electrolytes.</li> <li>• Define and classify electrode.</li> <li>• Describe the process of electrolysis.</li> <li>• Define and explain the Faraday's first and second laws of electrolysis.</li> <li>• Point out the application of electrolysis.</li> <li>• Define and classify the electrodes.</li> <li>• Differentiate between electrode potential and standard electrode potential.</li> <li>• Describe the types of electrodes on the basis of standard hydrogen electrode and calomel electrodes.</li> <li>• Explain electrochemical series and its application.</li> <li>• Construct Zn-Cu and Ag-Cu voltaic cell</li> <li>• Define and describe cell potential and standard cell potential.</li> <li>• Relate cell potential and free energy.</li> <li>• Derive the relation between <math>\Delta H</math> and <math>\Delta S</math> from the emf data</li> <li>• Derive the Nernst equation for determining the emf</li> <li>• Determine equilibrium constants by using standard potentials</li> <li>• Describe the structure and use of Amalgam electrodes, oxidation-reduction electrode, quinhydrone electrode and Ag/Ag<sup>+</sup> ion electrode</li> <li>• Explain chemical cell with and without transference</li> <li>• Explain Concentration cell with and without transference</li> <li>• Describe liquid junction potential for chemical cell and concentration cell</li> <li>• Discuss the determination of P<sup>H</sup> by use of potentiometer</li> <li>• Describe potentiometric titration of acid and base</li> <li>• Explain the determination of solubility product of sparingly soluble salt by emf measurement</li> <li>• Explain the basic principles, uses and limitations of voltametry, coulometry and electrogravimetry</li> <li>• Describe polarography, pulse and differential pulse polarography</li> <li>• Explain the basic principle of commercial battery and fuel cell.</li> </ul> | <p>electrolytes</p> <ul style="list-style-type: none"> <li>• Electrolysis</li> <li>• Faraday's law of electrolysis</li> <li>• Electrode <ul style="list-style-type: none"> <li>- Electrode potential and standard electrode potential</li> <li>- Standard hydrogen electrode and calomel electrodes</li> </ul> </li> <li>• Electrochemical series</li> <li>• Voltaic cell</li> <li>• Cell potential and standard cell potential</li> <li>• Thermodynamics of electrode potential</li> <li>• Nernst Equation</li> <li>• Standard potential and equilibrium constant</li> <li>• Classification of electrodes: Amalgam electrodes, Oxidation-reduction electrodes, Quinhydrone electrode, Ag/Ag<sup>+</sup> ion electrode</li> <li>• Chemical cell with and without transference</li> <li>• Concentration cell with and without transference</li> <li>• Liquid Junction potential</li> <li>• Solubility products and emf</li> <li>• Potentiometric determination of P<sup>H</sup></li> <li>• Potentiometric acid-base titration</li> <li>• Basic principles of Voltametry, polarography, Coulometry and Electrogravimetry</li> <li>• Commercial battery and fuel cell</li> <li>• Solve numerical problems on the above mentioned topics</li> </ul> |   |
| <ul style="list-style-type: none"> <li>• Explain the general trends of periodic properties- electronic configuration, atomic radii, ionization potential, electronegativity, electron affinity S and P-block elements.</li> <li>• Describe occurrence, General method of preparation, isolation of the elements and factors influencing the choice of extraction</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p><b>Unit 5: Chemistry of S, P and D block elements</b></p> <ul style="list-style-type: none"> <li>• General group trends of S and P-block elements</li> <li>• Occurrence and isolation of the elements, Factors influencing the choice of extraction process and General properties of the</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 6 |

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| <p>process and the general physical and chemical properties of the s block and p block elements.</p> <ul style="list-style-type: none"> <li>• Compare S-block and P-block elements and their compounds.</li> <li>• Explain solubility of alkali metals in liquid <math>\text{NH}_3</math>, hydration energy and mobility of ions.</li> <li>• Explain anomalous behavior of Be, Grignard reagents, chlorophyll and Biological properties of Ca &amp; Mg</li> <li>• Describe the principle of extraction of Al, Alums.</li> <li>• Explain structure and allotropy of the elements, differences between C, Si, S and other remaining elements, Fullerene.</li> <li>• Describe nitrogen cycle, liquid ammonia as a solvent, phosphate fertilizers, and role of phosphate esters in biological process.</li> <li>• Explain acid rain and differences between oxygen and other elements.</li> <li>• Explain perchloric acids.</li> <li>• Explain isolation of Noble gases.</li> <li>• Explain the general trends in electronic configuration, ionic and covalent radii, electronegativity, electron affinity, ionization potential, color and magnetic properties, variable valences, complex formation with reference to 3d- block elements.</li> <li>• Describe general introduction of first transition (3d) and second transition (4d) series.</li> <li>• Compare the elements of 3d series and 4d series in terms of electronic configuration, reactivity of elements, stability of oxidation states, highest oxidation states, stability of complexes, bio-inorganic chemistry of iron and copper.</li> </ul> | <p>elements</p> <ul style="list-style-type: none"> <li>• Alkali metals- solubility in <math>\text{NH}_3</math>, Hydration energy and mobility of ions.</li> <li>• Alkaline-earth metals - Be-anomalous behavior, Grignard reagent, chlorophyll and biological properties of Ca and Mg,</li> <li>• Group III- Principle of extraction of Al, Alums.</li> <li>• Group IV- Structure and allotropy of the elements, Difference between C, Si and other remaining elements. Carbon clusters- Fullerene (preparation, structure and application).</li> <li>• Group V- Nitrogen cycle, liquid ammonia as solvent, phosphate fertilizers, and role of phosphate esters in biological process.</li> <li>• Group VI - Acid rain, difference between oxygen and other elements.</li> <li>• Group VII - Perchloric acids</li> <li>• Group Zero - Isolation of Noble gases</li> <li>• General group trends of 3d-block elements.</li> <li>• General introduction of first-transition (3d) and second transition (4d) series.</li> <li>• Comparison of the elements of 3d series with 4d transition series.</li> </ul> |   |
| <ul style="list-style-type: none"> <li>• Explain chemical industry and point out its importance.</li> <li>• Point out the stages in producing a new product.</li> <li>• Explain economics of production and cash flow in the production cycle.</li> <li>• Describe the principle applied in successful run of a chemical plant.</li> <li>• List out the raw materials and their sources for the production of <math>\text{NH}_3</math>, <math>\text{HNO}_3</math>, <math>\text{H}_2\text{SO}_4</math>, Washing soda and Urea.</li> <li>• Describe the process of manufacturing <math>\text{NH}_3</math> by Haber's process, <math>\text{HNO}_3</math> by Ostwald's process, <math>\text{H}_2\text{SO}_4</math> by Contact process, Washing soda by Ammonia Solvay process and Urea from carbamate with their flow sheet diagram.</li> <li>• Elaborate the manufacturing of paper and pulp on the basis of raw materials, sources of raw materials, stages of production of paper, Flow-</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p><b>Unit 6: Modern chemical manufacture</b></p> <ul style="list-style-type: none"> <li>• Chemical industry</li> <li>• Economics of production</li> <li>• Cash flow in the production cycle.</li> <li>• Running a chemical plant</li> <li>• Manufacture of <math>\text{NH}_3</math>, <math>\text{HNO}_3</math>, <math>\text{H}_2\text{SO}_4</math>, Washing soda and Urea.</li> <li>• Paper and Pulp</li> <li>• Environmental impact of the chemical industry.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5 |

|                                                                                                                                    |  |  |
|------------------------------------------------------------------------------------------------------------------------------------|--|--|
| sheet diagram for paper production and quality of paper.<br>• Develop a report about environmental impact of the chemical industry |  |  |
|------------------------------------------------------------------------------------------------------------------------------------|--|--|

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

### Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                                                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Periods |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>Develop observational, manipulative, calculative, inference drawing and report writing skills.</li> <li>Develop in student's ability to perform experiments having due regards safety.</li> <li>Maintain record base of the performed experiments.</li> </ul> | <ul style="list-style-type: none"> <li>To study the process of electrolysis and electroplating.</li> <li>To demonstrate the <math>P^H</math> value of unknown sample solution.</li> <li>To determine the equivalent Conductance at infinite dilution of strong and weak electrolyte</li> <li>To verify Ostwald dilution law by conductance measurement.</li> <li>To determine the contents of acetic acid in the given volume of vinegar by titrimetric method.</li> <li>Verify Nernst equation by determining the standard electrode potential of <math>Ag/Ag^+</math> electrode at different concentrations</li> <li>Determine the concentration and dissociation constant of acetic acid by potentiometric titration with sodium hydroxide using quinhydrone electrode.</li> <li>Determine the solubility and solubility product of a sparingly soluble salt (<math>AgCl</math>) in water</li> <li>To determine the molar enthalpy change of ammonium chloride solution.</li> <li>To recover blue vitrol crystals from the given mixture of copper sulphate and sodium chloride.</li> <li>To obtain hydrated calcium sulphate from the given marble chips.</li> <li>To isolate hippuric acid from given sample of cow urine.</li> <li>To observe any one chemical industry and draw the conclusion of environmental impact of the chemical pollution then prepare report for provided format.</li> </ul> | 48      |

### 4. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Individually laboratory work

**5. Evaluation:** Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

**5.1. Internal evaluation**

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                         |           |
|-----------------------------------------|-----------|
| 6) Attendance                           | 5 points  |
| 7) Participation in learning activities | 5 points  |
| 8) First assignment ( Presentation)     | 10 points |
| 9) Second assignment (Term exam)        | 10 points |
| 10) Third assignment (Project work)     | 10 points |
| Total                                   | 40 points |

**5.2 Theory: External evaluation (Full marks 40)**

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |           |
|--------------|------------------------------------------------------------------|-----------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points |
| <b>Total</b> |                                                                  | 40 points |

**Note: All questions are compulsory**

**5.3 Practical: Evaluation (Full marks- 20 points)**

The marks allocated to practical part are given in the following table.

| Examination  | Area                         | Points   | Total Points |
|--------------|------------------------------|----------|--------------|
| Internal     | Regularity                   | 2        | 6 points     |
|              | Practical Performance        | 2        |              |
|              | Record book                  | 2        |              |
| External     | Experiment (at least 2 Exp.) | 11 (5+6) | 14 Points    |
|              | Viva                         | 3        |              |
| Total Points |                              |          | 20 points    |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

**6. Recommended and References Books**

- Atkins. P. & Paula, J. (2010) *Physical chemistry*. (Ninth edition): Oxford university press.
- Bahl, A., & Bhal, B.S. (2008). *A textbook of organic chemistry*. New Delhi: S. Chanda and company limited.
- Bahl, A., Bhal, B.S. & Tuli, G. D. (2008). *Essential of physical chemistry*. New Delhi: S. Chanda and company limited.
- Dhaubdel, S.P., Pradhan, K.P., & Joshi, S.M. (n.d.). *Practical chemistry guide*. Nepal: Kathmandu.
- Ghimire, K.N. & Bohara, K.P. (2008). *University Experimental Physical Chemistry*. Kathmandu: Quest Publication
- Gurtu, J.N. & Gurtu, A. (2006). *Advance physical chemistry*. Meerut: Pragati Prakashan
- Kapoor (1992). *Textbook of Physical chemistry*. Mc Millan India Ltd.
- Khadka, N.M., Gautam, S.D. & Yadav, P.N. (n.d). *A core experimental chemistry*. Kathmandu: Kede Book Center.
- Khadka, D.B. (2009). *Practical Physical Chemistry*. Kathmandu: Sunlight Publication
- Madan, R.L. & Tuli, G.D. (2001) *Physical chemistry*. New Delhi: S Chand and Co. Ltd.
- March, J. (2012). *Advanced Organic Chemistry*. New Delhi: A Wiley Inter-science Publication.
- Maron, S.H & Prutton, C.F. (1972) *Principles of physical chemistry (fourth edition)*: New Delhi Oxford and IBH Co. pvt. Ltd.
- Nagig, S. & Anand, S.C.A. (1991). *Text book of physical chemistry*. Wiley Eastern Ltd.
- Pandit, C.N., Subedi, R.R. & Tiwari, P. (2074 B.S.). *A text book of Chemistry*, Kathmandu: K. P. PustakBhandar.

Pokherel, M.R., & Poudel, B.R. (2011). A text book of inorganic chemistry. Kathmandu: National Book Center.

Prakash, S., Tuli, G.D., Basu, S. K. & Madan, R.D. (2008). *Advanced inorganic chemistry*. New Delhi: S. Chanda and company limited.

Silbey, J. Robert, A. & Barendi, G.M. (2006). *Physical Chemistry*. New Delhi: Wiley India Pvt. Ltd.

Sthapit, M.K. & Pradhananga R.R. (2065 B.S.) A text book of physical chemistry, Kathmandu: Taleju Prakashan

Sthapit, M.K. & Pradhananga, R.R. (1998). *Experimental physical chemistry*. Kathmandu: Taleju Prakashan.

Vishwanathan, B. & Raghavan, P.S. (2005). *Practical Physical Chemistry*. New Delhi: Viva Books Pvt. Ltd.

Course Title: **Economic Biology**  
 Course Code: SCED 453  
 Nature of Course: Theory + Practical  
 Total Credit: 2+1 (Th. + Pr.)

Full Marks: 80 (T) +20 (P)  
 Pass Marks: 40 (T) +10 (P)  
 Semester: B.Ed. / V  
 Total Period: 32+48 (Th. + Pr.) = 80 Periods

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-West University. This course has divided in to two parts: Theory and Practical. The theoretical parts consists of different units' related to plant and animal science. The major topics included in this course are Farming of economically important animals, Animal disease, Animal pest and their control, Plant biotechnology, Economic plants, Plant growth hormones and diseases. In practical parts, different experiments to be performed which are listed in particle course, besides this experiment performed, field visit and report writing. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. The students are required to secure pass marks in theory as well as practical course separately.

### 2. General Objectives

On the completion of this course student will be able to following general objectives

- To provide students with the in-depth knowledge for the farming of economically important animals and breeding system.
- To make the student familiar with animal diseases, pest and their controlling measures.
- To enable the students in elaborating the Plant biotechnology and their importance, sterilization techniques, tissue and meristem culture as well as fermentation techniques.
- To familiarize the students with various economic plants their habitats and importance.
- To acquaint the students with the concept of plant growth hormones and various plant disease with their symptoms and control measures.
- To impact knowledge to the students on essential aspect of animal and plant science and their application.
- To enable students to prepare report on their field visit, write practical record file by using appropriate methods and approaches.

### 3. Specific Objectives and Contents

#### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Periods |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>• Describe the types, life cycle and economic importance of honey bee.</li> <li>• Discuss the modern techniques of bee keeping</li> <li>• Describe the types and life history of silkworm.</li> <li>• Point out the importance of sericulture.</li> <li>• Discuss the process and importance of mulberry cultivation and sericulture as agro industry.</li> <li>• Explain the different type's poultry breeds and breeding methods.</li> <li>• List the importance of products (Meat, egg etc) and byproduct (Manure, Feathers etc) of poultry farming.</li> <li>• Describe the role of poultry farming in rural development.</li> <li>• Collect information about various types of fish in Nepal.</li> <li>• Identify the silent features of culturable fishes.</li> <li>• Discuss the development of fish farming in Nepal.</li> <li>• Describe different types of ponds necessary for fish farming.</li> <li>• Explain the economic importance of fishes and their role in Nepalese society.</li> <li>• Explain the principle of animal husbandry.</li> </ul> | <b>Unit 1: Farming of Economically Important Animals</b> <ul style="list-style-type: none"> <li>• Farming of Honey bee (Types, life cycle, modern techniques and economic importance)</li> <li>• Farming of silkworm (Types, life history, mulberry cultivation and sericulture as agro industry)</li> <li>• Poultry farming (Indigenous and exotic breeding method, Poultry products; Byproducts of poultry farm; Role of poultry farming in rural development).</li> <li>• Farming of fishes (Development of fish farming in Nepal, Common fishes of Nepal, Different types of ponds for fish farming, Economic importance)</li> <li>• Animal husbandry</li> <li>• Animal breeds</li> </ul> | 9       |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |
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| <ul style="list-style-type: none"> <li>List the different animals (Cow, buffalo, goat, sheep and pig) breeds for Indigenous and exotic methods.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |
| <ul style="list-style-type: none"> <li>Explain the disease and parasites of bees and their control.</li> <li>Explain the disease and parasites of silkworm and their control.</li> <li>Explain the disease and parasites of fishes and their control.</li> <li>Explain the disease and parasites of birds and their control.</li> <li>Discuss the various types of disease of animal husbandry (Cow, buffalo, goat, sheep, pig) and their control.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Unit 2: Animal Disease</b> <ul style="list-style-type: none"> <li>Disease and parasite of bee</li> <li>Disease and parasite of silkworm</li> <li>Disease and parasite of fishes</li> <li>Disease and parasite of birds</li> <li>Disease of animal husbandry (Cow, buffalo, goat, sheep, pig)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                   | 4 |
| <ul style="list-style-type: none"> <li>Discuss the nature of pest.</li> <li>Describe the different types of animal pest.</li> <li>Explain the ways of controlling insect pest naturally and artificially.</li> <li>Elaborate the Integrated Pest Management (IPM) with ecological approach.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Unit 3: Animal Pest and Their Control.</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Types of pest</li> <li>Insects pest control (Natural and artificial)</li> <li>IPM with ecological approach</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3 |
| <ul style="list-style-type: none"> <li>Discuss the brief history of biotechnology</li> <li>List out the importance of biotechnology.</li> <li>Describe the importance of biotechnology in Medicine, food industry, agriculture, fermentation technology and Environmental engineering.</li> <li>Point out the major application of plant biotechnology.</li> <li>Explain the micropropagation tissue culture technique and their principles.</li> <li>Explain composition and selection of culture media.</li> <li>Elaborate the In vitro culture technique and principles on the basis of Totipotency, Basic procedure of culture techniques, composition and selection of media.</li> <li>Discuss the sterilization technique in plant tissue on the basis of Heat, Radiation, Chemicals and Filtration.</li> <li>Describe the various methods of plant tissue culture on the basis of Seed culture, Organ culture, Meristem culture, root culture, shoot culture, Embryo culture, Anther culture, and Callus culture.</li> <li>Explain the applications of meristem culture on the basis of Vegetative propagation, Recovery of virus free stock, Germplasm conservation, Plant protection, Production of improved variety of crop plants and disease resistant.</li> <li>Describe the process of fermentation for beverage production.</li> </ul> | <b>Unit 4: Plant Biotechnology</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>History of biotechnology</li> <li>Importance of biotechnology</li> <li>Biotechnology in (Medicine, food industry, agriculture, fermentation technology and Environmental engineering)</li> <li>Applications of plant biotechnology</li> <li>Plant tissue culture technique and principles technique (Micropropagation)</li> <li>In vitro culture technique and principles</li> <li>Sterilization technique in plant tissue.</li> <li>Methods of plant tissue culture</li> <li>Applications of Meristem culture</li> <li>Fermentation (Beverage production, Alcohol wine and beer)</li> </ul> | 7 |
| <ul style="list-style-type: none"> <li>Write the distribution, scientific names, families and economic importance of some medicinal, crop, timber and edible oil yielding plants of Nepal</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Unit 5: Economic Plants</b> <ul style="list-style-type: none"> <li>Important medicinal plants of Nepal {Bojho (Acorus calamus); Aswagandha</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 4 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>(Withaniasomnifera); Belladonna (Atropa belladonna); Ashuro (Justicia adhatoda); Digitalis or Foxglove (Digitalis purpurea); Pudina (Mentha arvensis); Lasun (Allium sativum) and Yarshagumba (Ophiocordyceps sinensis)}</p> <ul style="list-style-type: none"> <li>• Important crop plants of Nepal {Rice (Oryza sativa); Wheat (Triticum aestivum); and Maize (Zea mays)}</li> <li>• Important timber trees of Nepal {Sal (Shorea robusta); Sissoo (Dalbergia sissoo); Teak (Tectona grandis); Deodar (Cedrus deodara) and Pine (Pinus spp.)}</li> <li>• Important oil yielding plants of Nepal {Mustard (Brassica spp); Groundnut (Arachis hypogaea); Sesame (Sesamum indicum) and Sunflower (Helianthus annuus)}</li> </ul> |   |
| <ul style="list-style-type: none"> <li>• Define and list out the characteristics of plant growth hormones.</li> <li>• Describe the roles and application of auxins, gibberellins and cytokinins.</li> <li>• Explain the viral diseases of Tobacco Mosaic and Potato Mosaic on the basis of their symptoms, mode of transmission and control measures.</li> <li>• Describe the bacterial diseases of plant such as Black rot of crucifers, Citrus canker on the basis of their symptoms and control measures.</li> <li>• Elaborate the fungal diseases of plants such as Late Blight of potato, white rust of crucifers, loose smut of wheat on the basis of their symptoms and control measures.</li> </ul> | <p><b>Unit 6: Plant Growth Hormones and Disease</b></p> <ul style="list-style-type: none"> <li>• Plant growth hormone <ul style="list-style-type: none"> <li>➤ Auxins, Gibberellins, cytokinins</li> </ul> </li> <li>• Plant disease <ul style="list-style-type: none"> <li>➤ Viral diseases : Tobacco Mosaic, Potato Mosaic</li> <li>➤ Bacterial diseases: Black rot of crucifers, Citrus canker</li> <li>➤ Fungal diseases: Late Blight of potato, white rust of crucifers, loose smut of wheat</li> </ul> </li> </ul>                                                                                                                                                                                                           | 5 |

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                                                                                                                                                                                                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Periods |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>To observe and study the different types of life cycle of bee and silkworm.</li> <li>To identify the different types of legs of worker bee.</li> <li>To observe and identify different types of fishes that can be culture.</li> <li>To observe and study of common local fishes available in Nepal. Classify and comment on them.</li> <li>To prepare reports on field survey with proper format.</li> </ul> | <b>Unit 1: Unit 1: Farming of Economically Important Animals</b> <ul style="list-style-type: none"> <li>Bee and silkworm</li> <li>Legs of worker bee (Pro-thoracic, Meso-thoracic and Meta-thoracic leg)</li> <li>Different types of fishes (Labeo, Catla, Channa and carp-grass)</li> <li>Common local fishes (Channa, Anabas, Heteroponeustes, Puntina, and Mastacembalis)</li> <li>Reports on farming animals (Apicultur, Seri-culture, Pesci-culture)</li> </ul>                                                                                                                                                                                                   | 18      |
| <ul style="list-style-type: none"> <li>To observe and identify different types of animal pests.</li> <li>To prepare temporary and permanent slides of Aphid and other available animal pest.</li> </ul>                                                                                                                                                                                                                                              | <b>Unit 2: Animal Paste</b> <ul style="list-style-type: none"> <li>Animal pest (Aphid, Bugs, Hoppers and Bettels)</li> <li>Temporary and permanent slides.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 6       |
| <ul style="list-style-type: none"> <li>To observe and identify selected viral, bacterial and fungal diseases.</li> <li>To prepare the herbarium specimens of plant diseases</li> <li>To prepare temporary slides on some fungal diseases lactophenol and cotton blue.</li> <li>To identify viral, bacterial and fungal diseases from permanent slides.</li> </ul>                                                                                    | <b>Unit 3: Plant Diseases</b> <ul style="list-style-type: none"> <li>Viral, bacterial and fungal diseases</li> <li>Herbarium preparation of plant diseases.</li> <li>Preparation of temporary slides of fungi</li> <li>Identification of some viral, bacterial and fungal diseases.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                         | 12      |
| <ul style="list-style-type: none"> <li>To visit fields to collect, preserve and prepare herbaria of the collected plants and submit the report.</li> <li>To visit tissue culture laboratories and submit the report.</li> <li>To visit horticultural, agricultural farms or gardens for studying economic plants and plant diseases.</li> <li>To list plants of economic importance of a particular locality.</li> </ul>                             | <b>Unit 4: Field Trip and report writing.</b> <ul style="list-style-type: none"> <li>Collection of plants <ul style="list-style-type: none"> <li>➤ Preservation of plants collected</li> <li>➤ Preparation of herbaria of plants particularly belonging to (Magnoliaceae, Convolvulaceae, Scrophulariaceae, Verbenaceae, Amaryllidaceae, Commelianaceae and Amaranthaceae</li> <li>➤ Visit any locality to list the plants of economic importance and submit the report.</li> <li>➤ Visit to tissue culture laboratory for tissue culture technique</li> </ul> </li> <li>Horticultural and agricultural farms for studying plant diseases, economic plants.</li> </ul> | 12      |

#### 4. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Group work, Report writing and presentation
- Construction of learning materials
- Individually laboratory work
- Field visit

#### 5. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

##### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                          |           |
|------------------------------------------|-----------|
| 11) Attendance                           | 5 points  |
| 12) Participation in learning activities | 5 points  |
| 13) First assignment ( Presentation)     | 10 points |
| 14) Second assignment (Term exam)        | 10 points |
| 15) Third assignment (Project work)      | 10 points |
| Total                                    | 40 points |

##### 5.2 Theory: External evaluation (Full marks 50)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |           |
|--------------|------------------------------------------------------------------|-----------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points |
| <b>Total</b> |                                                                  | 40 points |

**Note: All questions are compulsory**

##### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination           | Area                                            | Points | Total Points     |
|-----------------------|-------------------------------------------------|--------|------------------|
| Internal              | Regularity                                      | 1.5    | 6 points         |
|                       | Practical Performance                           | 1.5    |                  |
|                       | Record book                                     | 3      |                  |
| External              | Experiment (at least 2 Exp.)                    | 6      | 6 Points         |
|                       | Viva                                            | 3      |                  |
| External and Internal | Field visit and Report writing (animal + Plant) |        | 4 + 4 = 8 points |
| Total Points          |                                                 |        | 20 points        |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

#### **6. Recommended and References Books**

- Banjade, M.R. and Paudel, N.S. (2008). Economic Potential of Non-timber Forest Products in Nepal: Myth or Reality? *Journal of Forest and Livelihood* (7)1.
- DPR(2016). *Medicinal Plants of Nepal*. Department of Plant Resources. Ministry of Forests and Soil Conservation. Government of Nepal, Kathmandu
- Dubey, R. C. (2009). *A Textbook of Biotechnology*. New Delhi: S. Chand and Company Ltd. (Unit IV)
- Dutta, A. C. (2007). *Botany for Degree Students*. New Delhi: Oxford University press.
- Farooqi A. A. and Sreeramu B. S. (2010). *Cultivation of Medicinal and Aromatic Crops*. Universities Press ( India) Private Limited, Hyderabad, India.
- Kalauni, D. and Joshi, A. (2018). Status of Medicinal and Aromatic Plant (MAPs) and Socio-Economic Influence in Nepalese Livelihood - A Review Research. *Acta Scientific Agriculture* (2) 9.
- Kayastha, B.P. (2002). *A Handbook of Trees of Nepal. Timber, Fodder, Fruit, Medicinal, Ornamental, Religious*. (Eds. R. Joshi, S.M. Amatya, P. B. Thapa and B. Bhatta). Kathmandu: Laligurans Pr. Press.
- Kumar, A. (2014). *Seed technology & Pathology*. Discovery Publishing House Pvt. Ltd. New Delhi.
- Ignacimuthu, S. (2007). *Basic Biotechnology*. New Delhi: Tata Mc. Grave Hill Publishin<sup>g</sup> Company Ltd.Ltd., New Delhi.
- Pandey B. P. (2009). *Modern practical botany Vol I and Vol II*. New Delhi: S. Chand and Company Ltd.
- Pandey, B. P. (2003). *Plant Pathology*. New Delhi: S. Chand and Company Ltd. (For unit V)
- Pandey, B.P. (2009). *Modern Practical Botany Vol II*. New Delhi: S Chand & Company Ltd.
- Pandey, P. N. and Vidyarthi, R. D. (2000). *A text book of zoology*. New Delhi: S. chanda and company Ltd.
- Parihar, P. (2004). *A Textbook of Biotechnology*. Jodhpur: Student Edition.
- Ranjitkar, H. D. (2010). *Botany.A Practical Handbook*. A. K. Ranjitkar, Kalanki, Kathmandu
- Santra, S.C. et al ( 2006). *College Practical Botany, Vol.I*, India: New Central Book Agency ( P) Ltd.
- Sateesh, M.K. (2003). *Biotechnology (Animal Cell Biotechnology, Immunology, Plant Biotechnology)*. New Delhi: New Age Int. Pvt. Ltd.
- Singh, R.S. (2008). *Plant Diseases*. New Delhi: Oxford & IBH Pub. Co. Pvt Ltd.
- Soper, R. (2005). *Biological Science*. Cambridge University Press, UK.
- Uprety, Y., Boon, E.K., Poudel, R.C., Shrestha, K.K., Rajbhandary, S., Ahenkan, A. & Tiwari, N.N. (2010) Non-timber Forest Products in Bardiya District of Nepal: Indigenous Use, Trade and Conservation. *Journal of Human Ecology*, 30:3, 143-158, DOI: 10.1080/09709274.2010.11906283.
- Vasistha, B. R. & Sinha, A. K. (2007). *Botany for degree student -fungi*. New Delhi: S. Chand & Comp. Ltd.
- Vidyarthi, R. D. & Pandey, P. N. (2008). *A Textbook of Zoology*. New Delhi: S. Chanda & Co. Ltd.
- Viswapremi, K. & Chandra, K. (1995). *Economic zoology*. New Delhi: Anomol Publication Pvt. Ltd.

Course Title: **Teaching Physics**  
Course Code: SCED 454  
Nature of Course: Theory + Practical  
Total Credit: 2+1 (Th. + Pr.)

Full Marks: 80 (T) +20 (P)  
Pass Marks: 40 (T) +10 (P)  
Semester: B.Ed. / V  
Total Period: 32+48 (Th. + Pr.) = 80 Periods

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-West University. This course has divided in to two parts: Theory and Practical. The theoretical parts consists of different units' related Physics teaching and learning. The major topics included in this course are Introduction of teaching physics in classroom; Theory of knowledge in physics and physics teacher; Objectives and curriculum of teaching physics; Methods, planning and resources in teaching physics; Pedagogical analysis of physics content; and Evaluation, Assessment, Practical and experiment in teaching and learning physics. In practical parts, different experiments to be performed which are listed in particle course related to completely theoretical part.

This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. It introduces the essential elements of physics teaching and practice needed to teach physics in an effective and inspirational manner. It develops the skills and competencies required for a physics teacher to teach physics in the national and global context. The students are required to secure pass marks in theory as well as practical course separately.

### 2. General Objectives

On the completion of this course student will be able to following objectives:

- To acquire knowledge of nature of physics to teach physics.
- To understand the pedagogical principles underpinning the Nepalese as well as global schooling programmes.
- To provide students with the in-depth knowledge of teaching physics and use of teaching at secondary level effective way.
- To understand the Aims and Objectives of teaching Physics.
- To enable the students in develop different format of lesson plan, construct objectives test on the basis Bloom's taxonomy, develop and preparation of improvised materials, construction of test items and item analysis.
- To apply and work with basic teaching skills in physics.
- To familiarize and use of physics lab and conduct experiment.
- To make students to understand the correlation between theory and the experiment.
- Students will achieve mastery over inquiry based classroom teaching.
- To acquire knowledge of Professional competencies of a Physics teacher.
- To acquire knowledge of Resource materials required for teaching Physics.
- To develop skill in construction, administration and interpretation of a different types of test items related to physics.
- To appreciate the role of Physics in daily life.
- To develop the skills of various techniques of evaluation and assessment tools and techniques.
- To enable students to prepare overall report on physics teaching with including different teaching facilitated components.

### 3. Specific Objectives and Contents

#### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                      | Contents                                                                                                                               | Periods |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"><li>• Introduce concept meaning and nature of teaching physics in a classroom.</li><li>• Discuss the impact of physics in nation and our society.</li><li>• Discuss the place of physics at secondary level.</li></ul> | <b>Unit 1: Introduction to Teaching Physics in a classroom</b> <ul style="list-style-type: none"><li>• Meaning and nature of</li></ul> | 4       |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |
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| <ul style="list-style-type: none"> <li>• Explain the scope and significance of physics in daily life.</li> <li>• Explain the development of physics and physics education in Nepal.</li> <li>• Co-relate the physics with social science, chemistry, biology, electronics, photography and work experience.</li> <li>• Correlate the creativity and intelligence of physics teaching..</li> <li>• Write a report on present status, place of today's chemistry at secondary level and reforms needs.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>Physics</p> <ul style="list-style-type: none"> <li>• Impact of physics</li> <li>• Place of physics</li> <li>• scope of Physics, and Significance of Physics in daily life,</li> <li>• Development of physics education.</li> <li>• Correlation of physics with other subjects</li> <li>• Creativity and physics teaching</li> </ul>                                                                                                                                                |   |
| <ul style="list-style-type: none"> <li>• Introduce theory of knowledge in physics</li> <li>• Discuss the process of learning physics on the basis of social constructivism, structuring inquiry, metacognitive inquiry and critical thinking.</li> <li>• Elaborate the ways of knowing on the on the basis of Sense perception, Reasoning, Language, Emotion, Imagination, Faith, Intuition, and Memory.</li> <li>• Identify the knowing areas of life in terms of subject disciplines</li> <li>• Develop the model and frameworks for thinking on physics education in Nepalese context.</li> <li>• Describe the role of a teacher in theory of knowledge on the basis of Stimulate, Facilitate, and Guide.</li> <li>• Discuss the theory of knowledge resource on the basis of International mindedness concept and andunderstanding the learner profile of a physics student.</li> <li>• Discuss the professional development of physics teacher on the basis of different teaching skills such as: Thinking skills, Communication skills, Social skills, Self-management skills, Research skills, Oral and written communication skills, Critical thinking skills, Problem solving skills, Teamwork and collaborative skills, Metacognitive skills, Self-regulated learner,</li> </ul> | <p><b>Unit 2: Theory of knowledge in physics and physics teacher</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• The process of learning,</li> <li>• Ways of knowing</li> <li>• Knowing areas of life in terms of subject disciplines.</li> <li>• Models and Frameworks for thinking.</li> <li>• Role of a teacher in theory of knowledge;</li> <li>• Theory of knowledge resources.</li> <li>• Development of different skill on physics teacher</li> </ul> | 6 |
| <ul style="list-style-type: none"> <li>• Discuss the historical background of physics curriculum and its studies in the context of Nepal.</li> <li>• Describe the principle for the formulation of good physics education.</li> <li>• List out the approaches to curriculum planning.</li> <li>• Elaborate the innovative approaches in development of chemistry curriculum.</li> <li>• Illustrate the different styles of curriculum.</li> <li>• Describe Physics Curriculum Study Project such as Nuffield physics programme, Physical Science Study Committee (PSSC), Harvard Physics Project (HPP) and The Florida State University (FSU) Project.</li> <li>• Explain the learning physics with the help of microcomputers on the basis of using micro-computers as calculators and simulations, Micro</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <p><b>Unit 3: Curriculum and objectives of Teaching Physics</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Historical background of physics curriculum studies in Nepal.</li> <li>• Principle of curriculum formation</li> <li>• Approaches to curriculum planning</li> <li>• Curriculum styles</li> <li>• Innovative approaches of Physics curriculum (Nuffield, PSSC, HPP, and FSU)</li> </ul>                                                            |   |

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| <p>computer simulations combined with laboratory work, and Micro-computer laboratory interfacing.</p> <ul style="list-style-type: none"> <li>• Critically analyze and evaluate our physics curriculum at secondary level than prepare report.</li> <li>• Compare our physics curriculum, textbook and teacher guide at secondary level.</li> <li>• Examine critically the future of physics curriculum in Nepalese context</li> <li>• Discuss the meaning and criteria for selection of aims in teaching physics</li> <li>• List out the general and specific objectives of present physics curriculum at secondary level.</li> <li>• Formulate instructional objectives in terms of behavior.</li> <li>• Develop behavioral objectives of physics content including different level of cognitive domain.</li> <li>• Develop objective and subjective types of question in different domain of bloom taxonomy in Physics.</li> <li>• Discuss the Anderson's Taxonomy for teaching and learning</li> <li>• List out the criteria for writing instructional objectives.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>• Learning physics with the help of Microcomputers.</li> <li>• Physics curriculum in school science</li> <li>• Comparative study of physics curriculum, textbooks and teachers guide of grade 9 -10</li> <li>• The future of physics curriculum in Nepalese context</li> <li>• Aims of teaching physics</li> <li>• Objectives of teaching Physics.</li> <li>• Bloom's taxonomy of objectives</li> <li>• Anderson's Taxonomy for teaching and learning</li> <li>• Criteria for Writing Instructional objectives</li> </ul>                                                                                                                                                                                                                                                                                                                                            |   |
| <ul style="list-style-type: none"> <li>• Define and list out the various methods of teaching physics.</li> <li>• Explain the Scientific methods in terms of meaning, steps, advantage and disadvantage</li> <li>• Discuss the lecture demonstration method on the basis of their principle, requirement for good demonstration, merits and demerits.</li> <li>• Organize and conduct the physics demonstration lesson following their essential steps.</li> <li>• Point out the common errors in a demonstration lesson.</li> <li>• Explain the assignment method of teaching physics on the basis of their procedure, Aims, Features of good assignment, Teachers role, Merits and Demerits.</li> <li>• Discuss the project method on the basis of Meaning, Steps, Role of teacher, Merits and Drawbacks.</li> <li>• Elaborate the Concentric method on the basis of meaning, procedure, merits and drawbacks</li> <li>• Describe the unit and inductive-deductive method on the basis of their meaning, characteristics, essential of a good unit, merits and limitations.</li> <li>• Describe the important methods of physics teaching: Heuristic method, flipped classroom, blended learning, web2 technology, think-pair-share, and concept mapping on the basis of concept, procedure and application.</li> <li>• Choose and discuss the suitable methods of teaching physics which is most suitable in the context of Nepalese school.</li> <li>• Develop concept map on any physics content on the basis of guideline for concept mapping.</li> <li>• Develop lesson Plan on the basis of Herbartian and</li> </ul> | <p><b>Unit 4: Methods, Planning and Resources For Teaching and Learning in Physics</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Scientific Method</li> <li>• Lecture demonstration method</li> <li>• Conduct of a physics demonstration lesson</li> <li>• Assignment method</li> <li>• Project method</li> <li>• Concentric method</li> <li>• Unit method</li> <li>• Inductive-Deductive method</li> <li>• Utilizing technology for teaching and learning</li> <li>• Heuristic method, flipped classroom, web2 technology, think-pair-share, and concept mapping</li> <li>• Lesson Plan: Herbartian Lesson Plan and Evaluation Approach to Lesson plan,</li> <li>• Unit Plan</li> <li>• Printed Resources : Text book, Work book, guides and reference material</li> <li>• Non-Printed Resources: Laboratory</li> <li>• Teaching Aids : Projected, Non-projected and</li> </ul> | 6 |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |
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| <p>evaluation approach on Physics content.</p> <ul style="list-style-type: none"> <li>• Prepare unit plan in physics units on the basis of format.</li> <li>• List out the different printed, non-printed and online resources and characteristics, uses, and limitation of physics teaching and learning.</li> <li>• Develop various projected, non-projected and electronic aids which are suitable in teaching physics.</li> <li>• Construct improvised materials for using different physics experiment at secondary level.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>Electronic Aids</p> <ul style="list-style-type: none"> <li>• Improvised Aids</li> </ul>                                                                                                                                                                                                                                                                                                                                                           |   |
| <ul style="list-style-type: none"> <li>• Point out the major steps of pedagogical analysis</li> <li>• Use pedagogical principles underpinning physics classroom teaching.</li> <li>• Analyze pedagogically on the following physics content on the basis of their basic concept or sub-concept, objectives, teaching methods, Learning experiences and activities, types, students response pattern, teacher role and evaluation strategies.</li> <li>➤ Measurement: Physical quantities, SI units, fundamental and derived units.</li> <li>➤ Force, Energy and Power: Momentum, relation among velocity, acceleration, displacement and time, Newton's laws of motion, Newton's law of gravitation, acceleration due to gravity, weight, mass, freefall and weightlessness, kinetic and potential energy, sources of energy, work and power</li> <li>➤ Pressure: Concept of pressure, atmospheric pressure, liquid pressure, Archimedes' Principle, Pascal's law, law of floatation</li> <li>➤ Heat, Optics and Sound: Heat and temperature, thermometers, specific heat capacity, reflection and refraction of light, refractive index, total internal reflection, concave and convex lense and formation of image through lenses, defects of vision, optical instruments, sound waves, sources of sound, reflection and refraction of sound, loudness, pitch and velocity</li> <li>➤ Electricity and Magnetism: Electric circuit, Ohm's law, conductivity, resistivity, molecular theory of magnet, magnetic lines of force, geomagnetism, motor effect, potential difference, series and parallel combinations of load and cell, house wiring, electric consumption, transformer, electric motor, dynomo and generator.</li> </ul> | <p><b>Unit 5: Pedagogical analysis of physics content.</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Steps of pedagogical analysis</li> <li>• Pedagogical principles underpinning classroom teaching</li> <li>• Pedagogical analysis of following topics</li> <li>➤ Measurement</li> <li>➤ Force, Energy and power</li> <li>➤ Pressure</li> <li>➤ Heat, optics and sounds</li> <li>➤ Electricity and Magnetism</li> </ul> | 6 |
| <ul style="list-style-type: none"> <li>• Define evaluation</li> <li>• List and explain the various types of evaluation.</li> <li>• Relate among objectives, learning experiences and evaluation of teaching physics.</li> <li>• Differentiate between Criterion-referenced and Norm-referenced evaluation</li> <li>• List out the main criteria of a good examination</li> <li>• Construct and standardized the objective test items in physics.</li> <li>• Design physics test paper at secondary level.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p><b>Unit 6: Evaluation, Assessment, Practical and Experiment in teaching and learning Physics</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Meaning and types of evaluation</li> <li>• Relationship among objectives, learning experiences and evaluation</li> </ul>                                                                                                                                                    | 4 |

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| <ul style="list-style-type: none"> <li>• Explain the evaluation of functional skills on the basis of concepts, generalizations and principles</li> <li>• Discuss assessment on the basis of meaning, Purpose, and types.</li> <li>• Differentiate between assessment and evaluation.</li> <li>• Discuss the concept and Purpose of CAS.</li> <li>• Define the terms Grades, Grading and Gradation.</li> <li>• List and explain the various types of reporting and grading system.</li> <li>• Justify for the implementation of grading system at higher level of education in Nepal</li> <li>• Point out the Challenges towards the implementation of grading system in Nepalese education.</li> <li>• Suggest the implementation of sound grading system at higher educational level in Nepal.</li> <li>• Discuss the evaluation of practical work and assessment of project work.</li> <li>• Point out the importance of practical work in physics</li> <li>• Organize practical work on any physics content.</li> </ul> | <ul style="list-style-type: none"> <li>• Criterion-Referenced and Norm-Referenced evaluation</li> <li>• Criteria of a good examination</li> <li>• Designing a physics test</li> <li>• Evaluation of functional skills</li> <li>• Assessment</li> <li>• Continuous Assessment System (CAS)</li> <li>• Grading system in student assessment</li> <li>• Evaluation of Practical work</li> <li>• Importance of practical work</li> <li>• Organization of practical work</li> </ul> |  |
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*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## **Part 2: Practical**

| <b>Specific objectives</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Contents</b>                                                                                                                                                                                                                                           | <b>Periods</b> |
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| <ul style="list-style-type: none"> <li>• To prepare objective and subjective types of question in different domain of bloom taxonomy in Physics (1 set).</li> <li>• To analyze critically and evaluate our secondary physics science curriculum.</li> <li>• To compare our physics curriculum, textbook and teacher guide at secondary level.</li> </ul>                                                                                                                                                                                                                                                                                                 | <b>Unit 1: Objectives and curriculum of teaching Physics</b> <ul style="list-style-type: none"> <li>• Analyze physics curriculum at secondary level</li> <li>• Comparison of Physics curriculum, textbook and teacher guide</li> </ul>                    | 9              |
| <ul style="list-style-type: none"> <li>• To prepare concept map on any physics content on the basis of guideline for concept mapping (at least 5 unit).</li> <li>• To prepare lesson Plan on the basis of teaching methods such as, Herbartian approach and evaluation approach (at least 3 each methods/approach).</li> <li>• To prepare unit plan on physics topics on the basis of format (at least 3).</li> <li>• To prepare micro-plan on Physics topics on the basis of format (at least 2) and present in classroom.</li> <li>• Construct improvised materials for using different physics experiment at secondary level (at least 5).</li> </ul> | <b>Unit 2: : Methods, Planning and Resources For Teaching and Learning in Chemistry</b> <ul style="list-style-type: none"> <li>• Concept map</li> <li>• Lesson plan</li> <li>• Unit plan</li> <li>• Micro plan</li> <li>• Improvised materials</li> </ul> | 9              |
| <ul style="list-style-type: none"> <li>• To develop the format for pedagogical analysis of physics content (at least 2 unit) and present in your class.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Unit 3: Pedagogical analysis</b>                                                                                                                                                                                                                       | 6              |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                           |   |
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| <ul style="list-style-type: none"> <li>• To construct Physics achievement test (at least 50), standardized these items with the help of pilot testing.</li> <li>• To construct physics test paper applicable for secondary level.</li> <li>• To analyses critically for the grading system of Nepal on the basis of purpose, challenges and recommendation for further suggestion.</li> <li>• To determine the length, external and internal diameter and calculate the volume of a given tube by using VernierCallipers.</li> <li>• To determine the diameter of a steel ball or rod by using screw gauze and determine its volume and density</li> <li>• To determine the value of 'g' in the laboratory by using simple pendulum</li> <li>• To verify the principle of moment and to find the weight of an unknown body.</li> <li>• To verify Archimedes's principle by using measuring cylinder</li> <li>• To determine the focal length of convex lance by using (U-V method or displacement method or plane mirror method)</li> <li>• To determine the focal length of concave lens using a concave mirror.</li> <li>• To determine the frequency of a tuning fork by means of sonometer</li> <li>• To determine the magnetic moment and pole strength of a magnet using oscillation magnetometer.</li> <li>• To determine the latent heat of fusion of ice or vaporization of water</li> <li>• To verify the Ohm's law and determine the specific resistance.</li> <li>• To verify the law of combination (series and parallel) of resistance using a post office box</li> </ul> | <b>Unit 4: Evaluation and Assessment, Practical and experiment of Teaching Physics</b> <ul style="list-style-type: none"> <li>• Achievement test and pilot testing</li> <li>• Grading system</li> <li>• Experiment of Teaching physics (at least 7 experiment)</li> </ul> | 3 |
| <ul style="list-style-type: none"> <li>• To prepare overall report of teaching chemistry in a given format: <ul style="list-style-type: none"> <li>- Title page</li> <li>- Acknowledgement</li> <li>- Acronyms and Abbreviations</li> <li>- Abstract</li> <li>- Table of contents</li> </ul> </li> </ul> <p>Unit 1: Introduction</p> <ul style="list-style-type: none"> <li>- Background</li> <li>- Objectives</li> <li>- Methods</li> </ul> <p>Unit 2: Preparation of subjective and objective type question in different domain</p> <p>Unit 3: Analysis of physics curriculum</p> <p>Unit 4: Comparison of physics curriculum, textbook and teacher guide</p> <p>Unit 5: Pedagogical analysis of physics content</p> <p>Unit 6: Preparation of text item and item analysis</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Unit 5: Overall report writing and presentation</b>                                                                                                                                                                                                                    | 6 |

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|---------------------------------|--|--|
| Unit 7: Grading system of Nepal |  |  |
| - Conclusion                    |  |  |
| - References                    |  |  |

#### 4. Instructional Techniques

Depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration, Blogging
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Develop multimedia presentation
- Concept mapping and brain storming
- Internet (web) surfing
- Group work, Report writing and presentation
- Individually laboratory work
- Home assignment and class participation

#### 5. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

##### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                          |                  |
|------------------------------------------|------------------|
| 16) Attendance                           | 5 points         |
| 17) Participation in learning activities | 5 points         |
| 18) First assignment ( Presentation)     | 10 points        |
| 19) Second assignment (Term exam)        | 10 points        |
| 20) Third assignment (Project work)      | 10 points        |
| <b>Total</b>                             | <b>40 points</b> |

##### 5.2 Theory: External evaluation (Full marks 50)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |                  |
|--------------|------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points        |
| <b>Total</b> |                                                                  | <b>40 points</b> |

**Note: All questions are compulsory**

##### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination | Area                             | Points | Total Points |
|-------------|----------------------------------|--------|--------------|
| Internal    | Regularity                       | 2      | 6 points     |
|             | Practical Performance            | 1      |              |
|             | Record book                      | 3      |              |
| External    | Demonstrate experiment (at least | 3      | 6 Points     |

|                       |                                                                                      |   |           |
|-----------------------|--------------------------------------------------------------------------------------|---|-----------|
|                       | 1 Exp.)                                                                              |   |           |
|                       | Viva                                                                                 | 3 |           |
| External and Internal | Overall Report writing + Presentation+ Lab design + Making improvised materials etc. |   | 8 Points  |
| Total Points          |                                                                                      |   | 20 points |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

## **6. References and Recommended Books**

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- Prakash, R., & Rath, T.N. (1996). *Emerging Trends in Teaching of Physics*. New Delhi: Kanisha Publishers.
- Prasad, J. (2005). *Practical Aspects in Teaching of Science*. Kanishka Publishers.
- Rao, A. (2002). *Teaching of Physics*. New Delhi: Anmol Publications Pvt. Ltd.
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- Shretha, U. P. (2049 BS). *A Physics practical guide*. Kathmandu: RatnaPustakkBhandar
- Siddiqui.,& Siddiqui. (1998). *Teaching of Science-Today and Tomorrow*. New Delhi: Doaba House.
- Thurber, W. A., &Colletta, A. (1964). *A Teaching Science in Today's Secondary Schools*. New Delhi: Prentice Hall of India.
- Udai, V. (2004). *Modern Teaching of Physics*. New Delhi: Anmol Publications Pvt. Ltd.
- Vaidya, N. (1996). *Science Teaching for the 21st Century*. New Delhi: Deep & Deep Publications.
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Course Title: **Teaching Chemistry**  
Course Code: SCED 455  
Nature of Course: Theory + Practical  
Total Credit: 2+1 (Th. + Pr.)

Full Marks: 80 (T) +20 (P)  
Pass Marks: 40 (T) +10 (P)  
Semester: B.Ed. / V  
Total Period: 32+48 (Th. + Pr.) = 80 Periods

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-West University. This course has divided in to two parts: Theory and Practical. The theoretical parts consists of different units' related Chemistry teaching and learning. The major topics included in this course are Introduction of teaching chemistry in classroom; Objectives and curriculum of teaching chemistry; Approaches, planning and resources in teaching chemistry; Pedagogical analysis of chemistry content; Chemistry laboratories and their safety rules; Chemistry teacher and their professional growth and Action service and assessment of learning chemistry. In practical parts, different experiments to be performed which are listed in practical course related to completely theoretical part.

This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. It introduces the essential elements of chemistry teaching and practice needed to teach chemistry in an effective and inspirational manner. It develops the skills and competencies required for a chemistry teacher to teach chemistry in the national and global context. The students are required to secure pass marks in theory as well as practical course separately.

### 2. General Objectives

On the completion of this course student will be able to following general objectives:

- To acquire knowledge of nature of chemistry to teach chemistry.
- To understand the pedagogical principles underpinning the Nepalese as well as global schooling programmes.
- To provide students with the in-depth knowledge of teaching chemistry and use of teaching at secondary level effective way.
- To enable the students in develop different format of lesson plan, construct behavioral objectives, develop and preparation of improvised materials, model, construction of test items and item analysis.
- To apply and work with basic teaching skills in chemistry.
- To familiarize and use of chemistry lab and conduct experiment.
- Students will achieve mastery over inquiry based classroom teaching.
- To develop scientific attitude among students.
- To develop Teaching Aids and other learning material.
- To acquire knowledge of Professional competencies of a Chemistry teacher.
- To acquire knowledge of Resource materials required for teaching Chemistry.

### 3. Specific Objectives and Contents

#### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Contents                                                                                                                                                                                                                                                                                                                                                                                                                             | Periods  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <ul style="list-style-type: none"><li>• Introduce concept meaning and nature of teaching chemistry in a classroom.</li><li>• Discuss the impact of chemistry in nation and our society.</li><li>• Explain the importance of chemistry as school subject, Practical, disciplinary and recreational value.</li><li>• Describe chemistry and society with special emphasis on environment, industry, agricultural, health and kitchen.</li><li>• Explain the development of chemistry and chemistry education in Nepal.</li><li>• Co-relate the chemistry with Mathematics, physics, biology, social science, Environment and work experience.</li></ul> | <b>Unit 1: Introduction to Teaching Chemistry in a classroom</b> <ul style="list-style-type: none"><li>• Meaning and nature of chemistry</li><li>• Impact if chemistry</li><li>• Importance of chemistry as school subject, Practical, disciplinary and recreational values of Chemistry</li><li>• Chemistry and society</li><li>• Development of chemistry and chemistry education.</li><li>• Co-relation of chemistry to</li></ul> | <b>4</b> |

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| <ul style="list-style-type: none"> <li>• Elaborate the meaning, characteristics of a scientific attitude person, techniques of developing scientific attitude</li> <li>• Define creativity and describe the characteristics of a creative person and techniques of developing creativity in chemistry teaching and learning.</li> <li>• Write a report on present status, place of today's chemistry at secondary level and reforms needs.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p>other subjects</p> <ul style="list-style-type: none"> <li>• Scientific attitude</li> <li>• Creativity and chemistry teaching.</li> <li>• Place of chemistry in today's school curriculum</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |
| <ul style="list-style-type: none"> <li>• Discuss the meaning of the terms: aim, Objective, Learning outcome, and Specification.</li> <li>• List out the general and specific objectives of present chemistry curriculum at secondary level.</li> <li>• Formulate instructional objectives in terms of behavior.</li> <li>• Develop behavioral objectives of chemistry content including different level of cognitive domain.</li> <li>• Establish the relation between new taxonomy and blooms taxonomy.</li> <li>• Develop objective and subjective types of question in different domain of bloom taxonomy in chemistry.</li> <li>• Discuss the historical background of chemistry curriculum and its studies in the context of Nepal.</li> <li>• Elaborate the innovative approaches in development of chemistry curriculum.</li> <li>• Describe Chemistry Curriculum Study Project such as UNESCO Pilot Project for Chemistry Teaching in Asia, Nuffield Chemistry Project, Modern Chemistry Project in Malaysia, Thailand Project, CHEM Study Project, CBA and ALCHEM project in Canada on the basis of their objectives, needed, organization of project, themes, materials and application.</li> <li>• Discuss the objectives of different chemistry project and compare our chemistry curriculum objectives.</li> <li>• Critically analyze and evaluate our chemistry curriculum at secondary level than prepare report.</li> <li>• Compare our chemistry curriculum, textbook and teacher guide at secondary level.</li> <li>• Examine critically the future of chemistry curriculum in Nepalese context</li> </ul> | <p><b>Unit 2: Objectives and curriculum of teaching chemistry</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Aim, Objective, Learning outcome, and Specification.</li> <li>• Objectives of teaching chemistry.</li> <li>• Bloom's taxonomy of objectives</li> <li>• New taxonomy of educational objectives.</li> <li>• Historical background of chemistry curriculum studies in Nepal.</li> <li>• Innovative approaches of curriculum (UNESCO Pilot Project for Chemistry Teaching in Asia, Nuffield Chemistry Project, Modern Chemistry Project in Malaysia, Thailand Project, CHEM Study Project, CBA ALCHEM project in Canada)</li> <li>• Chemistry curriculum in school science</li> <li>• Comparative study of chemistry curriculum, textbooks and teachers guide of grade 9 -10</li> <li>• The future of chemistry curriculum in Nepalese context</li> </ul> | 6 |
| <ul style="list-style-type: none"> <li>• Define and list out the various approaches of teaching chemistry.</li> <li>• Explain the inquiry based teaching and learning on the basis of structured inquiry, Guided inquiry, Open inquiry and Process oriented guided inquiry learning in chemistry.</li> <li>• Explain experiential learning on the basis of Kolb learning cycle.</li> <li>• Discuss problem and project based learning, Case based learning and discovery learning in chemistry and mention its importance.</li> <li>• Point out the importance of utilizing technology for</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <p><b>Unit 3: Approaches, Planning and Resources For Teaching and Learning in Chemistry</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Inquiry based teaching and learning</li> <li>• Experiential learning</li> <li>• Problem and project based learning.</li> <li>• Case based learning</li> <li>• Discovery learning</li> <li>• Utilizing technology for</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 6 |



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| <p>teaching and learning chemistry.</p> <ul style="list-style-type: none"> <li>Describe the important methods of chemistry teaching: Heuristic method, flipped classroom, blended learning, web2 technology, think-pair-share, and concept mapping on the basis of concept, procedure and application.</li> <li>Choose and discuss the suitable approaches/ methods of teaching chemistry which is most suitable in the context of Nepalese school.</li> <li>Develop concept map on any chemistry content on the basis of guideline for concept mapping.</li> <li>Discuss the meaning and importance of Herbertian lesson plan and evaluation approach to lesson plan,</li> <li>Develop lesson Plan on the basis of Herbertian and evaluation approach on chemistry content.</li> <li>Prepare unit plan in chemistry units on the basis of format.</li> <li>List out the different printed, non-printed and online resources and characteristics, uses, and limitation of chemistry teaching and learning.</li> <li>Critically analyzes chemistry textbook on the suitable format.</li> <li>Describe the types, features, merits and demerits of projected, non-projected and electronic aids.</li> <li>Develop various projected, non-projected and electronic aids which are suitable in teaching chemistry.</li> <li>Explain Dale's cone of experience</li> <li>Discuss improvised aids on the basis of their meaning, preparation and importance.</li> <li>Construct improvised materials for using different chemistry experiment at secondary level.</li> </ul> | <p>teaching and learning</p> <ul style="list-style-type: none"> <li>Heuristic method, flipped classroom, web2 technology, think-pair-share, and concept mapping</li> <li>Lesson Plan: Herbertian Lesson Plan and Evaluation Approach to Lesson plan,</li> <li>Unit Plan</li> <li>Printed Resources : Text book, Work book, guides and reference material</li> <li>Non-Printed Resources: Laboratory</li> <li>Online resources: Online curriculum centre (OCC), Technology Integration Matrix (TIM), and Instructional Technology (FCIT),</li> <li>Teaching Aids : Projected, Non-projected and Electronic Aids</li> <li>Dale's Cone of experience</li> <li>Improvised Aids</li> </ul> |   |
| <ul style="list-style-type: none"> <li>Define pedagogical analysis</li> <li>Point out the major steps of pedagogical analysis</li> <li>Analyze pedagogically on the following chemistry content on the basis of their basic concept or sub-concept, objectives, teaching methods, Learning experiences, types of learning, students response pattern and evaluation strategies.</li> <li>➤ Structure and Properties of Matter: Classification of elements, atomic structure, electronic configuration, valency, periodic table, bonding and molecular formula.</li> <li>➤ Chemical Reaction: Types, chemical equation, factors affecting rate of chemical reaction, limitation of chemical reaction</li> <li>➤ Acid, Base, Salt and Solution: Properties, types, uses, neutralization reaction, indicators, pH value, solution, solubility and crystallization</li> <li>➤ Laboratory Preparation and Properties of Gases: Hydrogen, Oxygen, Nitrogen, Ammonia, Carbon dioxide</li> <li>➤ Organic and Inorganic Compounds: Properties and uses of carbon and its compound, fertilizers, cement, glass, ceramics, plastic, soap, detergents and</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                              | <p><b>Unit 4: Pedagogical analysis of chemistry content.</b></p> <ul style="list-style-type: none"> <li>Introduction</li> <li>Steps of pedagogical analysis</li> <li>Pedagogical analysis of following topics</li> <li>➤ Structure and Properties of Matter</li> <li>➤ Chemical Reaction</li> <li>➤ Acid, Base, Salt and Solution</li> <li>➤ Laboratory Preparation and Properties of Gases</li> <li>➤ Organic and Inorganic Compounds</li> <li>➤ Metals</li> </ul>                                                                                                                                                                                                                   | 5 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |   |
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| pesticides<br>➤ Metals: Properties of metals, nonmetals and metalloids, availability, metallurgy, properties and uses of iron, aluminium, copper, silver and gold                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |   |
| <ul style="list-style-type: none"> <li>Elaborate the concept of chemistry teacher education.</li> <li>Describe the qualities and responsibilities of chemistry teacher.</li> <li>Discuss the professional development of chemistry teacher on the basis of different teaching skills such as: Micro teaching, Technology, Thinking skills, Communication, Self-management, Research, Critical thinking, Problem solving and collaborative skills,</li> <li>Elaborate and conduct the programmes for Professional Growth such as Seminars, Workshops, Conferences, Projects, MOOC/online courses, Visits to resource centers, libraries and Human resource networking.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Unit 5: Chemistry Teacher and Professional Growth</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Responsibilities and qualities of chemistry teacher</li> <li>Competencies of a Chemistry Teacher on the basis of different teaching skills.</li> <li>Programmes for Professional Growth</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                        | 3 |
| <ul style="list-style-type: none"> <li>Justify the need of chemistry laboratory in school curriculum.</li> <li>Discuss the importance of chemistry laboratory.</li> <li>List out the guidelines for the organization which help the chemistry teacher to make practical work effective.</li> <li>Elaborate the combined lecture-cum laboratory useful for secondary level in Nepal.</li> <li>Sketch the outline of chemistry lab by using chart paper useful for secondary level.</li> <li>Develop the low-cost improvised materials useful for chemistry practical activities.</li> <li>Explain laboratory instructions, laboratory manual and instruction card.</li> <li>List the different apparatus and equipment which is useful for Nepalese secondary level.</li> <li>Elaborate the chemistry kit on the basis of meaning, types and advantages.</li> <li>List out the common laboratory accidents and discuss their remedial measures.</li> <li>List the materials containing first aid box and point out its importance of practical work in chemistry.</li> <li>Point out the methods for storing chemicals in laboratory.</li> <li>List the rules to avoid accidents in chemistry practical works.</li> </ul> | <b>Unit 6: Chemistry Laboratory and their safety rules</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Need and Importance of chemistry laboratory</li> <li>Need and significance of laboratory work.</li> <li>Organization of practical work.</li> <li>Chemistry laboratories</li> <li>Design chemistry lab for using secondary level.</li> <li>Develop low-cost improvised materials</li> <li>Laboratory instruction</li> <li>Apparatus and equipment</li> <li>Chemistry Kit</li> <li>Common accidents and their remedies (Burns, Cuts, Eye accidents, Poisons, Inhalation of gases and fire)</li> <li>First aid box</li> <li>Storage of chemicals</li> <li>Laboratory discipline</li> </ul> | 4 |
| <ul style="list-style-type: none"> <li>Explain the importance of Reflective journals, Video diaries, Chemistry photo gallery, Chemistry images, Drawing, Logs and collaborative web pages, Digital stories, Podcasts, Social Networking, Reflective activities in chemistry teaching and learning.</li> <li>Differentiate between formative and summative assessment.</li> <li>Construct and standardized the objective test items in chemistry.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Unit 7: Assessment of learners understanding in Chemistry</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Reflective journals, Video diaries, Chemistry photo gallery, Chemistry images, Drawing, Logs and collaborative web pages, Digital stories, Podcasts,</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                   | 4 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                         |  |
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| <ul style="list-style-type: none"> <li>• Discuss and explain the unit test on the basis of its concept, construction- components weighting, blue print and uses.</li> <li>• Explain the techniques of rubrics for students assessment,</li> <li>• Elaborate the process of student's assessment in chemistry on the basis of e-quiz, Google form, MOODLE, Software enabled assessments, Web links for Chemistry question bank, Question paper, Answer key, Peer assessment, Reflective essays, Reading logs and Case studies.</li> </ul> | <p>Social Networking, Reflective activities, Writing an extended essays in Chemistry.</p> <ul style="list-style-type: none"> <li>• Formative and summative assessment,</li> <li>• Objective type test items and pilot testing</li> <li>• Unit Test</li> <li>• Rubrics for assessment,</li> <li>• Innovative techniques of student assessment</li> </ul> |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Contents                                                                                                                                                                                                                                                                                        | Periods |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>• To prepare behavioral objectives of chemistry content including different level of cognitive domain (at least 3 set) at secondary level.</li> <li>• To prepare objective and subjective types of question in different domain of bloom taxonomy in chemistry (1 set).</li> <li>• To analyze critically and evaluate our secondary biology science curriculum.</li> <li>• To compare our biology curriculum, textbook and teacher guide at secondary level.</li> </ul>                                                                                                                                                   | <p><b>Unit 1: Objectives and curriculum of teaching chemistry</b></p> <ul style="list-style-type: none"> <li>• Preparation of behavioral objectives</li> <li>• Analyze biology curriculum at secondary level</li> <li>• Comparison of biology curriculum, textbook and teacher guide</li> </ul> | 9       |
| <ul style="list-style-type: none"> <li>• To prepare concept map on any chemistry content on the basis of guideline for concept mapping (at least 5 unit).</li> <li>• To prepare lesson Plan on the basis of teaching methods such as, Herbartian approach and evaluation approach (at least 3 each methods/approach).</li> <li>• To prepare unit plan on chemistry topics on the basis of format (at least 3).</li> <li>• To prepare micro-plan on chemistry topics on the basis of format (at least 2) and present in classroom.</li> <li>• Construct improvised materials for using different chemistry experiment at secondary level (at least 5).</li> </ul> | <p><b>Unit 2: : Approaches, Planning and Resources For Teaching and Learning in Chemistry</b></p> <ul style="list-style-type: none"> <li>• Concept map</li> <li>• Lesson plan</li> <li>• Unit plan</li> <li>• Micro plan</li> <li>• Improvised materials</li> </ul>                             | 9       |
| <ul style="list-style-type: none"> <li>• To develop the format for pedagogical analysis of chemistry content (at least 2 unit) and present in your class.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Unit 3: Pedagogical analysis</b>                                                                                                                                                                                                                                                             | 6       |
| <ul style="list-style-type: none"> <li>• To design chemistry laboratory by using chart paper which is useful for secondary level.</li> <li>• To arrange the chemical and apparatus by appropriate ways in your chemistry lab.</li> <li>• To develop the model of first aid box which is useful at secondary level.</li> <li>• To prepare Carbon dioxide gas by using improvised materials.</li> <li>• To separate the different types of mixture by using improvised Materials or laboratory</li> </ul>                                                                                                                                                          | <p><b>Unit 4: Chemistry Laboratory and their safety rules</b></p> <ul style="list-style-type: none"> <li>• Lab design</li> <li>• Arranging chemical and apparatus</li> <li>• First aid box</li> <li>• Laboratory activity</li> </ul>                                                            | 15      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|---|
| techniques (Sublimation, Filtration, chromatography etc.) (at least 4 experiment)<br>• To prepare a crystal of different salt by applying crystallization techniques (at least 2 experiment)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                |   |
| • To construct chemistry achievement test (at least 50), standardized these items with the help of pilot testing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Unit 5: Evaluation and Assessment of biological science</b> | 3 |
| • To prepare overall report of teaching chemistry in a given format:<br>- Title page<br>- Acknowledgement<br>- Acronyms and Abbreviations<br>- Abstract<br>- Table of contents<br>Unit 1: Introduction<br>- Background<br>- Objectives<br>- Methods<br>Unit 2: Preparation of behavioral objectives<br>Unit 3: Preparation of subjective and objective type question in different domain<br>Unit 4: Analysis of chemistry curriculum<br>Unit 5: Comparison of chemistry curriculum, textbook and teacher guide<br>Unit 6: Pedagogical analysis of chemistry content<br>Unit 7: Preparation of text item and item analysis<br>- Conclusion<br>- References | <b>Unit 6: Overall report writing and presentation</b>         | 6 |

#### 4. Instructional Techniques

Depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration, Blogging
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Develop multimedia presentation
- Concept mapping and brain storming
- Internet (web) surfing
- Group work, Report writing and presentation
- Individually laboratory work
- Home assignment and class participation

#### 5. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

##### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                          |                  |
|------------------------------------------|------------------|
| 21) Attendance                           | 5 points         |
| 22) Participation in learning activities | 5 points         |
| 23) First assignment ( Presentation)     | 10 points        |
| 24) Second assignment (Term exam)        | 10 points        |
| 25) Third assignment (Project work)      | 10 points        |
| <b>Total</b>                             | <b>40 points</b> |

## 5.2 Theory: External evaluation (Full marks 50)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |                  |
|--------------|------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points        |
| <b>Total</b> |                                                                  | <b>40 points</b> |

**Note: All questions are compulsory**

## 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination           | Area                                                                                                        | Points | Total Points     |
|-----------------------|-------------------------------------------------------------------------------------------------------------|--------|------------------|
| Internal              | Regularity                                                                                                  | 2      | 6 points         |
|                       | Practical Performance                                                                                       | 1      |                  |
|                       | Record book                                                                                                 | 3      |                  |
| External              | Demonstrate experiment (at least 1 Exp.)                                                                    | 3      | 6 Points         |
|                       | Viva                                                                                                        | 3      |                  |
| External and Internal | Overall Report writing + Presentation+ Lab design + preparation of model + Making improvised materials etc. |        | 8 Points         |
| <b>Total Points</b>   |                                                                                                             |        | <b>20 points</b> |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

## 6. References Books

- Bergmann, J. & Sams, A. (2012). Flip your classroom: Reach every student in every class every day. *International Society for Technology in Education*.
- Bloom, B. S. (1956). *Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain*. New York: David McKay Co Inc
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- Hutchings, W. (2007). *Enquiry-Based Learning: Definitions and Rationale*. Manchester, UK. Centre for Excellence in Enquiry-Based Learning, The University of Manchester.
- Klein, J.D. (1992). Effects of cooperative learning and need for affiliation on performance, time on task and satisfaction. *Educational Technology Research and Development*. Vol 40, number 4. Pp 39–48.

## Recommended Reading

Anmad, S. (2007). *Teacher's hand Book of science*, New Delhi: Anmol Publication PVT. LTD.

- Das, R.C. (1985). *Science Teaching in Science in Schools (2nd ed.)*. Sterling Publishers Pvt. Ltd.
- Guy, K. (nd). *Laboratory Organization and Administration*, Mac Millan.
- Herron, T.D., Center L., Ward R., & Srinivasam V. (1997). *Problem Associated Concept Analysis Science Education*. 6, (2) 185-199.
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- Kamala, N. (2005). *Content Cum Method of Teaching Chemistry*. Bangalore: Sumukha, Prakashana.
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- Mittal, A. (2004). *Teaching of Chemistry*, New Delhi: APH Publishing Corporation.
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- School Chemistry Curriculum in USA, UK and Canada
- School Science Curriculum, CDC: Government of Nepal
- Sharma, R. C. (2010). *Modern Science Teaching*, New Delhi: DhanpathRai Publishing Company.
- Singh, M.P. (2004). *Modern Teaching of Chemistry*, New Delhi: Anmol publication PVT. LTD.
- Taber, K. (2012). *Teaching secondary chemistry*. London: Hodder Education
- Thurber, W. A., & Colletta, A. (1964). *A Teaching Science in Today's Secondary Schools*. New Delhi: Prentice Hall of India.
- Vaidya, N. (1996). *Science Teaching for the 21st Century*. New Delhi: Deep & Deep Publications.
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- Yadav, M. S. (2004). *Teaching of chemistry*. New Delhi: Anmol publications

**Mid-West University  
Graduate School of Education  
Surkhet, Nepal**



**Bachelor of Science Education (BEd-Sc)  
Curriculum  
6<sup>th</sup> Semester**

# **Bachelor of Science Education (BEd-Sc)**

## **Curriculum**

### **6<sup>th</sup> Semester**

| <b>S. No</b> | <b>Course Code No</b> | <b>Course Name</b>            | <b>Credit Hour</b> | <b>Feature</b>        |
|--------------|-----------------------|-------------------------------|--------------------|-----------------------|
| 1.           | SCED 461              | Physics Education             | 3                  | T-2, P-1              |
| 2.           | SCED 462              | Chemistry                     | 3                  | T-2, P-1              |
| 3            | SCED 463              | Biology                       | 3                  | T-2, P-1              |
| 4            | SCED 464              | Research in Science Education | 3                  | T-2, P-1              |
| 5            | SCED 465              | Basic Concept of Statistics   | 3                  | T-2, P-1              |
| <b>Total</b> |                       |                               | <b>15</b>          | <b>Th-10<br/>Pr-5</b> |



Course Title: **Physics Education**  
Course Code: SCED 461  
Nature of Course: Theory + Practical  
Total Credit: 2+1 (Th. + Pr.)

Full Marks: 80 (T) +20 (P)  
Pass Marks: 40 (T) +10 (P)  
Semester: VI /B.Ed.  
Total Period: 32+48 (Th. + Pr.) = 80 Periods

### 1. Course Description

This is a specialized theory course designed for the students of Bachelor level of Science education. This Course has two sections: **Physics Education theory and practical**. The aim of this course is to provide knowledge in the field of thermal expansion, kinetic theory and gas law, hygrometric, fundamentals of electro statics, capacitor and thermoelectricity in Physics which can help the prospective Physics teachers teach with confidence at the secondary education level as well as to be able to pursue higher studies in the science education. In practical parts, different experiments to be performed which are listed in particle course. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. The students are required to secure pass marks in theory as well as practical course separately.

### 2. General Objectives

On the completion of this course student will be able to following general objectives:

- To provide the students with adequate theoretical knowledge of physics.
- To develop knowledge and skills in thermal expansion.
- To enable the students in elaborating the kinetic theory and gas law.
- To familiarize the students with the concept of hygrometric.
- To make the students familiarize with the fundamental of electro statistics.
- To impact knowledge to the students on essential aspect capacitor.
- To acquaint the students with the concept of thermoelectricity.
- To make students to understand the correlation between theory and the experiment.

### 3. Specific Objectives and Contents

#### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Periods |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"><li>• Define thermal expansion and point out its application.</li><li>• Describe expansion of solid.</li><li>• explain the coefficient of expansion.</li><li>• Describe the coefficient of linear expansion by pullinger's method.</li><li>• Determine the differential expansion.</li><li>• Define and explain the working process and principles thermostat.</li><li>• Describe the expansion of liquid based on change of density.</li><li>• Elaborate the concept of absolute expansivity.</li><li>• Explain the anomalous expansion of water.</li><li>• Discuss the concept of correction of barometer.</li><li>• Solve the related numerical problems</li></ul> | <b>Unit 1: Thermal Expansion</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Expansion in Solids</li><li>• Coefficients of Expansion</li><li>• Measurement of Coefficient of Linear Expansion by Pullinger's Method</li><li>• Differential Expansion</li><li>• Thermostat</li><li>• Expansion of Liquids</li><li>• Change of Density</li><li>• Measurement of Absolute Expansivity</li><li>• Anomalous Expansion of Water</li><li>• Correction of Barometer</li><li>• Solve numerical problems</li></ul> | 5       |
| <ul style="list-style-type: none"><li>• Define kinetic theory of gas and gas law.</li><li>• List the postulates of kinetic theory of gas.</li><li>• Explain the pressure exerted by a gas and kinetic energy of gas.</li><li>• Describe the RMS Speed and Mean Speed Boltzmann Constant</li><li>• Derive the equation of boyle's and Charle's law.</li></ul>                                                                                                                                                                                                                                                                                                                                            | <b>Unit 2: Kinetic Theory and Gas Laws</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Postulates of Kinetic Theory</li><li>• Pressure Exerted by a Gas</li><li>• Kinetic Energy of the Gas</li></ul>                                                                                                                                                                                                                                                                                                    | 6       |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |   |
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| <ul style="list-style-type: none"> <li>Describe the volume coefficient and pressure coefficient.</li> <li>Explain the absolute temperature and absolute zero.</li> <li>Explain the Dalton's law of partial pressure and universal gas constant.</li> <li>Establish the relationship between one mole and Avogadro's constant.</li> <li>Solve simple related numerical problems.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>Relation Between Pressure and Kinetic Energy</li> <li>RMS Speed and Mean Speed Boltzmann Constant</li> <li>Derivation of Gas Laws</li> <li>Introduction Boyle's Law</li> <li>Charles' Law</li> <li>Volume Coefficient and Pressure Coefficient</li> <li>Absolute Temperature and Absolute Zero Temperature</li> <li>Dalton's Law of Partial Pressure Universal Gas Constant (R)</li> <li>Relation Between One Mole and Avogadro's' Constant</li> <li>Solve numerical problem</li> </ul>                                                                                |   |
| <ul style="list-style-type: none"> <li>Define the term hygrometry.</li> <li>Explain the saturated and unsaturated vapour with their similarities and dissimilarities.</li> <li>Describe the concepts of SVP and UVP.</li> <li>Explain the P-V and P-T diagram for vapours.</li> <li>Discuss the phase diagram and triple point.</li> <li>Explain the atmospheric humidity.</li> <li>Define the wet bulb and dry bulb hygrometer.</li> <li>Describe the weather phenomena with examples.</li> <li>Solve simple related numerical problems.</li> </ul>                                                                                                                                                                                                                                                                   | <b>Unit 3: Hygrometry</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Saturated and Unsaturated Vapours</li> <li>SVP and UVP</li> <li>P-V and P-T Diagrams for Vapours</li> <li>Phase Diagram and Triple Point</li> <li>Atmospheric Humidity</li> <li>Wet Bulb and Dry Bulb Hygrometer</li> <li>Weather Phenomena</li> <li>Solve numerical problem</li> </ul>                                                                                                                                                                                                                                | 5 |
| <ul style="list-style-type: none"> <li>Introduce fundamental of electrostatics with examples.</li> <li>Explain the process of electric charge.</li> <li>Define and explain procedure of charging body.</li> <li>Describe the modern theory of electrification.</li> <li>Elaborate the applications of electrostatics induction.</li> <li>Describe the charging a body by induction.</li> <li>Elaborate the concepts of conductor and insulator.</li> <li>Explain the gold leaf electroscope, and pith ball electroscope.</li> <li>Discuss the Charges Reside On the Surface of a Conductor.</li> <li>Explain the Faraday's Ice Pail Experiment.</li> <li>Define Surface Charge Density and Action of Points.</li> <li>Describe the Van de Graff Generator.</li> <li>Solve simple related numerical problems</li> </ul> | <b>Unit 4: Fundamentals of Electrostatics</b> <ul style="list-style-type: none"> <li>Introduction Electric Charges</li> <li>Methods of Charging of Body</li> <li>Modern Theory of Electrification</li> <li>Electrostatic Induction</li> <li>Charging a Body by Induction</li> <li>Conductor and Insulator</li> <li>Gold Leaf Electroscope (GLE)</li> <li>Pith Ball electroscope</li> <li>Charges Reside On the Surface of a Conductor</li> <li>Faraday's Ice Pail Experiment</li> <li>Surface Charge Density and Action of Points</li> <li>Van de Graff Generator</li> <li>Solve numerical problem</li> </ul> | 5 |
| <ul style="list-style-type: none"> <li>Define capacitor.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Unit 5 Capacitor</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 6 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• Explain the principle of capacitor.</li> <li>• Explain capacitance of capacitor.</li> <li>• Elaborate the polar and non-polar dielectrics.</li> <li>• Define and explain Polarization and Action of Dielectric in Capacitor.</li> <li>• Define the Dielectric Constant and Dielectric Strength.</li> <li>• Elaborate the grouping of capacitors.</li> <li>• Describe Energy Stored in a Capacitor.</li> <li>• Discuss the Energy Loss in Joining Capacitors.</li> <li>• Explain the Charging and Discharging of a Capacitor.</li> <li>• Solve simple related numerical problems</li> </ul> | <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Principle of a Capacitor</li> <li>• Capacitance of a Capacitor</li> <li>• Polar and Non Polar Dielectrics</li> <li>• Polarization and Action of Dielectric in Capacitor</li> <li>• Dielectric Constant and Dielectric Strength</li> <li>• Grouping of Capacitors</li> <li>• Energy Stored in a Capacitor</li> <li>• Energy Loss in Joining Capacitors</li> <li>• Charging and Discharging of a Capacitor</li> <li>• Solve numerical problems</li> </ul> |   |
| <ul style="list-style-type: none"> <li>• Introduce the concept of thermoelectricity.</li> <li>• Discuss the terms Seebeck Effect.</li> <li>• Describe the Relation Between Thermo e.m.f. and Temperature.</li> <li>• Elaborate the revolution of science and Galilean transformation</li> <li>• Explain the cause of thermo e.m.f. in thermoelectric Series.</li> <li>• Discuss the Peltier effect and Thomson's effect.</li> <li>• Describe the thermopile with example.</li> <li>• Solve simple related numerical problems</li> </ul>                                                                                             | <b>Unit 6: Thermoelectricity</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Seebeck Effect</li> <li>• Relation Between Thermo e.m.f. and Temperature</li> <li>• Cause of Thermo e.m.f. in Thermoelectric Series</li> <li>• Peltier Effect</li> <li>• Thomson's Effect</li> <li>• Thermopile</li> <li>• Solve related numerical problems</li> </ul>                                                                                                                                                 | 5 |

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## **Part 2: Practical**

- To use a Boyle's law apparatus for the verification of Boyle's law.
- To study the variation in volume (V) with pressure (P) for a sample of air at constant temperature by plotting graphs between P and V, and between P and  $\frac{1}{V}$ .
- To study the relationship between the temperature of a hot body and time by plotting a cooling curve.
- To study the relation between frequency and length of a given wire under constant tension using a sonometer.
- To study the relation between the length of a given wire and tension for constant frequency using a sonometer.
- To determine the specific heat capacity of a given (i) and solid (ii) a liquid by the method of mixtures.
- To determine the surface tension of water by capillary rise method.
- To determine the coefficient of viscosity of a given liquid by measuring the terminal velocity of a spherical body.
- To investigate the behaviour of current, voltage and resistance in series and parallel circuits with two resistors.
- To investigate the discharging and charging curves for a capacitor and determine the capacitance.
- By measuring resonance frequencies, coil inductance can be calculated. We work with two single coils, as well as series and parallel connections.
- Examining the relationship between voltage and current for a metal wire.

#### 4. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Group work, Report writing and presentation
- Individually laboratory work

#### 5. Evaluation: Internal and external Assessment

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

##### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                         |           |
|-----------------------------------------|-----------|
| 1) Attendance                           | 5 points  |
| 2) Participation in learning activities | 5 points  |
| 3) First assignment ( Presentation)     | 10 points |
| 4) Second assignment (Term exam)        | 10 points |
| 5) Third assignment (Project work)      | 10 points |
| Total                                   | 40 points |

##### 5.2 Theory: External evaluation (Full marks 60 %)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |           |
|--------------|------------------------------------------------------------------|-----------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points |
| <b>Total</b> |                                                                  | 40 points |

**Note: All questions are compulsory**

##### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination | Area                         | Points   | Total Points |
|-------------|------------------------------|----------|--------------|
| Internal    | Regularity                   | 1.5      | 4 points     |
|             | Practical Performance        | 1        |              |
|             | Record book                  | 1.5      |              |
| External    | Experiment (at least 2 Exp.) | 10 (5+5) | 13 Points    |
|             | Viva                         | 3        |              |

|                       |              |           |
|-----------------------|--------------|-----------|
| External and Internal | Project work | 3 points  |
| Total Points          |              | 20 points |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

#### **6. Recommended and References Books**

- Arora, C.L. (1988). B.Sc Practical Physics. New Delhi: S. Chand & Company, Ltd.
- Bajaj, N.K. (2000). *Physics*. Delhi: Tata MC Graw-Hill Publishing Com. Ltd.
- Gupta, S. K. and Pradhann, J. M. (1995). *A text book of physics part 1*. Jalandhar city: Surya Publication.
- Gupta, S. K. and Pradhann, J. M. (2009). *A text book of physics part 2*. Jalandhar city: Surya Publication.
- Huffer, C. M., Trinklein, F.E. & Bunge, M. (1973). *An introduction to astronomy*. New York: Holt, Rinehart and Winston, Inc.
- Sears, F.W., Zemansky, M.W., Yong , H.D., Freedman, R. A. & Ford, A. L.(2009). *University physics*. Singapore: Pears on Education.
- Shretha, U. P. (2049 BS). *A Physics practical guide*. Kathmandu: Ratna Pustakk Bhandar.
- Subrahmanyam, N. and Brij, L.(1996). *Principles of physics*. New Delhi: S. chanda and company Ltd.

Course Title: **Chemistry**  
Course Code: SCED 462  
Nature of Course: Theory + Practical  
Total Credit: 2+1 (Th. + Pr.)

Full Marks: 80 (T) +20 (P)  
Pass Marks: 40 (T) +10 (P)  
Semester: VI / B.Ed.  
Total Period: 32+48 (Th. + Pr.) = 80 Periods

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The theoretical parts consist of different units of chemistry which are essential applied in our daily life. The major topics included in this course are Water, solution, Phase and ionic equilibrium, Kinetics and chemical equilibrium, Complex and aromatic compounds. In practical parts, different experiments to be performed which are listed in particle course. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching and learning process. The students are required to secure pass marks in theory as well as practical course separately.

### 2. General Objectives

On the completion of this course student will be able to following general objectives:

- To enable the students in dealing with the water and their characteristics, Boiler scale and sludge and hardness of water.
- To familiarize the students with different types of solutions and their determination techniques.
- To help the students' different theories and measurement techniques of ionic and phase equilibria.
- To acquaint the students with the basic concepts kinetics and chemical equilibrium.
- To enable the students, familiarize with the concepts of complex and aromatic compounds.
- To provide students with an opportunity to understand the different aromatic compounds and their application.

### 3. Specific Objectives and Contents

#### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Periods |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"><li>• Identify the different sources of water.</li><li>• Explain the characteristic the water property.</li><li>• Discuss the effect of water on rocks and minerals.</li><li>• Elaborate the Mechanism of boiler scale formation, Effects of boiler scales and sludge and their disadvantages.</li><li>• List out the methods of preventing deposit formation.</li><li>• Describe the treatment of boiler water on the basis of phosphate, complexing agents and alkali treatment.</li><li>• Explain the preventing carbonate deposited in turbine condensers.</li><li>• Discuss the reasons for the analysis of water.</li><li>• Elaborate the hardness of water on the basis of types, formation and methods of removing hardness of water.</li><li>• Explain lime soda process, zeolite process and demineralization process in details for the removing of permanent hardness of water.</li><li>• Prepare a report on a topics water pollution, purification and hazard protection.</li></ul> | <b>Unit 1: Water and its measurement</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Sources of water supply</li><li>• Characteristics of water</li><li>• Effect of water on rocks and minerals</li><li>• Boiler scale and Sludge's<ul style="list-style-type: none"><li>- Mechanism, effect and disadvantage</li></ul></li><li>• Methods of preventing deposit formation</li><li>• Treatment of boiler water<ul style="list-style-type: none"><li>- Phosphate, complexing agent and alkali</li></ul></li><li>• Preventing deposit formation in turbine condensers</li><li>• Analysis of water</li><li>• Hardness of water<ul style="list-style-type: none"><li>- Types, techniques of the removal of hardness</li></ul></li><li>• Water pollution, purification and hazard protection.</li></ul> | 6       |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>Define solution and classify it.</li> <li>Measure the solution of gases in gases by transpiration methods.</li> <li>Discuss the solution of gases in liquids.</li> <li>Determine the solubility of sparingly soluble and highly soluble gases.</li> <li>Derive Raoult's law.</li> <li>Describe Raoult's law on the basis of their deviation with examples.</li> <li>Describe the methods for experimental determination of the solubility of a solid.</li> <li>Explain the solutions of solids on solids on the basis of vapor pressure of salt hydrates, deliquescence and efflorescence.</li> <li>Draw the curve for the vapour pressure of the hydrates of copper (II) sulphate at 40°C.</li> <li>Elaborate the properties of dilute solution on the basis of lowering of vapour pressure, Elevation of boiling points, Depression of freezing point etc. with their measurement techniques.</li> <li>Discuss the measurement and laws of osmotic pressure</li> <li>Explain the association and dissociation when placed in a solution in a solute.</li> <li>Solved related numerical problems.</li> </ul> | <b>Unit 2: Solution</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Types of solution <ul style="list-style-type: none"> <li>Solution of gases in gases</li> <li>Solution of gases in liquids</li> <li>Solutions of liquids in liquids</li> <li>Solutions solids in liquids</li> <li>Solutions of solids on solids</li> </ul> </li> <li>Properties of dilute solutions</li> <li>Osmosis</li> <li>Association and dissociation</li> <li>Numerical problems</li> </ul> | 5 |
| <ul style="list-style-type: none"> <li>Define phases equilibrium</li> <li>Draw the diagram for phase equilibrium.</li> <li>Draw the phase equilibrium diagram of water and carbon-dioxide.</li> <li>Describe the types of allotropy on the basis of their types Enantiotropy, Monotropy and Dynamic allotropy.</li> <li>Define and explain the Henry's law</li> <li>Measure the solubility of gases on the basis of Pyknometer and Ostwald's methods.</li> <li>Discuss the mixtures of miscible and partially miscible liquids.</li> <li>Explain the distribution or partition law.</li> <li>Elaborate eutectic mixture on the basis of different graphs.</li> <li>Solve related numerical problems.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Unit 3: Phases equilibrium</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Phases equilibrium diagrams</li> <li>Allotropy</li> <li>Henry's law</li> <li>Measurement of solubility of gases</li> <li>Mixtures of miscible and partially miscible liquids</li> <li>Distribution or Partition law</li> <li>Eutectic mixture</li> <li>Numerical problems</li> </ul>                                                                                                   | 4 |
| <ul style="list-style-type: none"> <li>Define and explain the reaction rate.</li> <li>Differentiate between order and molecularity of a reaction.</li> <li>State and explain the first and second order reaction with their test and examples.</li> <li>Illustrate and discuss the third order and zero order reaction.</li> <li>Draw the various forms of curves showing variation of rate with examples.</li> <li>Discuss the effect of temperature on reaction rate.</li> <li>Draw the energy activation diagram and discuss it.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Unit 4: Chemical Kinetics</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Reaction rate</li> <li>Order and molecularity of reaction.</li> <li>First, second, third and zero order reactions.</li> <li>Effect of temperature on reaction velocity</li> <li>Activation energy</li> <li>Collision and transition theory of reaction rate.</li> </ul>                                                                                                                 | 6 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                    |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>Describe the collision and transition theory of reaction rate.</li> <li>Explain the collision theory of unimolecular reactions and kinetic theory of termolecular reactions</li> <li>Solve related numerical problems.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>Collision theory of unimolecular reactions.</li> <li>Kinetic theory of termolecular reactions.</li> <li>Numerical problems</li> </ul>                                                                                                                                                                                                                       |   |
| <ul style="list-style-type: none"> <li>Define complex compounds.</li> <li>Draw the structure of different configuration of complex ions.</li> <li>Describe the labile and inert complexes.</li> <li>List out the rule of naming complex compounds.</li> <li>Explain the different types of isomerism of complex compounds with examples.</li> <li>Illustrate the stereoisomerism of complex compounds.</li> <li>Elaborate the bonding of process in complexes with the help of different examples and diagrams.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Unit 5: Complex Compounds</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Structure</li> <li>Labile and inert complexes</li> <li>Nomenclature of complexes</li> <li>Isomerism and stereoisomerism of complexes</li> <li>Bonding in complexes</li> </ul>                                                                                                                        | 4 |
| <ul style="list-style-type: none"> <li>Define aromatic compounds.</li> <li>List the sources of aromatic compounds.</li> <li>Justify petroleum as the source of aromatic compounds.</li> <li>List the characteristics of aromatic compounds.</li> <li>Explain the Huckel's rule of aromaticity.</li> <li>Establish the structure of benzene.</li> <li>Draw the resonance structure of ring activator and deactivator group of benzene homologous.</li> <li>Write the electrophilic substitution reaction of benzene with its mechanism.</li> <li>Describe the laboratory preparation methods of phenol, nitrobenzene, aniline and benzoic acid and list out their uses.</li> <li>Illustrate the laboratory test of phenols with other aromatic compounds.</li> <li>Write the reduction reaction of nitrobenzene.</li> <li>Define diazotization and write the reaction with its mechanism.</li> <li>Write the synthesis process of BHC, DDT, BDC, TNT azo dyes, Picric acid, Phenolphthalein, Salicylic acid and their uses.</li> </ul> | <b>Unit 6: Aromatic Compounds</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Sources of aromatic compounds</li> <li>Aromaticity</li> <li>Benzene</li> <li>Orientation of benzene derivatives</li> <li>Phenol</li> <li>Nitrobenzene</li> <li>Aniline</li> <li>Benzoic acid</li> <li>Aryldiazonium salt</li> <li>Synthesis of commercially important organic compounds.</li> </ul> | 7 |

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

### Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                                                                                                                  | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Periods |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>Determine the order of reaction.</li> <li>Relate the solubility and temperature.</li> <li>Determine the hardness of water.</li> <li>Estimate the percentage composition of mixture <math>\text{Fe}^{\text{II}}</math> and <math>\text{Fe}^{\text{III}}</math> salts.</li> <li>Observe the colours of the complexes</li> </ul> | <ul style="list-style-type: none"> <li>To determine rate constant and order of reaction for hydrolysis of an ester catalyzed by acid.</li> <li>To determination of the effect of acid concentration on the reaction rate between Mg and acid reaction</li> <li>To determination of the order of the reaction between <math>\text{CaCO}_3(\text{s})</math> and hydrochloric acid</li> <li>To determine the order of reaction with respect to NaOH and KI</li> <li>To investigate the relationship between solubility and temperature. (KCl and different temperature)</li> <li>To determine the hardness of water complexometrically using EDTA.</li> </ul> | 48      |



|                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <ul style="list-style-type: none"> <li>Determination of the solubility product, critical solution temperature and density of liquid.</li> <li>Examine the properties of phenol.</li> </ul> | <ul style="list-style-type: none"> <li>To estimate of percentage composition mixture <math>\text{Fe}^{\text{II}}</math> and <math>\text{Fe}^{\text{III}}</math> salts.</li> <li>To observe the colours of the complexes of <math>\text{Cu}(\text{II})</math>, <math>\text{Ni}(\text{II})</math> and <math>\text{Co}(\text{II})</math> salts with hydrochloric acid and ammonia solutions</li> <li>To Identify cation of the colours of complex ions in aqueous medium</li> <li>To determination of the solubility product of <math>\text{Ca}(\text{OH})_2</math></li> <li>To examine the properties of phenol.</li> <li>To determine the critical solution temperature of phenol-water system.</li> <li>To determine the density of liquid by specific gravity bottle.</li> </ul> |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

## 2 Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Individually laboratory work

## 3 Evaluation: Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                         |                  |
|-----------------------------------------|------------------|
| 6) Attendance                           | 5 points         |
| 7) Participation in learning activities | 5 points         |
| 8) First assignment ( Presentation)     | 10 points        |
| 9) Second assignment (Term exam)        | 10 points        |
| 10) Third assignment (Project work)     | 10 points        |
| <b>Total</b>                            | <b>40 points</b> |

### 5.2 Theory: External evaluation (Full marks 40)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|    |                                                                  |           |
|----|------------------------------------------------------------------|-----------|
| 1. | Objective type question (multiple choice: 10 questions x 1point) | 10 points |
|----|------------------------------------------------------------------|-----------|

|              |                                                 |           |
|--------------|-------------------------------------------------|-----------|
| 2.           | Short answer question ( 6 questions x 5 points) | 30 points |
| <b>Total</b> |                                                 | 40 points |

**Note: All questions are compulsory**

### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination  | Area                         | Points   | Total Points |
|--------------|------------------------------|----------|--------------|
| Internal     | Regularity                   | 2        | 6 points     |
|              | Practical Performance        | 2        |              |
|              | Record book                  | 2        |              |
| External     | Experiment (at least 2 Exp.) | 11 (5+6) | 14 Points    |
|              | Viva                         | 3        |              |
|              |                              |          |              |
| Total Points |                              |          | 20 points    |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

### Recommended and References Books

- Bahl, A., & Bhal, B.S. (2008). *A textbook of organic chemistry*. New Delhi: S. Chanda and company limited.
- Bahl, A., Bhal, B.S. & Tuli, G. D. (2008). *Essential of physical chemistry*. New Delhi: S. Chanda and company limited.
- Dhaubdel, S.P., Pradhan, K.P., & Joshi, S.M. (n.d.). *Practical chemistry guide*. Nepal: Kathmandu.
- Khadka, N.M., Gautam, S.D. & Yadav, P.N. (n.d). *A core experimental chemistry*. Kathmandu: Kedeaa Book Center.
- Pandit, C.N., Subedi, R.R. & Tiwari, P.(2074 B.S.). *A text book of Chemistry*, Kathmandu: K. P. Pustak Bhandar.
- Pokherel, M.R.,& Poudel, B.R. (2011). *A text book of inorganic chemistry*. Kathmandu: National Book Center.
- Prakash, S., Tuli, G.D., Basu, S. K. & Madan, R.D. (2008). *Advanced inorganic chemistry*. New Delhi: S. Chanda and company limited.
- Sahay, S. (1990). *Quantitative chemical analysis*. New Delhi: S. Chanda and company limited.
- Sthapit, M.K. & Pradhananga R.R. (2065 B.S.) *A text book of physical chemistry*, Kathmandu: Taleju Prakashan
- Sthapit, M.K. & Pradhananga, R.R.(1998). *Experimental physical chemistry*. Kathmandu: Taleju Prakashan.
- Vishnoi, N.K. (1985). *Advanced practical organic chemistry*. India: Vikas Publishing House Pvt. Ltd.

Course Title: **Biology**  
 Course Code: SCED 463  
 Nature of Course: Theory + Practical  
 Total Credit: 2+1 (Th. + Pr.)

Full Marks: 80 (T) +20 (P)  
 Pass Marks: 40 (T) +10 (P)  
 Semester: VI / B.Ed.  
 Total Period: 32+48 (Th. + Pr.) = 80 Periods

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The major topics included in this course are Plant taxonomy, Cell biology and genetics, Embryology of plants and animals, Human biology, Human population and socially significant disorder. In practical parts, different experiments to be performed which are listed in particle course, besides this experiment performed, field visit and report writing. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. The students are required to secure pass marks in theory as well as practical course separately.

### 2. General Objectives

On the completion of this course student will be able to following general objectives:

- To provide students with the in-depth knowledge of historical and modern approach of plant taxonomy and taxonomic character of different dicot.
- To acquaint the students with the concept of cell biology and genetics.
- To enable the students in elaborating the embryology of plants and animals.
- To familiarize the students with trends of population growth and know the way of controlling over population.
- To make the students familiarize with the human biology related to digestive, respiratory, circulatory and reproductive systems of human.
- To impact knowledge to the students on essential aspect socially significant disorder.
- To enable students to prepare herbarium on their field visit, prepare report and develop practical record file by using appropriate methods and approaches.

### 3. Specific Objectives and Contents

#### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Periods |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>• Describe the historical approach of plant taxonomy</li> <li>• Elaborate the modern approach of plant taxonomy on the basis of Phytochemistry, Cytology, Cytogenetics, Palynology, Anatomy and Embryology.</li> <li>• Explain the taxonomic categories species, genus and family</li> <li>• Explain the important role and rules of ICBN</li> <li>• Discuss the important roles of herbarium in plant taxonomy</li> <li>• Describe the taxonomic characters, systematic position, economic importance and affinities of Dicot: Magnoliaceae, Convolvulaceae, Scrophulariaceae and Monocot: Amaryllidaceae, Commelinaceae</li> <li>• Differentiate between taxonomic characters, systematic position and affinities dicot ant monocot families.</li> </ul> | <b>Unit 1: Plant Taxonomy</b> <ul style="list-style-type: none"> <li>• Historical approach               <ul style="list-style-type: none"> <li>- Pre-Darwinian</li> <li>- Post Darwinian (Hutchinson's)</li> <li>- Recent (Takhtajan)</li> </ul> </li> <li>• Modern approach</li> <li>• Taxa and taxonomic hierarchy</li> <li>• Botanical nomenclature (International code of botanical nomenclature)               <ul style="list-style-type: none"> <li>- Introduction</li> <li>- Important roles and rules</li> </ul> </li> <li>• Herbarium and its roles in plant taxonomy</li> <li>• Taxonomic characters systematic position, economic importance and affinities of</li> </ul> | 5       |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <ul style="list-style-type: none"> <li>- Dicot: Magnoliaceae, Convolvulaceae, Scrophulariaceae and</li> <li>- Monocot: Amaryllidaceae, Commelinaceae</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |
| <ul style="list-style-type: none"> <li>• Explain cell theories on the basis of protoplasmic and organismal theories.</li> <li>• Differences the structures of prokaryotic and eukaryotic cells.</li> <li>• Discuss the prokaryotic cells on the basis of - PPLO, Bacteria and blue green algae.</li> <li>• Describe the structure and functions of plasma membrane</li> <li>• Describe the structure and functions of various cell organelles - plastids, mitochondria, golgi complex, ribosome, endoplasmic reticulum</li> <li>• Describe the structure and functions of nucleus</li> <li>• Identify the genetic materials</li> <li>• Illustrate the evidence for DNA as genetic material of culture</li> <li>• Explain the evidence of RNA as genetic material for virus</li> <li>• Draw and explain the Watson and Crick structure model of DNA</li> </ul> | <b>Unit 2: Cell Biology and Genetics</b> <ul style="list-style-type: none"> <li>• Cell <ul style="list-style-type: none"> <li>- Cell theories</li> </ul> </li> <li>• Prokaryotic cells <ul style="list-style-type: none"> <li>- PPLO, Bacteria and blue green algae</li> </ul> </li> <li>• Eukaryotic cells</li> <li>• Plasma membrane (structure and function)</li> <li>• Cytoplasm <ul style="list-style-type: none"> <li>- Structure</li> <li>- Functions of cell organelles: (Plastids, Mitochondria, Golgi complex, Ribosome and Endoplasmic reticulum)</li> </ul> </li> <li>• Nucleus <ul style="list-style-type: none"> <li>(Occurrence and position, Nuclear membrane, Nuclear pores, Nucleoplasm, Nucleolus and Chromatin fibers)</li> </ul> </li> <li>• Genetic materials <ul style="list-style-type: none"> <li>- Identification of genetic materials</li> <li>- Evidences for DNA as genetic material</li> <li>- Evidences for RNA as genetic material</li> <li>- Watson and Crick model of DNA</li> </ul> </li> </ul> | 6 |
| <ul style="list-style-type: none"> <li>• Describe the process of sporogenesis and gametogenesis.</li> <li>• Illustrate the General account of megasporangium, megasporogenesis and megagametogenesis.</li> <li>• Explain the process of double fertilization in angiosperms.</li> <li>• Explain the development of endosperm and embryo in in a typical dicot plant.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Unit 3: Embryology of plant</b> <ul style="list-style-type: none"> <li>• General account of microsporangium, micro sporogenesis and micro gametogenesis</li> <li>• General account of megasporangium, megasporogenesis and megagametogenesis</li> <li>• Fertilization – Double fertilization and significance</li> <li>• Formation of endosperm and embryo in a typical dicot plant.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 5 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• Discuss the different types of eggs and ovulation process.</li> <li>• Draw and explain the structure of egg and sperm.</li> <li>• Demonstrate the process of fertilization.</li> <li>• Identify cleavage and stages of development of mammals.</li> <li>• Discuss the theory of development of mammals.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Unit 4: Embryology of mammals</b> <ul style="list-style-type: none"> <li>• Types of egg</li> <li>• Spermatozoa</li> <li>• Fertilization</li> <li>• Cleavage and its type</li> <li>• Different developmental stages (morula, blastula, gastrula, neurula)</li> <li>• Theories of development</li> <li>• Development of rabbit</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4 |
| <ul style="list-style-type: none"> <li>• Introduce human biology.</li> <li>• Describe the human digestive system on the basis of different regions of alimentary canal, their structure and functions.</li> <li>• Discuss the digestion process of food including different digestive enzyme, Regions of food digestion, digestion of carbohydrate, protein and fat.</li> <li>• Explain the absorption process of digested food-stuffs.</li> <li>• Elaborate the respiratory organs and their associated structures.</li> <li>• Discuss the artificial respiration.</li> <li>• Explain the mechanism and physiology of respiration.</li> <li>• Draw and explain the internal and structure of human heart and their working process.</li> <li>• Differentiate between arteries and veins systems.</li> <li>• Explain the process of blood circulation in arteries and veins in man.</li> <li>• Discuss the blood groups on the basis of their types and Rh-factors.</li> <li>• Draw and explain the structure of human kidney and nephron</li> <li>• Explain the mechanism of urine formation on the basis of Glomerular filtration, Selective absorption, Tubular secretion and Micturition.</li> <li>• Define homeostasis and discuss homeostasis organs and their mechanism in man.</li> <li>• Discuss the sexual reproduction and reproductive organs of male and female.</li> <li>• Draw the structure of male and female sex organs and explain their functions.</li> <li>• Illustrate the menstruation cycle and their effects of fertilization.</li> </ul> | <b>Unit 5: Human biology</b> <ul style="list-style-type: none"> <li>• Digestive system of man <ul style="list-style-type: none"> <li>- Digestion of carbohydrates, protein and fats</li> <li>- Absorption and egestion</li> </ul> </li> <li>• Respiratory system of man <ul style="list-style-type: none"> <li>- Parts of respiratory system</li> <li>- Mechanism of pulmonary respiration in man (Ventilation)</li> <li>- Physiology of respiration (transport of O<sub>2</sub> and CO<sub>2</sub>)</li> </ul> </li> <li>• Circulatory system of man <ul style="list-style-type: none"> <li>- Structure of human heart</li> <li>- Arteries and veins systems</li> <li>- Blood grouping and Rh-factor in man</li> </ul> </li> <li>• Excretory system of man <ul style="list-style-type: none"> <li>- Structure of human kidney</li> <li>- Mechanism of urine formation</li> <li>- Homeostasis</li> </ul> </li> <li>• Reproductive system of man <ul style="list-style-type: none"> <li>- Concept of sexual reproduction.</li> <li>- Male reproductive organs</li> <li>- Females reproductive organs</li> <li>- Ovulation and menstruation</li> </ul> </li> </ul> | 8 |
| <ul style="list-style-type: none"> <li>• Define demography and demographic terms.</li> <li>• List the stages of demographic cycle.</li> <li>• Draw the population growth curves.</li> <li>• Differentiate between J-shaped and S-shaped curves.</li> <li>• Discuss the human population growth and population in Nepal.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Unit 6: Human population and socially significant disorder</b> <ul style="list-style-type: none"> <li>• Demography</li> <li>• Population growth curves</li> <li>• Human population growth</li> <li>• Causes of increasing human population</li> <li>• Controls of over population</li> <li>• Drug abuse</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 4 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                           |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <ul style="list-style-type: none"> <li>• Point out and discuss the causes of increase in human population and consequences of over population.</li> <li>• Elaborate the control of over-population on natural, hormonal, mechanical, chemical, surgical and mass communication methods.</li> <li>• Define socially significant diseases and diseases associated with mental health.</li> <li>• Define drug abuse and drug addiction.</li> <li>• Explain drug addiction on the basis of their types, effects on health, reasons and control measures.</li> <li>• Define alcoholism and smoking. Explain on the basis of effects, symptoms, reasons and controlling measures.</li> </ul> | <ul style="list-style-type: none"> <li>- Drug addiction: Types, effects, reasons and control measures</li> <li>• Alcoholism</li> <li>- Alcohol addiction: effects, symptoms, reasons and control measures.</li> <li>• Smoking</li> <li>- Types, effect and control of smoking.</li> </ul> |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                           | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Periods |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>• To identify the angiosperm plants in semi technical terms with floral diagrams and floral formulae.</li> <li>• To prepare the herbaria of the plants belonging to the angiosperm families included in the course content.</li> </ul> | <b>Unit 1: Plant Taxonomy</b> <ul style="list-style-type: none"> <li>• Identification and description of plants belonging to the following families (at least four families): <ul style="list-style-type: none"> <li>- Magnoliaceae</li> <li>- Convolvulaceae</li> <li>- Scrophulariaceae</li> <li>- Verbenaceae</li> <li>- Amaranthaceae</li> <li>- Commelinaceae</li> <li>- Amaryllidaceae.</li> </ul> </li> <li>• Herbarium preparation of the plants belonging to families included in the course content.</li> </ul> | 15      |
| <ul style="list-style-type: none"> <li>• To observe and draw different stages of embryo development in plants</li> <li>• To identify different permanent slides of animal embryology.</li> </ul>                                                                              | <b>Unit 2: Embryology</b> <ul style="list-style-type: none"> <li>• Embryology of Plants <ul style="list-style-type: none"> <li>- Embryo sac , Endosperm and dicot embryo</li> </ul> </li> <li>• Embryology of animals <ul style="list-style-type: none"> <li>- Egg, sperm, zygote of frog, chick embryo</li> </ul> </li> </ul>                                                                                                                                                                                            | 9       |
| <ul style="list-style-type: none"> <li>• To prepare the charts of prokaryotic and eukaryotic cells.</li> </ul>                                                                                                                                                                | <b>Unit 3: Cell Biology</b> <ul style="list-style-type: none"> <li>• Preparation of charts of well labeled diagrams of prokaryotic and eukaryotic cells</li> </ul>                                                                                                                                                                                                                                                                                                                                                        | 3       |
| <ul style="list-style-type: none"> <li>• To prepare a model of human heart and demonstrate it.</li> <li>• To prepare the chart of human arteries, veins, digestive system, male and female reproductive organ of human.</li> </ul>                                            | <b>Unit 4: Human biology</b> <ul style="list-style-type: none"> <li>- Preparation of charts and models</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                         | 9       |

|                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                         |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <ul style="list-style-type: none"> <li>To visit fields to collect, preserve and prepare herbaria of the collected plants and submit the report.</li> <li>Analyze the trends of population growth and their consequences in Nepal and submission of report in proper format.</li> </ul> | <b>Unit 5: Field Trip and report writing.</b> <ul style="list-style-type: none"> <li>Collection of plants</li> <li>Preservation of plants collected</li> <li>Population growth rate of Nepal</li> </ul> | 12 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|

#### 4. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Group work, Report writing and presentation
- Construction of learning materials
- Individually laboratory work
- Field visit

#### 5. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

##### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                          |                  |
|------------------------------------------|------------------|
| 11) Attendance                           | 5 points         |
| 12) Participation in learning activities | 5 points         |
| 13) First assignment ( Presentation)     | 10 points        |
| 14) Second assignment (Term exam)        | 10 points        |
| 15) Third assignment (Project work)      | 10 points        |
| <b>Total</b>                             | <b>40 points</b> |

##### 5.2 Theory: External evaluation (Full marks 50)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |                  |
|--------------|------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points        |
| <b>Total</b> |                                                                  | <b>40 points</b> |

**Note: All questions are compulsory**

### **5.3 Practical: Evaluation (Full marks- 20 points)**

The marks allocated to practical part are given in the following table.

| Examination           | Area                           | Points  | Total Points |
|-----------------------|--------------------------------|---------|--------------|
| Internal              | Regularity                     | 1.5     | 4 points     |
|                       | Practical Performance          | 1       |              |
|                       | Record book                    | 1.5     |              |
| External              | Experiment (at least 2 Exp.)   | 9 (4+5) | 12 Points    |
|                       | Viva                           | 3       |              |
| External and Internal | Field visit and Report writing |         | 4 points     |
| Total Points          |                                |         | 20 points    |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

### **Recommended and References Books**

Dutta, A. C. (2007). *Botany for Degree Students*. New Delhi: Oxford University press.

Jain, V. K. (2008). *Fundamentals of Plant Physiology*. New Delhi: S. Chand & Company Ltd.

Majpuriya, T. C. (nd.). *Modern approach to zoology*. Jalandhar city: Suraj kapoor publication.

Noggle, G. R & Fritz, G. J. (2006). *Introductory Plant Physiology*. New Delhi: Prentice Hall of India Pvt Ltd,

Pandey B. P. (2009). *Modern practical botany Vol I and Vol II*. New Delhi: S. Chand and Company Ltd.

Pandey, P. N. & Vidyarthi, R. D. (2000). *A text book of zoology*. New Delhi: S. chanda and company Ltd.

Pandey, S. N. & Sinha, B.K. (2006). *Plant Physiology*. Bikash Publishing House Pvt. Ltd., New Delhi.

Ranjitkar, H. D. (2010). *Botany. A Practical Handbook*. A. K. Ranjitkar, Kalanki, Kathmandu

Salisbury, B. & Rodd, C. W. (2007). *Plant Physiology*. New Delhi: Thomson/ Wadsworth & Akash Press.

Santra, S. S., Chatterjee, T.P. and Das, A.P. (1990). *College Botany Practical*. Vol. I. New Central Book Agenc (P) Ltd., Calcutta, India.

Sharma.O.P. (1989). *Practical Botany for Degree students*, India : Pragati Prakashan, Meerut.

Soper, R. (2005). *Biological Science*. Cambridge University Press, UK.

Twymar, R. M. (2001). *Developmental Biology*. Viva BookPvt. Ltd., New Delhi.

Verma, P.S. (1995). *A manual of practical zoology*. New Delhi: S. Chand and Company Ltd.

Verma, P.S. & Agarwal, V. K. (2006). *Cell Biology, Genetics, molecular biology, evolution and ecology*. New Delhi: S. Chand and Company Ltd.

Vidyarthi, R. D. & Pandey, P. N. (2008). *A Textbook of Zoology*. New Delhi: S. Chanda & Co. Ltd.



### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has theoretical in nature and it consists of different units related to basic concept of research in science education. The major topics included in this course are Research in science education, Scientific methods and revolution of science, Concept of research, Research design, Tools of data collection, Review and development of research work. . It intends to develop their skills on research with a focus on science and science education research. It further deals with research proposal including report writing procedures in science education.

### 2. General Objectives

On the completion of this course student will be able to following general objectives:

- To provide students with the general knowledge of science education research.
- To provide students with an opportunity to understand inquiry based research with its application.
- To interpret the nature and fundamentals of research in science education.
- To acquaint the students with scientific methods and revolution of science.
- To familiarize the students with research design and different tools of data collection.
- To enable the students to prepare research report using appropriate methods and procedure.

### 3. Specific Objectives and Contents

#### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Periods |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>• Discuss the nature of science.</li> <li>• Compare science, non-science and pseudoscience.</li> <li>• Introduce scientific method of research.</li> <li>• Illustrate the meaning of scientific explanation.</li> <li>• Characterize the scientific explanation with examples.</li> <li>• Elaborate the meaning of educational research on the basis of their characteristics, types and purpose.</li> <li>• Differences between basic and applied research.</li> <li>• Compare and contrast the basic and applied research.</li> <li>• Discuss the types of research methods.</li> </ul> | <b>Unit 1: Research in science education</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Nature of sciences</li> <li>• non-science and pseudoscience</li> <li>• Scientific Explanations               <ul style="list-style-type: none"> <li>-Characteristics of scientific explanation</li> </ul> </li> <li>• Educational Research               <ul style="list-style-type: none"> <li>- Characteristics, Types and purpose</li> </ul> </li> <li>• Basic and applied research               <ul style="list-style-type: none"> <li>- Compare and contrast</li> </ul> </li> <li>• Research methods and their types.</li> </ul> | 7       |
| <ul style="list-style-type: none"> <li>• Introduce scientific method of research.</li> <li>• Explain the scientific research methods on the basis of their different steps.</li> <li>• Apply the principle of scientific research method in science education.</li> <li>• Draw the scientific method cycle.</li> <li>• Analyze the science education with respect to scientific research approaches.</li> <li>• Elaborate the meaning of inductionism and deductionisms in terms of physics education research.</li> </ul>                                                                                                       | <b>Unit 2: Scientific methods of research and Revolution of science</b> <ul style="list-style-type: none"> <li>• Meaning of scientific research</li> <li>• Scientific research methods               <ul style="list-style-type: none"> <li>- Different steps of scientific research</li> </ul> </li> <li>• Approaches or Principle of scientific research Method</li> </ul>                                                                                                                                                                                                                                                                         | 8       |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |    |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <ul style="list-style-type: none"> <li>Describe the meaning of scientific revolution on the basis of historical paradigm and structure of revolution.</li> <li>Analyze the Relativism of science with different perspectives.</li> <li>Appraise critically the Kuhn's revolution theory</li> </ul>                                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>The Cycle of Scientific Method</li> <li>Induction and Inductivism</li> <li>The Scientific Revolution <ul style="list-style-type: none"> <li>Historical Paradigm Revolution</li> <li>Structures of Revolution</li> </ul> </li> <li>Relativism in Science</li> <li>Kuhn's Revolutionary theory.</li> </ul>                                                                                                                                                                                                                                                                       |    |
| <ul style="list-style-type: none"> <li>Define research in different ways.</li> <li>List the characteristics of research.</li> <li>Illustrate the purpose and limitation of research.</li> <li>Apply qualitative and quantitative methods in science education research.</li> <li>Elaborate the mixed method research and their types.</li> <li>Apply mixed method research in science education.</li> <li>Illustrate the statement of the problem and hypothesis in science education research.</li> <li>Discuss the sample and sampling strategies on the basis of types, characteristics, size and sampling error.</li> </ul> | <b>Unit 3: Concept of research</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Definition of research</li> <li>Characteristics of research</li> <li>Purpose of research</li> <li>Limitation of research</li> <li>Quantitative research</li> <li>Qualitative research</li> <li>Mixed methods of research</li> <li>Statement of problem</li> <li>Hypothesis</li> <li>Measurement scales</li> <li>Sample and Sampling procedure <ul style="list-style-type: none"> <li>Types, Characteristics, size and Sampling error</li> </ul> </li> </ul>                                                           | 8  |
| <ul style="list-style-type: none"> <li>Introduce research design and their importance.</li> <li>Explain the characteristics of good research design.</li> <li>Apply the reliability and validity of science education research.</li> <li>Calculate the reliability in various ways.</li> <li>Discuss the factors affecting external and internal validity.</li> <li>Describe the various types of experimental research design in science education.</li> <li>Illustrate the pre-experimental, true experimental and quasi experimental design in science education.</li> </ul>                                                 | <b>Unit 4: Research design</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Importance of research design</li> <li>Characteristics of good research design</li> <li>Reliability <ul style="list-style-type: none"> <li>Methods of calculating reliability</li> </ul> </li> <li>Validity <ul style="list-style-type: none"> <li>Factors affecting external and internal validity</li> </ul> </li> <li>Types of experimental research design <ul style="list-style-type: none"> <li>Pre-experimental design</li> <li>True experimental design</li> <li>Quasi experimental design</li> </ul> </li> </ul> | 7  |
| <ul style="list-style-type: none"> <li>List out the various types of tools for data collection.</li> <li>Apply the various tools of data collection in science education research.</li> <li>Discuss the interview as tools of data collection on the basis of their types and scheduling.</li> <li>Illustrate the observation techniques and their types.</li> <li>Define and discuss the questionnaire and case study as a tools for data collection.</li> </ul>                                                                                                                                                               | <b>Unit 5: Tools of data collection</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Interview</li> <li>Observation</li> <li>Questionnaire</li> <li>Case study</li> <li>Anecdotal record</li> <li>Rating scale</li> <li>Check list</li> </ul>                                                                                                                                                                                                                                                                                                                                                         | 11 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                   |   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• Prepare an anecdotal record and discuss in your classroom.</li> <li>• Describe the test, check list and Gallup poll for using tools of data collection.</li> </ul>                                                                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"> <li>• Test</li> <li>• Gallup poll</li> </ul>                                                                                                                                                                                                                   |   |
| <ul style="list-style-type: none"> <li>• Describe the components of research proposal and report writing</li> <li>• Outline the format of research proposal</li> <li>• Develop the research proposal in the areas of science education</li> <li>• Develop the format for report and article writing</li> <li>• Use APA format for text citation, text formatting and final report preparation</li> <li>• Review the selected science book and science related article (at least one) on the basis of available analysis format.</li> </ul> | <b>Unit 6: Review and development of research work</b> <ul style="list-style-type: none"> <li>• Proposal development for science education research</li> <li>• Report and article writing</li> <li>• Text citation and formatting report- APA Style</li> <li>• Book and article review</li> </ul> | 7 |

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

#### 4. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion
- Inquiry method
- Project method
- Cooperative and collaborative learning methods
- Proposal writing and presentation in the classroom
- Home assignments
- Team teaching and feedback session
- Group activities

#### 5. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

***Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination***

##### 5.1. Internal evaluation

#### 6. Internal Evaluation ..... 40%

Internal evaluation will be conducted by course teacher based on following activities:

|                                                         |                  |
|---------------------------------------------------------|------------------|
| 1) Attendance                                           | 5 points         |
| 2) Participation in learning activities                 | 5 points         |
| 3) First assignment ( written assignment)               | 10 points        |
| 4) Second assignment ( project work with presentation ) | 10 points        |
| 5) Third assignment/ Exam                               | 10 points        |
| <b>Total</b>                                            | <b>40 points</b> |

#### 5.2 External Evaluation (Final Examination) ..... 60%

The Examinations Management Office will conduct final examination at the end of the semester. The types and nature of the questions to be included in the final examination are as follows:

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Examination Division, office of the Dean, Faculty of Education will conduct final examination at the end of semester.

- |                                                                |          |
|----------------------------------------------------------------|----------|
| 1) Objective type question (Multiple choice 10questionsx1mark) | 10 marks |
| 2) Short answer questions (6 questions x 5 marks)              | 30 marks |
| 3) Long answer questions (2 questions x 10 marks)              | 20 marks |

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Total

60 marks

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**Note: All questions are compulsory**

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

**Recommended books**

- American Psychological Association (2010). *Publication Manual of American Psychological Association* (6<sup>th</sup> edition). Washington DC: APA.
- Bordens, K. S and Abbott, B. B. (2011). *Research Design and Methods*. A Process approach, 8 edition. Indiana University.
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**1. Course Description**

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course is theoretical nature. It consists of different units related to basic concept of statistics. The major topics included in this course are introduction of statistics, measure of dispersion, measure of relative position, measure of relationship, analysis and presentation of data and analysis of qualitative data.

**2. General Objectives**

On the completion of this course student will be able to following general objectives:

- To provide students with the general knowledge and basic concept of statistics.
- To acquaint the students with the measure of dispersion, measure of relative position and measure of relationship.
- To enable the students in analysis and presentation of data.
- To make the students familiarize with the analysis of qualitative data.

**3. Specific Objectives and Contents****Part 1: Theory**

| Specific Objectives                                                                                                                                                                                                                                                                                       | Contents                                                                                                                                                                                                                                                                      | Periods  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <ul style="list-style-type: none"> <li>• State the meaning and definition of statistics</li> <li>• List the types and uses of statistics</li> <li>• Explain the population and sampling in statistics</li> <li>• Explain variables and their controlling techniques.</li> </ul>                           | <b>Unit 1: Introduction of statistics</b><br>Meaning and definition of statistics <ul style="list-style-type: none"> <li>• Types of statistics</li> <li>• Use of statistics</li> <li>• Population and sampling</li> <li>• Variables</li> </ul>                                | <b>6</b> |
| <ul style="list-style-type: none"> <li>• State the meaning of range and variance in statistics</li> <li>• Define standard deviation.</li> <li>• Explain the normal distribution</li> <li>• List the applications of normal curves.</li> <li>• Define and illustrate the skewness and kurtosis.</li> </ul> | <b>Unit 2: Measures of dispersion</b> <ul style="list-style-type: none"> <li>• Range</li> <li>• Variance</li> <li>• Standard deviation</li> <li>• Normal distribution</li> <li>• Characteristics and application of normal curves</li> <li>• Skewness and kurtosis</li> </ul> | <b>6</b> |
| <ul style="list-style-type: none"> <li>• Define measures of relative position.</li> <li>• State and illustrate the percentile.</li> <li>• Describe the importance of percentile rank.</li> <li>• Elaborate the standardized scale.</li> </ul>                                                             | <b>Unit 3: Measures of relative positions</b> <ul style="list-style-type: none"> <li>• Percentile</li> <li>• Percentile rank</li> <li>• Standardized scale</li> </ul>                                                                                                         | <b>5</b> |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                      |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <ul style="list-style-type: none"> <li>• Introduce the measure of relationship in statistic.</li> <li>• Define and explain the test of significance of mean.</li> <li>• Explain the T-test, and chi square test.</li> <li>• Elaborate the correlation coefficient and their procedure of calculation.</li> <li>• Elaborate the analysis of variance with their calculating procedure.</li> <li>• Explain the multiple regression.</li> <li>• Describe the analysis of covariance.</li> </ul>                                                                                   | <b>Unit 4: Measures of relationship</b> <ul style="list-style-type: none"> <li>• Test of significance of mean</li> <li>• T-test</li> <li>• Chi-square test</li> <li>• Correlation coefficient</li> <li>• Analysis of variance (ANOVA)</li> <li>• Multiple regression</li> <li>• Analysis of covariance (ANCOVA)</li> </ul>                           | 12 |
| <ul style="list-style-type: none"> <li>• Define and explain analysis and presentation of data.</li> <li>• Describe the steps of data processing.</li> <li>• Define and explain measure of central tendency.</li> <li>• Elaborate the mean, median and mode with their calculating procedure.</li> <li>• Explain role of percentage in data interpretation.</li> <li>• Discuss graphical representation of data in interpretation phase.</li> </ul>                                                                                                                             | <b>Unit 5: Analysis and presentation of data</b> <ul style="list-style-type: none"> <li>• Steps in data processing</li> <li>• Measure of central tendency <ul style="list-style-type: none"> <li>- Mean</li> <li>- Median</li> <li>- Mode</li> </ul> </li> <li>• Percentage</li> <li>• Graphical representation of data</li> </ul>                   | 7  |
| <ul style="list-style-type: none"> <li>• Discuss the sources and nature of qualitative data</li> <li>• Interpret qualitative data analysis process</li> <li>• Describe the steps of qualitative data analysis procedure</li> <li>• Explain different approaches of qualitative analysis as thematic inductive and domain approaches</li> <li>• Demonstrate skills required for qualitative data analysis</li> <li>• Apply qualitative data analysis approaches for a qualitative data</li> <li>• Elaborate the importance of qualitative data analysis in research.</li> </ul> | <b>Unit 6: Qualitative data analysis</b> <ul style="list-style-type: none"> <li>• Sources and nature of qualitative data</li> <li>• Concept of qualitative data analysis</li> <li>• Steps in qualitative data analysis</li> <li>• Approaches of qualitative data analysis</li> <li>• Importance of qualitative data analysis in research.</li> </ul> | 12 |

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

#### 4. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method

- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Group work, Report writing and presentation
- Individually laboratory work
- Field visit

## 5. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory               | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, and external semester examination**

### 5.1. Internal evaluation

Internal evaluation will be conducted by course teacher based on following activities

|                                          |                  |
|------------------------------------------|------------------|
| 16) Attendance                           | 5 points         |
| 17) Participation in learning activities | 5 points         |
| 18) First assignment ( Presentation)     | 10 points        |
| 19) Second assignment (Term exam)        | 10 points        |
| 20) Third assignment (Project work)      | 10 points        |
| <b>Total</b>                             | <b>40 points</b> |

### 5.2 Theory: External evaluation (Full marks 60)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |                  |
|--------------|------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points        |
| 3            | long answer questions (2 questions x 10 points                   | 20 points        |
| <b>Total</b> |                                                                  | <b>60 points</b> |

**Note: All questions are compulsory**

### Recommended Book and References

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**Mid-West University  
Graduate School of Education  
Surkhet, Nepal**



**Bachelor of Science Education (BEd-Sc)  
Curriculum  
7<sup>th</sup> Semester**

# Bachelor of Science Education (BEd-Sc)

## Curriculum

### 7<sup>th</sup> Semester

| S. No        | Course Code No | Course Name                 | Credit Hour | Feature               |
|--------------|----------------|-----------------------------|-------------|-----------------------|
| 1.           | SCED 471       | Physics Education           | 3           | T-2, P-1              |
| 2.           | SCED 472       | Chemistry Education         | 3           | T-2, P-1              |
| 3            | SCED 473       | Biology Education           | 3           | T-2, P-1              |
| 4            | SCED 474       | Environment and Geo-Science | 3           | T-3                   |
| 5            | SCED 475       | Concept of STEAM Education  | 3           | T-2, P-1              |
| <b>Total</b> |                |                             | <b>15</b>   | <b>Th-11<br/>Pr-4</b> |

Course Title: **Physics Education**  
Course Code: SCED 471  
Nature of Course: Theory + Practical  
Total Credit: 2+1 (Th. + Pr.)

Full Marks: 80 (T) +20 (P)  
Pass Marks: 40 (T) +10 (P)  
Semester: B.Ed./ VII  
Total Period: 32+48 (Th. + Pr.) = 80 Periods

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The theoretical parts consists of different units related to fluid properties, basic properties of sound wave and modern physics. The major topics included in this course are Fluid dynamics, Wave and sound, Acoustic phenomena, Wave in pipe and string, Huygens's construction, Inference and diffraction of light wave, Vacuum tube and Crystal structure. In practical parts, different experiments to be performed which are listed in particle course, besides this experiment performed, observation and report writing, project work in physics related issues are also included. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. The students are required to secure pass marks in theory as well as practical course separately.

### 2. General Objectives

On the completion of this course student will be able to following general objectives:

- To provide students with the general and basic knowledge of fluid dynamics.
- To acquaint the students with the basic properties of sound wave and wave motion.
- To develop in-depth knowledge of Acoustic phenomena, Wave in pipe and string, Huygens's construction, Inference of light wave and Diffraction of light wave.
- To impart the basic knowledge of modern physics related to Vacuum tube and crystal structures.
- To make the students able in solving numerical problems related to the content.
- To provide students with an opportunity to understand inquiry based physics education with its application on pedagogy and other various fields.
- To enable students to prepare report on their observation, write practical record file by using appropriate methods and approaches.

### 3. Specific Objectives and Contents

#### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Periods |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"><li>• Define viscosity</li><li>• Derive Newton's formula for viscous force</li><li>• Differentiate between Streamlined and Turbulent flow</li><li>• Define coefficient of viscosity.</li><li>• State and derive POiseuille's formula</li><li>• State and proof Stoke's law.</li><li>• Write the major application, deviation and measurement of Stook's law.</li><li>• Determine the terminal velocity by using Stook's law.</li><li>• State and derive the equation of continuity.</li><li>• State and derive Bernoulli's equation</li><li>• Describe the major application and consequences of Bernoulli's principle.</li><li>• Explain the energy of moving liquid on the basis of pressure, kinetic and potential energy.</li><li>• List out the important of viscosity.</li></ul> | <b>Unit 1: Fluid Dynamics</b><br>1.1 Introduction<br>1.2 Viscosity and Newton's formula of viscous force <ul style="list-style-type: none"><li>- Streamlined and Turbulent flow</li><li>- Coefficient of viscosity</li></ul> 1.3 Poiseuille's formula<br>1.4 Stoke's law and termination <ul style="list-style-type: none"><li>- Derivation and measurement</li></ul> 1.5 Equation of continuity<br>1.6 Bernoulli's theorem<br>1.7 Energy of a moving liquid<br>1.8 Importance of viscosity<br>1.9 Solve Numerical problem | 5       |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>Solve numerical problem related to fluid dynamics.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |
| <ul style="list-style-type: none"> <li>Define the term wave, wave length, amplitude, time period and frequency.</li> <li>Derive relationship between velocity, frequency and wavelength.</li> <li>Define and express progressive wave in different ways and mention its characteristics.</li> <li>Derive differential from of wave equation.</li> <li>State the principle of superposition.</li> <li>Define and derive the equation of stationary wave and mention its characteristics.</li> <li>Describe the stationary wave in open and closed boundaries.</li> <li>Differentiate between progressive and stationary wave.</li> <li>Derive equation of inference of wave.</li> <li>Discuss the condition of constructive and destructive inference.</li> <li>Discuss the phenomenon of reflection, refraction and diffraction of sound wave.</li> <li>Explain free, damped, forced oscillation and resonance.</li> <li>Give the examples and consequences of resonance.</li> <li>Discuss the velocity of sound wave in solid, liquid and gas.</li> <li>Derive the formula for velocity of sound in a gas by using dimensional method.</li> <li>Describe Newton's formula for velocity of sound and Laplace correction.</li> <li>Discuss various factors which affects the velocity of sound.</li> <li>Define musical notes, noise, overtones and harmonics.</li> <li>Differentiate between musical notes and noise.</li> <li>Explain the term pitch, loudness and quality of sound.</li> <li>Discuss the various factors effecting pitch, loudness and quality of sound.</li> <li>Derive the expression of intensity of sound.</li> <li>Derive the relation between intensity and loudness of sound.</li> <li>Define unit of Loudness.</li> <li>Define beats and derive the beat frequency.</li> <li>Derive relation to measure the frequency to measure the beat.</li> <li>Define and discuss the Doppler effect on the basis of change in apparent frequency in different conditions.</li> <li>Discuss the application of Doppler's effect on the basis of red shift, RADAR and SONAR.</li> </ul> | <p><b>Unit 2: Wave and Sound</b></p> <p><b>2.1 Basic Properties of waves</b></p> <p>2.1.1 Introduction</p> <p>2.1.2 Path difference and phase difference</p> <p>2.1.3 Progressive wave and its characteristics</p> <p>2.1.4 Differential from of wave equation</p> <p>2.1.5 Principle of superposition</p> <p>2.1.6 Stationary wave and its characteristics</p> <p>2.1.7 Inference of wave</p> <p>2.1.8 Reflection, Refraction and diffraction of sound wave</p> <p>2.1.9 Oscillation</p> <p>2.1.10 Forced oscillation and resonance</p> <p>2.1.11 Consequences of resonance</p> <p>2.1.12 Velocity of sound wave in solid, liquid and gas</p> <p>2.1.13 Newton's formula and Laplace correction</p> <p>2.1.14 Factors affecting velocity of sound in gas</p> <p><b>2.2 Acoustic phenomena</b></p> <p>2.2.1 Musical notes</p> <p>2.2.2 Overtones and harmonics</p> <p>2.2.3 Pitch and loudness</p> <p>2.2.4 Intensity of sound</p> <p>2.2.5 Intensity levels</p> <p>2.2.6 Beats</p> <p>2.2.7 Doppler's effect</p> <p>2.2.8 Infrasonic and ultrasonic wave</p> <p>2.2.9 Acoustic building and reverberation of sound</p> <p><b>2.3 Numerical problems</b></p> | 9 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>Define and discuss the application of Infrasonic and Ultrasonic wave.</li> <li>Define reverberation and write acoustic building.</li> <li>Solve numerical examples related to topics.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |
| <ul style="list-style-type: none"> <li>Discuss various modes of vibrations in closed pipe and open end pipes with their properties.</li> <li>Explain the end correction of pipes on the basis of open ends and closed ends.</li> <li>Discuss the existence of nodes and antinodes.</li> <li>Determine the speed of sound by resonance tube method.</li> <li>Derive velocity of transverse wave along a stretched string by dimensional analysis.</li> <li>Discuss various modes of vibration in stretched string.</li> <li>Explain the law of transverse vibration of string.</li> <li>Verify laws of transverse vibration of string.</li> <li>Describe the process of determine frequency of tuning fork by Sonometer.</li> <li>Solve simple numerical examples related to topics.</li> </ul>                                                                                                 | <b>Unit 3: Wave in pipe and String</b><br><b>3.1 Wave in pipe</b><br>3.1.1 Vibration in closed and open end pipes<br>3.1.2 End correction in pipes<br>3.1.3 Existence of nodes and antinodes.<br>3.1.4 Speed of sound by Resonance tube method.<br><b>3.2 Wave in string</b><br>3.2.1 Velocity of transverse wave along a stretched string.<br>3.2.2 Modes of vibration of stretched string<br>3.2.3 Laws of transverse vibration of string.<br>3.2.4 Verification of laws of vibrating spring.<br>3.2.5 Frequency of tuning fork by Sonometer.<br><b>3.3 Numerical problems</b>                                 | 5 |
| <ul style="list-style-type: none"> <li>Define wave front and rays.</li> <li>State and discuss Huygens's principle</li> <li>Prove the laws of reflection, refraction and total internal reflection by applying Huygens's principle.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Unit 4: Huygens's Construction</b><br>4.1 Wave front and rays<br>4.2 Huygens's principle<br>4.3 Application of Huygens's principle                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2 |
| <ul style="list-style-type: none"> <li>Define interference and coherent source.</li> <li>Write the condition of observable interference.</li> <li>Derive an expression of fringe width by Yong's double slit experiment.</li> <li>Explain inference in thin films due to reflected and transmitted light.</li> <li>Describe colors of thin films and Blooming.</li> <li>Determine the wavelength of monochromatic light by using Newton's ring principle.</li> <li>Define diffraction and classify it.</li> <li>Explain Fraunhofer diffraction due to single slit and discuss their maxima and minima with the basis of width.</li> <li>Calculate wavelength of light using a diffraction grating.</li> <li>Describe the construction of Spectrometer and discuss their determination process of refractive index.</li> <li>Solve simple numerical example related to above topics.</li> </ul> | <b>Unit 5: Inference and Diffraction of light wave</b><br><b>5.1 Inference of light wave</b><br>5.1.1 Introduction<br>5.1.2 Coherent source<br>5.1.3 Condition for inference<br>5.1.4 Yong's double slit experiment<br>5.1.5 Calculation of fringe separation<br>5.1.6 Measurement of wave length<br>5.1.7 White light pattern<br>5.1.8 Inference in the thin film.<br>- Colours, Blooming, Fringes produced and Newton's ring<br><b>5.2 Diffraction of light wave</b><br>5.2.1 Introduction<br>5.2.2 Fraunhofer diffraction<br>5.2.3 Diffraction grating<br>5.2.4 Spectrometer<br><b>5.3 Numerical problems</b> | 6 |
| <ul style="list-style-type: none"> <li>Define vacuum tubes and electronics.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Unit 6: Modern Physics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <ul style="list-style-type: none"> <li>List the function of electronic device.</li> <li>Discuss the various ways of electron emission.</li> <li>Describe the process of thermionic emission.</li> <li>Discuss the cathodes and their types.</li> <li>Describe the construction process of Diode and Triode valve.</li> <li>Discuss the characteristics of Diode and Triode valve.</li> <li>Discuss the junction diode and its application.</li> <li>List out the application of vacuum tube.</li> <li>Classify solid.</li> <li>Define and point out the crystalline and amorphous solids.</li> <li>Differentiate between crystalline and amorphous solids.</li> <li>Discuss the unit cell and their parameters.</li> <li>Illustrate Crystal Lattice, Crystal system, Bravais Lattice and Closed packed structure.</li> <li>Discuss the various forms of binding and their properties.</li> </ul> | <b>6.1 Vacuum tube</b><br>6.1.1 Introduction<br>6.1.2 Electronic and electronic device<br>6.1.3 Electron and thermionic emission<br>6.1.4 Cathodes and their types<br>6.1.5 Vacuum tube and their types<br>6.1.6 Diode and Triode valve<br>6.1.7 Junction diode and its application<br>6.1.8 Application of vacuum tube<br><b>6.2 Crystal Structure</b><br>6.2.1 Introduction<br>6.2.2 Classification of solid<br>6.2.3 Unit cell<br>6.2.4 Crystal Lattice and system<br>6.2.5 Bravais Lattice<br>6.2.6 Closed packed structures<br>6.2.7 Forms in binding |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Contents                                                                                                                         | Periods |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>To determine the coefficient of viscosity of liquid (glycerine, turpentine etc.) by Stoke's method.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Unit 1: Fluid Dynamics</b><br>1.1 Coefficient of viscosity of liquid                                                          | 6       |
| <ul style="list-style-type: none"> <li>To determine the velocity of sound in the lab by resonance methods and calculate the velocity of sound in dry air at NTP</li> <li>To compare the frequency of two tuning forks by using the resonance tube apparatus.</li> <li>To determine the velocity of sound by resonance tube using several tuning forks and the find end correction.</li> <li>To determine the frequency of the given fork by tuning fork by Sonometer method.</li> <li>To compare the frequencies of the given tuning forks using Sonometer.</li> <li>To determine the frequency of AC mains by using Sonometer.</li> <li>To determine the variation of frequency of a stretched wire with length and tension with the help of Sonometer.</li> <li>To verify the law of the length of Sonometer wire.</li> <li>To prepare and study the characteristics of musical notes.</li> </ul> | <b>Unit 2: Wave and Sound</b><br>2.1 Velocity of sound<br>2.2 Frequency<br>2.3 Sonometer<br>2.4 Characteristics of musical notes | 24      |
| <ul style="list-style-type: none"> <li>To determine the wavelength of sodium light by using Newton's ring apparatus.</li> <li>To determine the wavelength of a given laser light by using diffraction grating element.</li> <li>To determine the wavelength of a given sodium light from spectrometer method by using diffraction grating element.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Unit 3 : Inference and Diffraction of light wave</b><br>3.1 Inference<br>3.2 Diffraction                                      | 12      |

|                                                                                                                                                                                                                                                                                        |                                             |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|---|
| <ul style="list-style-type: none"> <li>To draw the forward characteristic curve of a p-n junction semi-conductor diode and determine its static and dynamic resistance.</li> <li>To draw the characteristics of a Zener diode and determine its reverse break down voltage.</li> </ul> | <b>Unit 4 : Modern physics</b><br>4.1 Diode | 6 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|---|

#### 4. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Group work, Report writing and presentation
- Construction of learning materials
- Individually laboratory work

#### 5. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

##### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                         |                  |
|-----------------------------------------|------------------|
| 1) Attendance                           | 5 points         |
| 2) Participation in learning activities | 5 points         |
| 3) First assignment ( Presentation)     | 10 points        |
| 4) Second assignment (Term exam)        | 10 points        |
| 5) Third assignment (Project work)      | 10 points        |
| <b>Total</b>                            | <b>40 points</b> |

##### 5.2 Theory: External evaluation (Full marks 40)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |                  |
|--------------|------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points        |
| <b>Total</b> |                                                                  | <b>40 points</b> |

**Note: All questions are compulsory**

##### 6.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination | Area | Points | Total Points |
|-------------|------|--------|--------------|
|-------------|------|--------|--------------|

|                       |                              |          |                  |
|-----------------------|------------------------------|----------|------------------|
| Internal              | Regularity                   | 1.5      | 5 Points         |
|                       | Practical Performance        | 2        |                  |
|                       | Record book                  | 1.5      |                  |
| External              | Experiment (at least 2 Exp.) | 10 (5+5) | 13 Points        |
|                       | Viva                         | 3        |                  |
| External and Internal |                              |          |                  |
|                       | Project work + Presentation  | 2        | 2 Points         |
| <b>Total Points</b>   |                              |          | <b>20 points</b> |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

#### **Recommended and Reference Book**

Arora, C.L. (1988). B.Sc Practical Physics. New Delhi: S. Chand & Company, Ltd.

Bajaj, N.K. (2000). *Physics*. Delhi: Tata MC Graw-Hill Publishing Com. Ltd.

Duncan, T. (2008). *Advanced physics*. London: Hodder Education.

Gautam, B.K., Naupane, S. K. & Chapagain, N.P. (2005). *Text book of physics*. Kathmandu: Kala publication.

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Halliday, D., Resnick, R. & Walker, J. (2009). *Fundamentals of physics*. New York: John Wiley and Sons.

Huffer, C. M., Trinklein, F.E. & Bunge, M. (1973). *An introduction to astronomy*. New York: Holt, Rinehart and Winston, Inc.

Jha, A. K. (2017). *Practical physics*. Kathmandu: Neema Pustak Prakashan.

Sears, F.W., Zemansky, M. W., Yong, H.D., Freedman, R.A. & Ford, A.L. (2009). *University physics*. Singapore: Pears on Education.

Shretha, U. P. (2049 BS). *A Physics practical guide*. Kathmandu: Ratna Pustakk Bhandar.

Subrahmanyam, N. and Brij, L.(1996). *Principles of physics*. New Delhi: S. chanda and company Ltd.



Course Title: **Chemistry Education**  
Course Code: SCED 472  
Nature of Course: Theory + Practical  
Total Credit: 2+1 (Th. + Pr.)

Full Marks: 80 (T) +20 (P)  
Pass Marks: 40 (T) +10 (P)  
Semester: B.Ed. / VII  
Total Period: 32+48 (Th. + Pr.) = 80 Periods

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The theoretical parts consist of different units of chemistry which provide essential knowledge in our daily life. The major topics included in this course are oxides and oxy-acids of some metals, bioinorganic chemistry, Photochemistry, Colloids, Role of inorganic and organic reagents in organic chemistry and Polymer and polymerization processes. In practical parts, different experiments to be performed which are listed in particle course. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching and learning process. The students are required to secure pass marks in theory as well as practical course separately.

### 2. General Objectives

On the completion of this course student will be able to following general objectives:

- To enable the students in dealing with the preparation, properties and uses of different oxides and oxy acids of non-metals.
- To enable students draw the structure of different chemical compounds.
- To familiarize the students with different types collides their preparation, separation techniques, properties and applications.
- To know the students for the basic concept of photochemistry.
- To acquaint the students with the basic concepts bioinorganic chemistry.
- To enable the students familiarize with different organic and inorganic reagents their roles and analytical techniques.
- To provide students with an opportunity to understand the different types of polymers and their polymerization processes.
- To inculcate the knowledge and skills for the management of polymeric pollutants.
- To maintain record base of the performed experiments.

### 3. Specific Objectives and Contents

#### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Periods |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"><li>• Describe the methods of preparation and properties of Metaboric and orthobopric acid.</li><li>• Draw the structure of metaboric and orthoboric acids.</li><li>• Draw the structure of different kinds of borates.</li><li>• Explain the chemistry of borax.</li><li>• Classify different types of silicates and draw their structures.</li><li>• Discuss the chemistry of Silicones (Preparation, Properties and uses).</li><li>• Describe the methods of preparation and properties of <math>N_2O</math>, <math>NO</math>, <math>NO_2</math>, <math>N_2O_3</math> and <math>N_2O_5</math></li><li>• Draw the structure of <math>N_2O</math>, <math>NO</math>, <math>NO_2</math>, <math>N_2O_3</math> and <math>N_2O_5</math></li><li>• Describe the preparation, properties and structure of Hyponitrous and Nitroxylic acid.</li></ul> | <b>Unit 1: Oxides and oxy acids of Non-Metals</b> <ul style="list-style-type: none"><li>• Boron<ul style="list-style-type: none"><li>- Metaboric acid, Orthoboric acid, Borates And Borax</li></ul></li><li>• Silicon (Si)<ul style="list-style-type: none"><li>- Silicates and Silicones</li></ul></li><li>• Oxides and oxy-acids of Nitrogen<ul style="list-style-type: none"><li>- Nitrous acid, Nitric oxides, Nitrogen dioxide, Dinitrogen trioxide, Dinitrogen pentoxide</li></ul></li></ul> | 9       |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>Describe the preparation, properties and structure of Phosphrous pentoxide and Phosphrous trioxides</li> <li>Discuss the Methods of preparation, Properties and uses of Hypophosphrous acid, Phosphorus acid, Orthophosphoric acid and Pyrophosphoric acid.</li> <li>Draw the structure of Hypophosphrous acid, Phosphorus acid, Orthophosphoric acid and Pyrophosphoric acid.</li> <li>Discuss the Methods of preparation, Properties and uses of Sulphur dioxide Sulphur trioxide, Sulphurous acid, Caro's acid, Marshall's acid and Dithionic acid.</li> <li>Draw the structure of Sulphur dioxide Sulphur trioxide, Sulphurous acid, Caro's acid, Marshall's acid and Dithionic acid.</li> <li>Discuss the Methods of preparation, Properties and uses of Chlorine monoxide, Chlorine dioxide, Hypochlorous acid, Chlorous acid and Perchloric acid</li> <li>Draw the structure of Chlorine monoxide, Chlorine dioxide, Hypochlorous acid, Chlorous acid and Perchloric acid</li> </ul> | <ul style="list-style-type: none"> <li>- Hyponitrous acid and Nitroxylic acid</li> <li>• Oxides and Oxy acids of Phosphrous <ul style="list-style-type: none"> <li>- Phosphrous pentoxide And Phosphrous trioxides</li> <li>- Hypophosphrous acid, Phosphorus acid, Orthophosphoric acid And Pyrophosphoric acid.</li> </ul> </li> <li>• Oxides and Oxy-acids of Sulphur <ul style="list-style-type: none"> <li>- Sulphur dioxide, Sulphur trioxide, Sulphurous acid, Caro's acid, Marshall's acid and Dithionic acid</li> </ul> </li> <li>• Oxides and oxy-acids of Chlorine <ul style="list-style-type: none"> <li>- Chlorine monoxide, Chlorine dioxide, Hypochlorous acid, Chlorous acid and Perchloric acid</li> </ul> </li> </ul> |   |
| <ul style="list-style-type: none"> <li>Define colloids and classify it.</li> <li>Discuss the different methods for the preparations of colloidal solutions.</li> <li>Explain the process for the purifications of colloidal solutions on the basis of Dialysis and Ultrafiltration.</li> <li>Describe the properties of colloids on the basis of optical properties, Brownian movement and electrical properties.</li> <li>Discuss the precipitations of colloids by electrolysis</li> <li>Discuss the stability of the colloidal state.</li> <li>Define emulsions and discuss the various deviations from ideal behavior.</li> <li>Define gel and classify on the basis of mechanical properties.</li> <li>Discuss the properties and uses of gels.</li> <li>List out the various applications of collides.</li> </ul>                                                                                                                                                                                                            | <b>Unit 2: Collides</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Classification of colloids</li> <li>• Methods of preparation of colloidal solution</li> <li>• Purification of colloidal solutions</li> <li>• Properties of colloids</li> <li>• Precipitation of colloids by electrolysis</li> <li>• The stabilization of the colloidal state</li> <li>• Emulsions</li> <li>• Gels</li> <li>• Applications of colloids</li> </ul>                                                                                                                                                                                                                                                                               | 5 |
| <ul style="list-style-type: none"> <li>Define photochemistry.</li> <li>Express the absorption of light.</li> <li>Derive the law of photochemical equivalence.</li> <li>Describe the Quantum yield on the basis of arrangement of photochemical studies.</li> <li>Describe the primary and secondary photochemical processes.</li> <li>Explain photochemical reactions on the basis of photolysis of ammonia, Decomposition of</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Unit 3: Photochemistry</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• The absorption of light</li> <li>• The law of photochemical equivalence</li> <li>• The Quantum yield</li> <li>• Photochemical Processes</li> <li>• Photochemical reactions</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <p>hydrogen iodide in the gaseous phase, The hydrogen-chlorine reactions, Dimerization of anthracene in solution, Double decompositions, Isomeric transformations and chain reactions.</p> <ul style="list-style-type: none"> <li>Describe the photo process on the basis of fluorescence and Phosphorescence.</li> <li>Illustrate Franck-Condon principle of predissociation spectra.</li> <li>Comparison of Radiation chemistry with photochemistry.</li> <li>List out the applications of Radiation Chemistry.</li> <li>Solve related numerical problems.</li> </ul>                                                                                                                            | <ul style="list-style-type: none"> <li>Photo process</li> <li>Predissociation spectra</li> <li>Radiation Chemistry</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |   |
| <ul style="list-style-type: none"> <li>Define and classify the trace elements.</li> <li>Discuss the role of <math>\text{Na}^+</math>, <math>\text{K}^+</math>, <math>\text{Mg}^{++}</math>, <math>\text{Ca}^{++}</math>, Cu, Fe and Zn in biological system.</li> <li>Illustrate the harmful effect of excess intake of metals on human body.</li> <li>Draw the structure of Chlorophyll and Haemoglobin.</li> <li>Explain the mechanism of photosynthesis.</li> <li>Discuss the role of haemoglobin in living system.</li> <li>Explain process of nitrogen fixation on the basis of symbiotic bacteria and lightning discharge.</li> <li>Draw the labelling diagram of nitrogen cycle.</li> </ul> | <p><b>Unit 4: Bioinorganic Chemistry</b></p> <ul style="list-style-type: none"> <li>Introduction</li> <li>Trace elements (<math>\text{Na}^+</math>, <math>\text{K}^+</math>, <math>\text{Mg}^{++}</math>, <math>\text{Ca}^{++}</math>, Cu, Fe and Zn)</li> <li>Harmful effect of metal ions.</li> <li>Chlorophyll</li> <li>Mechanism of photosynthesis</li> <li>Haemoglobin</li> <li>Nitrogen Fixation</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                          | 4 |
| <ul style="list-style-type: none"> <li>List out the common features of organic reagents.</li> <li>Discuss the advantages of using organic reagents.</li> <li>Give the analytical applications of Oxine, Dimethyl glyoxime, <math>\alpha</math>-nitroso <math>\beta</math>-naphthol, Cupferon, Aluminon, Rodamine –B, Benzidine, Cupron and Magneson,</li> <li>Illustrate the analytical capability of Alizarin-S, Nitron and Salicyladoxin</li> <li>Illustrate the common inorganic reagents for the precipitation of metal ions.</li> <li>Discuss advantages and disadvantages of organic reagents over inorganic reagents.</li> </ul>                                                            | <p><b>Unit 5: Roles of Organic and Inorganic Reagents in Inorganic Analysis</b></p> <ul style="list-style-type: none"> <li>Organic reagents <ul style="list-style-type: none"> <li>Oxine, Dimethyl glyoxime, <math>\alpha</math>-nitroso <math>\beta</math>-naphthol, Cupferon, Aluminon, Rodamine –B, Benzidine, Cupron, Magneson, Alizarin-S, Nitron, Salicyladoxin</li> </ul> </li> <li>Common inorganic Reagents <ul style="list-style-type: none"> <li><math>\text{NH}_3</math>, <math>\text{H}_2\text{S}</math>, <math>\text{HCl}</math>, <math>\text{H}_2\text{SO}_4</math>, <math>\text{AgNO}_3</math>, <math>\text{BaCl}_2</math>, <math>(\text{NH}_4)_2\text{CO}_3</math>, <math>(\text{NH}_4)_2\text{HPO}_4</math> and <math>\text{MgCl}_2 + \text{NH}_4\text{Cl}</math></li> </ul> </li> </ul> | 4 |
| <ul style="list-style-type: none"> <li>Define Polymer and polymerization.</li> <li>Classify polymers.</li> <li>Discuss the polymerization process on the basis of Condensation and addition polymerizations</li> <li>Describe chemistry of polymerization on the basis of stepwise, Chain, Radical and Ionic polymerization.</li> <li>Discuss the effects of various factors of polymerization rate.</li> <li>Discuss the various examples of organic and inorganic polymers like Nylon-66, Dacron, PVC,</li> </ul>                                                                                                                                                                                | <p><b>Unit 6: Polymers and polymerization Process</b></p> <ul style="list-style-type: none"> <li>Introduction</li> <li>Classification of Polymers</li> <li>Polymerization processes</li> <li>Chemistry of polymerization</li> <li>Effects of polymerization rate</li> <li>Examples of some organic and inorganic polymers</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 5 |

|                                                                                                                                                                                                                                                                                                                      |                                                          |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|--|
| Polyethene, Bakelite, PVA, Natural rubber, Polyhalophosphagines, Phosphate glass, Maddrell's salts, Kuroll's salts, Phosphrous based network polymers, Polycarboranes, Siliones rubber, Silicons Resins etc and their uses.<br>• Prepare a report on effect of polymeric pollutants and their management techniques. | • Management of polymeric pollutants in the environment. |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|--|

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                                                                                           | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Periods |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>Develop observational, manipulative, calculative and inference drawing skills.</li> <li>Develop in student's ability to perform experiments having due regards safety.</li> <li>Maintain record base of the performed experiments.</li> <li>Develop report on the basis of research format.</li> </ul> | <ul style="list-style-type: none"> <li>To perform the various precipitation reactions with the help of inorganic reagents (NH<sub>3</sub>, H<sub>2</sub>S, HCl, H<sub>2</sub>SO<sub>4</sub>, AgNO<sub>3</sub>, BaCl<sub>2</sub>, (NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub>, (NH<sub>4</sub>)<sub>2</sub>HPO<sub>4</sub> and MgCl<sub>2</sub>+ NH<sub>4</sub>Cl)</li> <li>To perform the analytical techniques of various organic reagents (Oxine, Dimethyl glyoxime, <math>\alpha</math>-nitroso <math>\beta</math>-naphthol, Cupferon, Aluminon, Rodamine –B, Benzidine, Cupron, Magneson, Alizarin-S, Nitron, Salicyladoxin etc )</li> <li>To estimate Pb, As, Cu and Fe in qualitatively.</li> <li>To determine the concentration of free chlorine in given sample.</li> <li>To determine the concentration of NO<sub>2</sub> and NO<sub>3</sub> ions in provided sample. (Brucine or Phenol disulphonic acid methods).</li> <li>To determine the concentration of phosphate ion in provided sample.</li> <li>Determine the organic matter present in a provided sample (Soil) by Walky and Blacks methods.</li> <li>To determine the ferrous and ferric ions by provided sample.</li> <li>To determine Calcium present in a given food sample.</li> <li>To estimate Na and K in provided soil sample</li> <li>Prepare a report on polymeric pollutants their effects, managing ways to control and present the classroom.</li> </ul> | 48      |

## 2 Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Individually laboratory work
- Field work

### 3 Evaluation: Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

#### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                         |           |
|-----------------------------------------|-----------|
| 6) Attendance                           | 5 points  |
| 7) Participation in learning activities | 5 points  |
| 8) First assignment (Presentation)      | 10 points |
| 9) Second assignment (Term exam)        | 10 points |
| 10) Third assignment (Project work)     | 10 points |
| Total                                   | 40 points |

#### 5.2 Theory: External evaluation (Full marks 40)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |           |
|--------------|------------------------------------------------------------------|-----------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points |
| <b>Total</b> |                                                                  | 40 points |

**Note: All questions are compulsory**

#### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination  | Area                         | Points   | Total Points |
|--------------|------------------------------|----------|--------------|
| Internal     | Regularity                   | 2        | 6 points     |
|              | Practical Performance        | 2        |              |
|              | Record book                  | 2        |              |
| External     | Experiment (at least 2 Exp.) | 11 (5+6) | 14 Points    |
|              | Viva                         | 3        |              |
| Total Points |                              |          | 20 points    |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

#### Recommended and References Books

- Atkins. P. & Paula, J. (2010) *Physical chemistry*. (Ninth edition):Oxford university press.
- Bahl, A., & Bhal, B.S. (2008). *A textbook of organic chemistry*. New Delhi: S. Chanda and company limited.
- Bahl, A., Bhal, B.S. &Tuli, G. D. (2008). *Essential of physical chemistry*. New Delhi: S. Chanda and company limited.
- Dhaubdel, S.P., Pradhan, K.P., & Joshi, S.M. (n.d.). *Practical chemistry guide*. Nepal: Kathmandu.
- Khadka, N.M., Gautam, S.D. & Yadav, P.N. (n.d). *A core experimental chemistry*. Kathmandu: Kedeaa Book Center.
- Madan,R.L. & Tuli,G.D.(2001) *Physical chemistry*. New Delhi: S Chand and Co. Ltd.
- Pandit, C.N., Subedi, R.R. & Tiwari, P.(2074 B.S.). *A text book of Chemistry*, Kathmandu: K. P. Pustak Bhandar.
- Pokherel, M.R.,& Poudel, B.R. (2011). *A text book of inorganic chemistry*. Kathmandu: National Book Center.
- Pokherel, M. R., Yadav, P.N. & Shrestha, S. (2017). *Advanced Practical Inorganic Chemistry*. Kathmandu: Kshitiz Publication.
- Prakash, S., Tuli, G.D., Basu, S. K. & Madan, R.D. (2008). *Advanced inorganic chemistry*. New Delhi: S. Chanda and company limited.

Sharma, K. K. & Sharma, L.K. (2012). *A textbook of Physical chemistry*. Delhi: Vikas Publishing House pvt. Ltd.

Sthapit, M.K. & Pradhananga R.R. (2065 B.S.) A text book of physical chemistry, Kathmandu: Taleju Prakashan

Vishnoi, N.K. (1985). *Advanced practical organic chemistry*. India: Vikas Publishing House Pvt. Ltd.

Course Title: **Biology Education**

Full Marks: 80 (T) +20 (P)

Course Code: SCED 473

Pass Marks: 40 (T) +10 (P)

Nature of Course: Theory + Practical

Semester: B.Ed. / VII

Total Credit: 2+1 (Th. + Pr.)

Total Period: 32+48 (Th. + Pr.) = 80 Periods

### 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The major topics included in this course are The theoretical part aims to give some knowledge to the students on animal tissues, water relations, medicinal and aromatic plants of Nepal, organic and mushroom farming, whereas practical part deals with preparation of temporary and permanent tissues of different animals tissues, identification and preservation of some important medicinal and aromatic plants, culturing techniques for some mushrooms and different aspects of developmental biology of plants regarding plant cell, tissues and organs. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching learning process. The students are required to secure pass marks in theory as well as practical course separately.

### 2. General Objectives

The general objectives of this course are as follows:

- To acquaint the students with the concept of animals tissues and their types.
- To provide students with the in-depth knowledge of different relation of water, history, mechanism of diffusion, osmosis, absorption and ascent of sap.
- To acquaint the students with the concept of cell biology and genetics.
- To acquaint the students with some important medicinal and aromatic plants (MAPs) of Nepal.
- To impart some theoretical and practical knowledge of organic and mushroom farming.
- To enable students to prepare herbarium on their field visit, prepare report and develop practical record file by using appropriate methods and approaches.

### 3. Specific Objectives and Contents

#### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Periods |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"><li>• Classify animal tissue and their basic characters.</li><li>• Draw the structure of different types of animal tissues and write their functions.</li><li>• Differentiate between fibro cartilage and elastic cartilage</li><li>• Differentiate between different subtypes of tissues such as striated and non-striated, WBC and RBC, Unipolar and bipolar, Cartilage and bone, compact bone and spongy bone, blood and lymph, Dendron and axon, neuron and neuroglia cell etc.</li><li>• Write the meaning of important terms such as synapsis, Matrix, Haversian system, Canaliculi, Kraus's membrane etc.</li><li>• Discuss the distribution of all subtypes of tissue in the body.</li></ul> | <b>Unit 1: Animal Tissues</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• Types of animal tissue</li><li>• Differentiate between different subtypes of tissues</li><li>• Epithelial tissue<ul style="list-style-type: none"><li>- Simple, compound and specialized</li></ul></li><li>• Connective tissues<ul style="list-style-type: none"><li>- Proper, skeletal and Fluid</li></ul></li><li>• Muscular tissues<ul style="list-style-type: none"><li>- Unstriated, striped and Cardiac</li></ul></li><li>• Nervous tissue<ul style="list-style-type: none"><li>- Neurons, Neuroglia, Ependymal cells and Neurosecretory cells</li></ul></li></ul> | 5       |
| <ul style="list-style-type: none"><li>• Explain the importance of water.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Unit 2: Water Relations</b> <ul style="list-style-type: none"><li>• Importance of water</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 7       |

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• Discuss the meaning, mechanism and examples of diffusion</li> <li>• Elaborate the diffusion pressure (DP) and diffusion pressure deficit (DPD)</li> <li>• List out the factors affecting diffusion and significance of diffusion.</li> <li>• Discuss the process of osmosis and their types.</li> <li>• Demonstrate osmosis by egg membrane.</li> <li>• Demonstrate with potato osmoscope.</li> <li>• Explain the different factors affecting osmosis</li> <li>• List out the types of solution</li> <li>• Relate osmotic in plant cells</li> <li>• Point out the significance of osmosis.</li> <li>• Describe the meaning, examples and significance of Imbibition.</li> <li>• Discuss the meaning of absorption</li> <li>• Explain the mechanism of active and passive absorption.</li> <li>• Discuss the absorption of solute and theories of absorption.</li> <li>• Differentiate between active and passive water absorption.</li> <li>• List out the factors affecting the rate of water absorption.</li> <li>• Discuss the mechanism of ascent of sap.</li> <li>• Demonstrate the process of ascent of sap.</li> <li>• Describe the theories of ascent of sap.</li> <li>• Explain different theory of Transport and causes of root pressure.</li> <li>• Demonstrate the root pressure</li> <li>• List out the factors affecting root pressure.</li> </ul> | <ul style="list-style-type: none"> <li>• Diffusion <ul style="list-style-type: none"> <li>- Process of diffusion with examples</li> <li>- Factors affecting and significance</li> <li>- Simple experiment on diffusion</li> </ul> </li> <li>• Osmosis <ul style="list-style-type: none"> <li>- Meaning and types</li> <li>- Experiment of osmosis in plants</li> <li>- Effects of osmosis</li> <li>- Types of solution</li> <li>- Osmotic relations in plant cells</li> <li>- Significance of osmosis</li> </ul> </li> <li>• Imbibition <ul style="list-style-type: none"> <li>- Meaning , example and significance</li> </ul> </li> <li>• Absorption <ul style="list-style-type: none"> <li>- Meaning, Mechanism, Absorption of solute, Theories and factors affecting</li> </ul> </li> <li>• Ascent of sap <ul style="list-style-type: none"> <li>- Meaning, mechanism, theory</li> <li>- Transport</li> <li>- Root pressure</li> </ul> </li> </ul> |   |
| <ul style="list-style-type: none"> <li>• Define medicinal and aromatic plants (MAPs) with examples and impart knowledge on their present and future scope.</li> <li>• To explain the distribution of major MAPs in various climatic zones in Nepal.</li> <li>• Describe the measures for conservation of MAPs in-situ and ex-situ.</li> <li>• Explain the national policy and programs for promotion of MAPs in Nepal.</li> <li>• Describe the morphology, importance, climatic and soil requirements, cultivation and harvesting techniques of commercially important MAPs of Nepal.</li> <li>• Describe the uses and sustainable harvesting technologies of some important MAPs:</li> <li>• List some important herbs (mentioned in the content) used for cosmetics and explain their cosmetic uses.</li> <li>• List some important herbs (mentioned in the content) used for cosmetics and explain their cosmetic uses.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p><b>Unit 3: Medicinal and Aromatic Plants(MAPs)</b></p> <ul style="list-style-type: none"> <li>• Introduction – Present status and future scope of MAPs</li> <li>• Distribution of major MAPs in various climatic zones in Nepal</li> <li>• Conservation of MAPs in-situ and ex-situ</li> <li>• National policies and programs for promotion of MAPs</li> <li>• Cultivation technology of some commercially important MAPs of Nepal:<br/> <i>Swertia chirayata</i> (Chiraito), <i>Asparagus racemosus</i> (Kurilo), <i>Valeriana jatamansi</i> (Sugandhwal), <i>Piper longum</i> (Pipla) and <i>Zanthoxylum armatum</i> (Timur)-</li> <li>• Uses and sustainable harvesting technologies of some important MAPs : <i>Ophicordyceps</i></li> </ul>                                                                                                                                                                                                   | 5 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <i>sinensis</i> (Yarshagumba) <i>Nardostachys grandiflora</i> (Jatamashi),<br><i>Podophyllum hexandrum</i> (Laghu patra), <i>Glycyrrhiza grabra</i> (Jethimadhu)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |
| <ul style="list-style-type: none"> <li>List some important herbs (mentioned in the content) used for cosmetics and explain their cosmetic uses.</li> <li>List some important herbs (mentioned in the content) used for cosmetics and explain their cosmetic uses.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Unit 4: Herbal cosmetics</b><br>(some important herbs used for cosmetic uses : Aloe( <i>Aloe vera</i> ), Neem( <i>Azadirachta indica</i> ), Tulsi( <i>Ocimum sanctum</i> ), Ashuro( <i>Adhatoda vasica</i> ), Til ( <i>Sesamum indica</i> ), Besar or Turmeric( <i>Curcuma angustifolia</i> ), Ritha ( <i>Sapindus mukorossi</i> ), Badam ( <i>Arachis hypogea</i> ), Amla( <i>Embllica officinalis</i> ), Coconut oil( <i>Cocos nucifera</i> ), Sunflower oil( <i>Helianthus annus</i> ), Srikhand ( <i>Santalum album</i> ), Garlic ( <i>Allium sativum</i> )                                                                                                                                                                                                                | 4 |
| <ul style="list-style-type: none"> <li>Explain the meaning of organic farming.</li> <li>Explain the importance and challenges of organic farming in Nepal.</li> <li>List some important organic agricultural crops cultivated in Nepal.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Unit 5: Organic Farming</b> <ul style="list-style-type: none"> <li>Introduction, Importance and challenges of organic farming in Nepal</li> <li>Some important organic agricultural crops cultivated in Nepal (Vegetables: pea, soybean, Coriander, cauliflower, cabbage, lady finger, brinjal, radish, spinach, tomato, carrot, bitter gourd, etc. Other crops: mushroom, turmeric, garlic, ginger, cucumber, tea, chilly, fenugreek etc.).</li> </ul>                                                                                                                                                                                                                                                                                                                        | 4 |
| <ul style="list-style-type: none"> <li>Describe the vegetative structure and life cycle of a typical mushroom.</li> <li>List some important edible and poisonous mushrooms found in Nepal.</li> <li>Identify some precautions for consuming wild mushrooms.</li> <li>To identify symptoms of mushroom poisoning and measures for domestic treatment.</li> <li>List some important wild edible and cultivated mushrooms in Nepal.</li> <li>Explain the nutritional and medicinal value of mushrooms.</li> <li>Explain the general technique of mushroom farming.</li> <li>Explain the steps of farming some mushrooms cultivated in Nepal: <i>Pleurotus</i> sp. (Kanye chyaw or Oyster mushroom), <i>Agaricus bisporus</i> (Gobre chyaw or Button mushroom), <i>Lentinula edodes</i> (Mrige or</li> </ul> | <b>Unit 6: Mushroom farming</b> <ul style="list-style-type: none"> <li>Vegetative structure and life cycle of a typical mushroom</li> <li>Edible and poisonous mushrooms</li> <li>Precautions for consuming wild mushrooms and symptoms after consuming poisonous mushrooms and domestic treatment</li> <li>Edible mushrooms- wild and cultivated</li> <li>Nutritional and medicinal value of mushrooms</li> <li>Major types of cultivated mushrooms in Nepal: <i>Pleurotus</i> sp. (Kanye chyaw or Oyster mushroom), <i>Agaricus bisporus</i> (Gobre chyaw or Button mushroom), <i>Lentinula edodes</i> (Mrige or Shitake chyaw), <i>Volvariella</i> sp. (Parale chyaw or paddy straw mushroom), <i>Calocybe indica</i>(Dudhe chyaw), <i>Coprinus commatus</i> (Katle</li> </ul> | 7 |



|                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                              |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Shitake chyau), <i>Volvariella</i> sp. (Parale chyau or paddy straw mushroom). <ul style="list-style-type: none"> <li>Explain the present status of mushroom farming in Nepal in different Research centers, farming stations, mushroom industries, mushroom development and promotion centres.</li> </ul> | chyau), <i>Ganoderma lucidum</i> (Ragate chyau) <ul style="list-style-type: none"> <li>Mushroom farming – Steps of mushroom farming – 1. Composting 2. Spawning 3. Casing 4. Pinning 5. Cropping</li> <li>Present status of mushroom farming in Nepal Major Mushroom Research centres, farming stations, mushroom industries, mushroom development and promotion centres in Nepal</li> </ul> |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## Part 2: Practical

| Specific objectives                                                                                                                                                                                                                                                                                                                                               | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Periods |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>To Prepare temporary and permanent of different types of animal tissues</li> </ul>                                                                                                                                                                                                                                         | <b>Unit 1: Animal Tissues</b> <ul style="list-style-type: none"> <li>Study of tissues and diversity in shapes and sizes of animal cells (e.g. squamous epithelium, muscle fibers and mammalian blood smear) through temporary/permanent slides.</li> </ul>                                                                                                                                                                                                                                                                          | 12      |
| <ul style="list-style-type: none"> <li>To Demonstrate the diffusion of sugar and salts solution.</li> <li>To demonstrate the osmosis by egg membrane, potato osmoscope., ascent of sap and root pressure</li> <li>To study the distribution of stomata in the upper and lower surface of leaves and plasmolysis in epidermal peels (e.g. Rhoeo leaves)</li> </ul> | <b>Unit 2: Water Relations</b> <ul style="list-style-type: none"> <li>To demonstrate the diffusion sugar and salt solutions.</li> <li>Study of osmosis by potato osmometer.</li> <li>Study of distribution of stomata in the upper and lower surface of leaves.</li> <li>Study of plasmolysis in epidermal peels (e.g. Rhoeo leaves)</li> <li>Demonstrate osmosis by egg membrane.</li> <li>Demonstrate with potato osmoscope.</li> <li>Demonstrate the process of ascent of sap.</li> <li>Demonstrate the root pressure</li> </ul> | 12      |
| <ul style="list-style-type: none"> <li>To collect and prepare the herbarium of medicinal and aromatic plants.</li> </ul>                                                                                                                                                                                                                                          | <b>Unit 3: Medicinal and aromatic plants</b> <ul style="list-style-type: none"> <li>Identification and preservation of some available medicinal and aromatic plants.</li> </ul>                                                                                                                                                                                                                                                                                                                                                     | 6       |
| <ul style="list-style-type: none"> <li>To collect, preserve and identify some available mushrooms.</li> <li>To study vegetative and reproductive structures of a typical mushroom (<i>Agaricus</i>).</li> <li>To study techniques of mushroom farming.</li> </ul>                                                                                                 | <b>Unit 4: Mushrooms</b> <ul style="list-style-type: none"> <li>Identification and Preservation of some available mushrooms.</li> <li>Structure and reproduction of a mushroom(<i>Agaricus</i>)</li> <li>Techniques of mushroom farming</li> </ul>                                                                                                                                                                                                                                                                                  | 9       |

|                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                       |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>To visit fields and agricultural laboratories for studying medicinal and aromatic plants and mushroom farming and to submit the report</li> <li>To visit fields to collect, preserve and prepare herbaria of the collected plants and submit the report.</li> </ul> | <b>Unit 5: Field Trip and report writing.</b> <ul style="list-style-type: none"> <li>Visit to agricultural farms and laboratories</li> <li>Submission of field trip report</li> </ul> | 9 |
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#### 4. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Group work, Report writing and presentation
- Construction of learning materials
- Individually laboratory work
- Field visit

#### 5. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

##### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                          |                  |
|------------------------------------------|------------------|
| 11) Attendance                           | 5 points         |
| 12) Participation in learning activities | 5 points         |
| 13) First assignment ( Presentation)     | 10 points        |
| 14) Second assignment (Term exam)        | 10 points        |
| 15) Third assignment (Project work)      | 10 points        |
| <b>Total</b>                             | <b>40 points</b> |

##### 5.2 Theory: External evaluation (Full marks 50)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|    |                                                                  |           |
|----|------------------------------------------------------------------|-----------|
| 1. | Objective type question (multiple choice: 10 questions x 1point) | 10 points |
| 2. | Short answer question ( 6 questions x 5 points)                  | 30 points |

|              |  |           |
|--------------|--|-----------|
| <b>Total</b> |  | 40 points |
|--------------|--|-----------|

**Note: All questions are compulsory**

### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination           | Area                           | Points  | Total Points |
|-----------------------|--------------------------------|---------|--------------|
| Internal              | Regularity                     | 1.5     | 4 points     |
|                       | Practical Performance          | 1       |              |
|                       | Record book                    | 1.5     |              |
| External              | Experiment (at least 2 Exp.)   | 9 (4+5) | 12 Points    |
|                       | Viva                           | 3       |              |
| External and Internal | Field visit and Report writing |         | 4 points     |
| Total Points          |                                |         | 20 points    |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

### Recommended and References Books

- Aneja, K. R. (2003). *Experiments in Microbiology, Plant Pathology and Biotechnology*.
- Biswas, Subrata, Datta, M. and Nagachan, S.V. (2012). *Mushrooms : A Manual for Cultivation*. PHI Learning Private Limited , New Delhi, India.
- DPR (2067 BS). *Nepalko Aarthik Bikaskalagi Prathamikta Prapta 30 Jadibutiharuko Pahichan Pustika*. Department of Plant Resources, Ministry of Forests and Soil Conservation. Government of Nepal, Kathmandu.
- DPR(2016). *Medicinal Plants of Nepal*. Department of Plant Resources. Ministry of Forests and Soil Conservation. Government of Nepal, Kathmandu
- Farooqi A. A. and Sreeramu B. S. (2010). *Cultivation of Medicinal and Aromatic Crops*. Universities Press ( India) Private Limited, Hyderabad, India.
- Jana, B. L. (2015). *Relevance of Organic Farming*. Aavashkar Publishers Distributers, Jaipur, India.
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- Majpuriya, T. C. (nd.). *Modern approach to zoology*. Jalandhar city: Suraj Kapoor publication.
- Neupane, S.P. (2014). *Mushroom Farming in Nepal (in Nepali)*. Kathmandu, Binita Neupane , Kathmandu.
- Pandey B. P. (2009). *Modern practical botany Vol I and Vol II*. New Delhi: S. Chand and Company Ltd.
- Pandey, P. N. & Vidyarthi, R. D. (2000). *A text book of zoology*. New Delhi: S. chanda and company Ltd.
- Ram, R.C. (2007). *Mushrooms and their cultivation techniques*. Aviskar Prakashan. Jaipur, India.
- Ranjitkar, H. D. (2010). *Botany. A Practical Handbook*. A. K. Ranjitkar, Kalanki, Kathmandu
- Santra, S. S., Chatterjee, T.P. and Das, A.P. (1990). *College Botany Practical*. Vol. I. New Central Book Agenct (P) Ltd., Calcutta, India.
- Sharma.O.P. (1989). *Practical Botany for Degree students*, India : Pragati Prakashan, Meerut.
- Soper, R. (2005). *Biological Science*. Cambridge University Press, UK.
- Suman and Sharma (2007). *Mushroom Cultivation and uses*. AGROBIOS, India.-
- Thomas Y., Karki, M., and Parajuli D. eds (2002). *Himalayan Medicinal and Aromatic Plants. Balancing Use and Conservation*. Proceedings of the Regional Workshop on Wise Practices and Experimental

Learning in Conservation and Management of Himalaya Medicinal Plants (December 15-20, 2002,

Verma, P.S. (1995). A manual of practical zoology. New Delhi: S. Chand and Company Ltd.

Vidyarthi, R. D. & Pandey, P. N. (2008). *A Textbook of Zoology*. New Delhi: S. Chanda & Co. Ltd.

Course Title: **Environment and Geo-Science**

Course Code: SCED 474

Nature of Course: Theory

Total Credit: 3

Full Marks: 100

Pass Marks: 50

Semester: B.Ed. / VII

Total Period: 48

## 1. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-West University. This course has consists only theoretical part and consists of different units related to environment and geo-science. The major topics included in this course are history of earth, the cultural heritage of Nepal and its preservation, natural disaster, agriculture and sustainable development, bio-technology and its application in environment protection and sources of energy on environment. This course aims to enhance the theoretical knowledge and apply the protection on environment.

### General Objectives

On the completion of this course student will be able to following general objectives:

- To provide students with the general knowledge and basic concept of environment and geo-science.
- To acquaint the students with the history of the earth, geological time scales and way reasoning and thinking about the earth and their phenomena.
- To enable the students in elaborating the types of cultural heritage of Nepal and aware the preservation techniques.
- To familiarize the students with different types of natural disasters and aware the precaution measures.
- To enable the students in elaborating the different sources of energy and their uses.
- To make the students familiarize with bio-technology and its implication in environmental protection.
- To enable students to prepare report on their field visit, write on the appropriate methods and approaches.

## 2. Specific Objectives and Contents

### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Periods |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"><li>• Define geology.</li><li>• Relate geology and religion on the basis of different views of natural history.</li><li>• Generate the ways of scientific thinking and reasoning on the earth in our surroundings.</li><li>• Discuss the history of earth on the basis of their origin.</li><li>• Classify and define rock and measuring their properties.</li><li>• Explain the process of sediment deposition and preservation.</li><li>• Discuss about the plate tectonic.</li><li>• Illustrate the geological time and time scale of basin development.</li><li>• Elaborate the process of fossil formation their identification.</li></ul> | <b>Unit 1: History of earth</b> <ul style="list-style-type: none"><li>• Geology and religion: different views of natural history</li><li>• Scientific ways of thinking and reasoning</li><li>• History of earth<ul style="list-style-type: none"><li>- Origin of earth</li></ul></li><li>• Rocks and their types<ul style="list-style-type: none"><li>- Measuring rock properties</li></ul></li><li>• Sediment deposition and preservation</li><li>• Plate tectonics</li><li>• Geological time<ul style="list-style-type: none"><li>- The time-scale of basin development</li></ul></li><li>• Fossil</li></ul> | 9       |

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| <ul style="list-style-type: none"> <li>Describe the importance of fossil on the identification of evidences of history and energy.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"> <li>Identification, formation and importance</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |    |
| <ul style="list-style-type: none"> <li>Introduce the various natural disaster occurs in earth.</li> <li>Describe the landslide on the basis of their causes, impact and control measures.</li> <li>Define floods and list out its causes, impact and control measures.</li> <li>Define and explain the major earthquake in Nepal.</li> <li>Discuss the causes, impact and precautionary measures of earthquake.</li> <li>Define drought and list out its causes, impact and control measures.</li> <li>Prepare a report related to natural disaster and present in your classroom.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Unit 2: Natural Disaster.</b> <ul style="list-style-type: none"> <li>Landslides <ul style="list-style-type: none"> <li>Causes, impact and control measures</li> </ul> </li> <li>Floods. <ul style="list-style-type: none"> <li>Causes, impact and control measures</li> </ul> </li> <li>Earthquake <ul style="list-style-type: none"> <li>Causes, Impact and Precautionary Measures</li> </ul> </li> <li>Drought <ul style="list-style-type: none"> <li>Causes, impact and control measures</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 8  |
| <ul style="list-style-type: none"> <li>Describe the major religions Hinduism, Buddhism, Islam, Christianity and their impact on the environment.</li> <li>Define social customs and explain their impact on environment on the basis of Festivals and Music and Musical Instruments.</li> <li>Discuss the Monuments, Languages, Costumes and Ornaments and their impact on social environment.</li> <li>Illustrate the different types of food habit and their impact on social environment.</li> <li>Describe the Importance of Nepal's Cultural Heritage in the world.</li> <li>Explain the major threats of cultural heritage on the basis of Modernization, Population Pressure and Urbanization and, environmental pollution.</li> <li>Elaborate the Problems and Constraints of Conservation on the basis of Lack of Awareness, Poor State of Indigenous Technology, Financial Constraints and Policies and Commitments</li> <li>Discuss the measures of conservation of cultural heritage on the basis of Preparation of a National Monuments, Register Restoration and Rehabilitation of Monuments, Preservation and Development of Archaeological Sites., Conservation Education, Public Participation, Legal Provision, Documentation and Research, and International Cooperation</li> <li>Prepare a report related to measures for conservation of cultural heritage and present in your classroom</li> </ul> | <b>Unit 3: The Cultural Heritage of Nepal and Its Preservation.</b> <ul style="list-style-type: none"> <li>Major Religions and their Impact on the Environment <ul style="list-style-type: none"> <li>Hinduism, Buddhism, Islam and Christianity</li> </ul> </li> <li>Social Customs and their Impact on the Environment. <ul style="list-style-type: none"> <li>Festivals and their Impact on the Environment.</li> <li>Music and Musical Instruments.</li> </ul> </li> <li>Monuments, Languages, Costumes and Ornaments.</li> <li>Food Habits</li> <li>Importance of Nepal's Cultural Heritage</li> <li>Threats to Cultural Heritage <ul style="list-style-type: none"> <li>Modernization</li> <li>Population Pressure and Urbanization</li> <li>Pollution</li> </ul> </li> <li>Problems and Constraints of Conservation <ul style="list-style-type: none"> <li>Lack of Awareness</li> <li>Poor State of Indigenous Technology.</li> <li>Financial Constraints</li> <li>Policies and Commitments</li> </ul> </li> <li>Measures for Conservation of Cultural Heritage</li> </ul> | 12 |
| <ul style="list-style-type: none"> <li>Introduce agriculture and sustainable development.</li> <li>Describe the modern and traditional agricultural practices in the context of Nepal.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Unit 4: Agriculture and Sustainable Development.</b> <ul style="list-style-type: none"> <li>Introduction</li> <li>Agricultural Practices</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 6  |

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• Explain tillage and their effects on soil.</li> <li>• Discuss the direct drilling on the basis of agricultural and sustainable development.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>- Traditional Practices.</li> <li>- Modern Practices.</li> <li>• Tillage</li> <li>- Effects of Tillage on Soil</li> <li>• Direct Drilling</li> </ul>                                                                                                                                                                                                                                                                                                               |   |
| <ul style="list-style-type: none"> <li>• Introduce bio-technology.</li> <li>• Illustrate the bio-informatics.</li> <li>• Explain bio-technology and pollution control.</li> <li>• Discuss the bioremediation techniques for the pollution control.</li> <li>• Describe the aerobic and anaerobic process for biological de-odourisation.</li> <li>• Explain the process for biological purification of contaminated air</li> </ul>                                                                                                                                                                                                                                                                  | <b>Unit 5: : Bio-Technology and its Application in Environmental Protection</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Bio-informatics</li> <li>• Bio-Technology and pollution control</li> <li>• Bioremediation</li> <li>• Biological deodorization</li> <li>• Biological purification of contaminated air</li> </ul>                                                                                                                                                          | 5 |
| <ul style="list-style-type: none"> <li>• Define energy.</li> <li>• Classify energy on the basis of primary and secondary sources.</li> <li>• Explain the major types of energy resources and their advantage on the basis of Nuclear, Solar, Hydropower, Biomass, Biogas, Geothermal, Wind energy.</li> <li>• Differentiate between nuclear fission and fusion.</li> <li>• Discuss the alternative source of and conservation of energy.</li> <li>• Discuss biomass energy on the basis of Production of ethanol from biomass and Production of methane from biomass,</li> <li>• Elaborate the Ocean thermal energy conversion (OTEC)</li> <li>• Explain the tidal power and air energy.</li> </ul> | <b>Unit 6: Sources of energy on environment</b> <ul style="list-style-type: none"> <li>• Nuclear fission and fusion</li> <li>• Solar energy and its uses</li> <li>• Hydro power</li> <li>• Wind power,</li> <li>• Biomass energy, <ul style="list-style-type: none"> <li>-Production of ethanol from biomass</li> <li>- Production of methane from biomass,</li> </ul> </li> <li>• Geothermal energy,</li> <li>• Ocean thermal energy conversion (OTEC)</li> <li>• Tidal power and air energy,</li> </ul> | 8 |

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

### 3. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Group work, Report writing and presentation
- Individually laboratory work
- Field visit

#### 4. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

##### 5.1. Internal evaluation

###### a. Internal Evaluation ..... 40%

Internal evaluation will be conducted by course teacher based on following activities:

|                                                         |           |
|---------------------------------------------------------|-----------|
| 1) Attendance                                           | 5 points  |
| 2) Participation in learning activities                 | 5 points  |
| 3) First assignment ( written assignment)               | 10 points |
| 4) Second assignment ( project work with presentation ) | 10 points |
| 5) Third assignment/ Exam                               | 10 points |
| Total                                                   | 40 points |

###### 5.2 External Evaluation (Final Examination)..... 60%

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. The types and nature of the questions to be included in the final examination are as follows:

Examination Division, office of the Dean, Faculty of Education will conduct final examination at the end of semester.

|                                                                |          |
|----------------------------------------------------------------|----------|
| 1) Objective type question (Multiple choice 10questionsx1mark) | 10 marks |
| 2) Short answer questions (6 questions x 5 marks)              | 30 marks |
| 3) Long answer questions (2 questions x 10 marks)              | 20 marks |

|       |          |
|-------|----------|
| Total | 60 marks |
|-------|----------|

**Note: All questions are compulsory**

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council**

#### Recommended Book

Pandit, C.N & Subedi, R.R. (2012). *Environmental Chemistry*. Kathmandu: Cambrige publication Pvt. Ltd. kalimati.  
IUCN, (2000). *Environmental Education, Source Book*, Nepal: The World Conservation union, Kathmandu.

#### Reference Book

Dara S.S.(2004). *A textbook of Environmental Chemistry and Pollution Control*. New Delhi: S. Chand & Company Ltd. Ram Nagar.  
DE, A.K.(2007). *Environmental Chemistry*. Delhi: New Age International P. Limited Publishers, Ansari Road, Daryaganj.  
Jadhav, H.V. & Purohit S.H.(2008). *Global Pollution and Environmental Monitoring*. New Delhi: Himalaya Publishing House.  
Katyal, T.&Satake, M. (1989). *Environmental pollution*. India: Anmol Publication Pvt.Ltd. New Delhi.  
Miller G.T.(2005). *Living in the Environment Principles, Connections, and Solutions (13ed.)*. Singapore: Thomson Asia Pte.Ltd. ISBN 981-265-632-4.

Course Title: **Concept of STEAM Education**  
Course Code: SCED 475  
Nature of Course: Theory + Practical  
Total Credit: 2+1 (Th. + Pr.)

Full Marks: 80 (T) +20 (P)  
Pass Marks: 40 (T) +10 (P)  
Semester: B.Ed. / VII  
Total Period: 32+48 (Th. + Pr.) = 80 Periods

## 6. Course Description

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has divided in to two parts: Theory and Practical. The theoretical parts consist of different units related to STEAM Education which provide essential knowledge in the related fields. The major topics included in this course are Introduction of STEAM education, Contemporary aspect of STEAM education, Curriculum in STEAM Education, STEAM lesson development and implementation, and STEAM project development and implementation in science learning. In practical parts, different aspect of STEAM education related activities are performed which are listed in particle course. This course aims to enhance the theoretical knowledge and apply their practical skills in teaching and learning process. The students are required to secure pass marks in theory as well as practical course separately.

## 7. General Objectives

On the completion of this course student will be able to following general objectives:

- To enable the students familiarize STEAM education there approaches and relation of science education.
- To enable students know the contemporary aspect of STEAM education.
- To familiarize the students with different types STEAM curricula and their application in school level.
- To enable the students for the development of STEAM lesson and their implementation.
- To provide students with an opportunity to understand the different types STEAM project development and implementation in science learning.
- To inculcate the knowledge for the challenges of STEAM project implementation and ways to tackle this problem.
- To maintain record base of the performed experiments related to STEAM education.

## 8. Specific Objectives and Contents

### Part 1: Theory

| Specific Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Periods |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"><li>• Introduce STEAM education and there approaches.</li><li>• Explain the history of STEAM and STEAM Education.</li><li>• Discuss the Philosophical and theoretical understanding of STEAM approach.</li><li>• Elaborate the Concept of holistic education and multi-disciplinary approach in science learning.</li><li>• Relate the science learning with engineering process and practice, technology, integration of arts, and mathematical habits.</li><li>• Describe the STEAM mindsets and skillsets, and core competencies</li><li>• Discuss the teaching science through stems on the basis of <i>Science, Technology, Engineering, and Mathematics</i></li></ul> | <b>Unit 1: STEAM education</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• History of STEM and STEAM education</li><li>• STEAM approach<ul style="list-style-type: none"><li>- Philosophical and theoretical understanding of STEAM approach.</li><li>- Concept of holistic education and multi-disciplinary approach</li></ul></li><li>• Interrelationship of science learning</li><li>• STEAM mindsets and skillsets, and core competencies</li></ul> | 5       |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>• <i>Teaching Science through STEM (Science, Technology, Engineering, and Mathematics)</i></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |
| <ul style="list-style-type: none"> <li>• Explain the STEAM education and sustainable development.</li> <li>• Familiarize the 21<sup>st</sup> century skill development through STEAM approach</li> <li>• Discuss the Critical thinking, reflection, and design thinking on the basis of STEAM approach</li> <li>• Elaborate the Integration of ICT, Arts with science teaching/ learning through STEAM perspective.</li> <li>• Describe the STEAM approach on the basis of Greater diversity of students and The lifelong learning and STEAM approach</li> <li>• Discuss The skills needed in a digital age for STEAM (science) teacher / educator</li> <li>• Relate the Art, theory, research, and best practices in science teaching and STEAM approach</li> </ul> | <b>Unit 2: Contemporary aspect of STEAM education</b> <ul style="list-style-type: none"> <li>• STEAM education and sustainable development.</li> <li>• 21<sup>st</sup> century skill development through STEAM approach</li> <li>• Critical thinking, reflection, and design thinking in STEAM approach</li> <li>• Integration of ICT, Arts with science teaching/ learning through STEAM perspective.</li> <li>• Greater diversity of students and lifelong learning and STEAM approach</li> <li>• The skills needed in a digital age for STEAM (science) teacher / educator</li> <li>• Art, theory, research, and best practices in science teaching and STEAM approach</li> </ul> | 7 |
| <ul style="list-style-type: none"> <li>• Discuss the Concept of STEAM curriculum and its development in science education.</li> <li>• Express the Components of the STEAM Curriculum.</li> <li>• Describe the Traditional, transitional and transformative curriculum</li> <li>• Discuss the The framework for understanding the official and enacted curriculum</li> <li>• Explain the Content-driven, Process-driven and Objectives-driven curricula</li> <li>• Describe the Competence- or outcomes-based curricula.</li> <li>• Discuss the STEAM curriculum on the basis of power and social change.</li> <li>• Explain the approaches of STEAM curriculum design.</li> <li>• Apply STEAM curriculum design in school level.</li> </ul>                          | <b>Unit 3: STEAM Curriculum Development</b> <ul style="list-style-type: none"> <li>• Concept of STEAM curriculum and its development.</li> <li>• The Components of the STEAM Curriculum</li> <li>• Traditional, transitional and transformative curriculum</li> <li>• Official and enacted curriculum</li> <li>• Content, Process and objective-driven curricula</li> <li>• Competence- or outcomes-based curricula</li> <li>• STEAM Curriculum: power and social change</li> <li>• Approaches to STEAM curricula design</li> <li>• Application of STEAM curriculum in school level.</li> </ul>                                                                                      | 6 |
| <ul style="list-style-type: none"> <li>• Discuss the Concept of STEAM lesson and its development.</li> <li>• Describe the STEAM lesson planning tools and reflection tool.</li> <li>• Elaborate the science lesson and engineering process/ practices</li> <li>• Integrate the science lesson and technology.</li> <li>• Integrate the science lesson and arts.</li> <li>• Relate and discuss the science lesson and mathematical habits.</li> <li>• Integrate and discuss the science lesson and design thinking.</li> </ul>                                                                                                                                                                                                                                        | <b>Unit 4: STEAM Lesson development and implementation.</b> <ul style="list-style-type: none"> <li>• Concept of STEAM lesson</li> <li>• Tools STEAM lesson planning and reflection tool</li> <li>• Science lesson and engineering process/ practices</li> <li>• Integration of Science lesson <ul style="list-style-type: none"> <li>- Technology, arts, Mathematical habits and design thinking</li> </ul> </li> </ul>                                                                                                                                                                                                                                                              | 7 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>Integrate the all concepts for the development of school based lesson plan and their implementation.</li> <li>Describe the techniques for the evaluation/ assessment in STEAM lesson.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>Integration of all concepts: development of school level STEAM lesson (plan) and its implementation.</li> <li>Evaluation/ assessment in STEAM lesson</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                 |   |
| <ul style="list-style-type: none"> <li>Introduce the concept of STEAM project development and their implementation in science learning.</li> <li>Explain the process of STEAM project planning and action.</li> <li>Elaborate the ways of creative STEAM project development on the basis of Lateral thinking, resourcefulness, discipline, curiosity, process not product</li> <li>Explain the steps of STEAM project base learning.</li> <li>Design STEAM project base learning in secondary science including physics, chemistry, biology, environment, and astronomy and their implementation.</li> <li>Discuss the challenges of STEAM project implementation and ways to tackle this problem.</li> </ul> | <b>Unit 5: STEAM project development and implementation</b> <ul style="list-style-type: none"> <li>Concept of STEAM project and its development.</li> <li>STEAM project planning and action</li> <li>Ways of creating STEAM project development: <ul style="list-style-type: none"> <li>Lateral thinking, resourcefulness, discipline, curiosity, process not product</li> </ul> </li> <li>Steps of STEAM project base learning</li> <li>Design STEAM project base learning in secondary science and its implementation</li> <li>Challenges of STEAM project implementation</li> </ul> | 7 |

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

#### **Part 2: Practical**

| <b>Specific objectives</b>                                                                                                                                                                                                                             | <b>Contents</b>                                                                                                                                                                                                                                                                                                                                                                                    | <b>Periods</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <ul style="list-style-type: none"> <li>Explore problems and their remedial measures.</li> <li>Develop STEAM curriculum</li> <li>Develop STEAM Lesson and unit plan.</li> <li>Design STEAM Project</li> <li>Develop STEAM learning materials</li> </ul> | <ul style="list-style-type: none"> <li>To explore the problems and their remedial measures of critical reflection upon own (existing) science learning practices</li> <li>To develop STEAM curriculum based on primary level or basic level.</li> <li>To develop STEAM unit and lesson plans.</li> <li>To Design the STEAM-projects and development of resources or learning materials.</li> </ul> | 48             |

#### **4 Instructional Techniques**

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion method
- Demonstration method
- Project method
- Inquiry method
- Collaborative method
- Heuristic method
- Problem solving method
- Concept mapping and brain storming
- Home assignments and class participation
- Internet (web) surfing
- Individually laboratory work

- Field work

## 5 Evaluation: Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                          |                  |
|------------------------------------------|------------------|
| 16) Attendance                           | 5 points         |
| 17) Participation in learning activities | 5 points         |
| 18) First assignment ( Presentation)     | 10 points        |
| 19) Second assignment (Term exam)        | 10 points        |
| 20) Third assignment (Project work)      | 10 points        |
| <b>Total</b>                             | <b>40 points</b> |

### 5.2 Theory: External evaluation (Full marks 40)

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                  |                  |
|--------------|------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1point) | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points)                  | 30 points        |
| <b>Total</b> |                                                                  | <b>40 points</b> |

**Note: All questions are compulsory**

### 5.3 Practical: Evaluation (Full marks- 20 points)

The marks allocated to practical part are given in the following table.

| Examination           | Area                                                          | Points | Total Points     |
|-----------------------|---------------------------------------------------------------|--------|------------------|
| Internal              | Regularity                                                    | 2      | 8 points         |
|                       | Performance of activity                                       | 3      |                  |
|                       | Record book                                                   | 3      |                  |
| External              | Develop STEAM lesson plan for any area of science (exam time) | 4      | 8 Points         |
|                       | Viva                                                          | 4      |                  |
| External and Internal | Design STEAM project                                          | 2      | 4 points         |
|                       | STEAM curriculum development and explore the problems.        | 2      |                  |
| <b>Total Points</b>   |                                                               |        | <b>20 points</b> |

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

### References Books

- Babaci-WilHITE, Z. (2019). Promoting Language and STEAM as Human Rights in Education Science, Technology, Engineering, Arts and Mathematics-Springer Singapore.  
<http://62.182.86.140/main/2314000/3baa8d9db6eb2c67c52a787e9cb719da/Zehlia%28http://library.lol/main/3BAA8D9DB6EB2C67C52A787E9CB719DA%29>
- Douglas H. & Thomos, K. (2020). Challenges and Opportunities for Transforming From STEM to STEAM Education. USA: IGI Global  
<http://library.lol/main/0947A58DB6699E9FF67C44F1217B2F44>
- Ge, X., Lfenthaler, D. & Spector, J.M. (2015). Emerging Technologies for STEAM Education. Springer International Publishing.  
<http://libgen.rs/book/index.php?md5=68082A567011F863E7342E792608FCF4>

- Jaime E. M. (2017). The Search for Method in STEAM Education. Springer International Publishing. <http://libgen.rs/book/index.php?md5=0CD45D09C22263A1A4874C20D2FC877C>
- Myint, S. K., & Shaljan, A. (2019). STEAM Education Theory and Practice. Springer International Publishing. <http://library.lol/main/C3F542BDEAEBBEDDCB465B2623606535>

**Mid-West University  
Graduate School of Education  
Surkhet, Nepal**



**Bachelor of Science Education (BEd-Sc)  
Curriculum  
8<sup>th</sup> Semester**

# Bachelor of Science Education (BEd-Sc)

## Curriculum

### 8<sup>th</sup> Semester

| S. No        | Course Code No | Course Name                                      | Credit Hour | Feature              |
|--------------|----------------|--------------------------------------------------|-------------|----------------------|
| 1.           | SCED 481       | Recent Issues in Science Education               | 3           | T-2, P-1             |
| 2.           | SCED 482       | Art of Science Teaching Strategies (ASTS)        | 3           | T-3                  |
| 3            | SCED 483       | Science, Society and Environment (SSE) Education | 3           | T-3                  |
| 4            | SCED 484       | Student Teaching: On-Campus                      | 3           | T-1, P-2             |
| 5            | SCED 485       | Student Teaching: Off-Campus                     | 3           | P-3                  |
| <b>Total</b> |                |                                                  | <b>15</b>   | <b>Th-9<br/>Pr-6</b> |

**Mid-West University**  
**Graduate School of Education**

Course Title: **Recent Issues in Science Education**

Total Credit: 2+1 (Th. + Pr.)

Course Code: SCED 481

Total Period: 32+48 (Th. + Pr.) = 80 Periods

Semester: B.Ed. /VIII

Nature of Course: Theory + Practical

### **1. Course Description**

This course is designed for students who specialize in science education at the Bachelor level of Mid-Western University. This course has been divided into two parts: Theoretical and Practical understanding of science education-related issues. The theoretical understanding issues consist of different units related to science education issues like as recent contemporary issues, ICT-based issues in science, Classroom teaching-related issues, Curriculum related issues, etc. which are especially focused on science teaching and learning. In practical understanding, mostly focused to the development of issue papers, seminar papers, preparing review articles, etc. according to APA format.

This course aims to provide students with opportunities to identify explore and understand issues relevant to the school science education in Nepal. This course also helps students directly link their knowledge with the current practices in science education. The course allows students to write and present comprehensive seminar paper based on the analysis of the selected science educational issues comparing, relating and drawing upon the theoretical perspectives and research findings.

### **2. General Objectives**

On the completion of this course, student will be able to following general objectives:

- To assist the students to identify science education-related issues.
- To develop critical perspectives about the selected science teaching learning-related issues.
- To prepare a proposal for undertaking a review study and writing the seminar paper.
- To review the science-related theoretical literature, article, and research report.
- To write the comprehensive seminar paper in APA format.
- To disseminate the report in a seminar organized in campus.
- To understand the pedagogical principles underpinning the Nepalese as well as global schooling programs.
- To provide students with the in-depth knowledge of teaching chemistry and use of teaching at the secondary level effective way.

### **3. Specific Objectives and Contents**

#### **Part 1: Theoretical Understanding of Science Education-related Issues**

| <b>Specific Objectives</b>                                                                             | <b>Contents</b>                                                   | <b>Periods</b> |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|----------------|
| <ul style="list-style-type: none"><li>• To get oriented about different contemporary science</li></ul> | <b>Unit 1: Concept of Contemporary Science Educational Issues</b> | <b>8</b>       |

|                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <p>educational issues with special reference to Nepalese context.</p> <ul style="list-style-type: none"> <li>To develop critical insight/ perspectives on each issues.</li> </ul>                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>Language (Instructional medium of science)</li> <li>Non-formal approach in science teaching</li> <li>Distance learning in science and equity and inclusion</li> <li>Commonwealth mode of distance learning</li> <li>Inclusion of science each and every people</li> <li>Science for all</li> <li>Global thinking</li> <li>Models and issues of science schooling</li> <li>Modes of shadow science education</li> <li>Free and compulsory science education</li> <li>Science for the community</li> <li>Present status of science education rural/ urban environment of Nepal</li> <li>Co-relation of science with other subjects</li> <li>Cognitive and behavioristic theories/approaches in science learning.</li> <li>Difficulties of encouraging creativity related activities in science education</li> <li>Inclusion and implementation of human in science education at secondary level</li> <li>Development of scientific temper and implication for school education</li> <li>Eastern vs Western concept of science</li> <li>An inquiry into the Historical nature of science</li> </ul> |                 |
| <ul style="list-style-type: none"> <li>Discuss the historical background of ICT and its uses in the context of Nepal.</li> <li>Examine critically the future of ICT in science teaching and learning in Nepalese context</li> <li>To get oriented about different ICT based issues in science education.</li> <li>To develop critical insight/ perspectives on each issues.</li> </ul> | <p><b>Unit 2: ICT based Issues in Science Education</b></p> <ul style="list-style-type: none"> <li>Modern technology in science</li> <li>Role of ICT in school with special reference to teaching science</li> <li>Computer based multimedia with special reference to Nepalese school.</li> <li>Problems of using ICT in science content teaching</li> <li>ICT resources to support science teaching and learning</li> <li>Role of ICT in personality development and career building</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p><b>6</b></p> |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>• E-learning and changing nature of classroom</li> <li>• Challenges and drawbacks of E-learning in Nepalese science classroom</li> <li>• Need of imparting E-learning in science teacher professional development.</li> <li>• Utilizing technology for teaching and learning (Online resources: Online curriculum centre (OCC), Technology Integration Matrix (TIM), and Instructional Technology (FCIT) etc)</li> <li>• The future of ICT in science teaching and learning</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |          |
| <ul style="list-style-type: none"> <li>• Discuss different modern methods for teaching and learning science</li> <li>• Critically analyses the present status of laboratory work and improvised materials in Rural/ Urban context of Nepalese secondary schools.</li> <li>• To get oriented about different classroom teaching and practical work in science topics related issues within school science education in Nepal.</li> <li>• To develop critical insight/ perspectives on each issues.</li> </ul> | <p><b>Unit 3: Classrooms Teaching Related Issues in Science Education</b></p> <ul style="list-style-type: none"> <li>• Development of modern methods of science and technology teaching (Inquiry based, Experiential, Case based, Project based, Constructivist etc.)</li> <li>• Skills involved in science teaching</li> <li>• Community participation for the skill development of science</li> <li>• Status of teacher professional development (training) and use in classroom teaching</li> <li>• Ways of science teacher development in Nepalese context</li> <li>• Organization of science fair and academic games in science education</li> <li>• Core idea of science teaching</li> <li>• Learning to teach from experience to reflection</li> <li>• Student learning styles: Implication for teaching</li> <li>• Emerging pedagogical practices in science education</li> <li>• Science teaching materials with special reference to rural environment.</li> <li>• Science laboratory in Rural context in Nepal</li> <li>• Setting of discovery laboratory in school science</li> <li>• Status of science practices (Laboratory work in secondary science education)</li> </ul> | <b>6</b> |

|                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
|                                                                                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>Improvisation apparatus and their use in science education (Effectiveness and drawbacks)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |
| <ul style="list-style-type: none"> <li>Analyze critically status of science curriculum and existing practices of evaluation system at secondary level in Nepalese Rural/ Urban context.</li> <li>To get oriented about curriculum and evaluation related issues in school science education.</li> <li>To develop critical insight/ perspectives on each issues.</li> </ul>                                            | <b>Unit 4: Science Curriculum and Evaluation Related Issues</b> <ul style="list-style-type: none"> <li>Development of science curriculum</li> <li>Scope and limitation of science curriculum</li> <li>Curriculum development in Rural context in Nepal</li> <li>Local vs Global science curriculum</li> <li>Causes of science curriculum changes</li> <li>Effect of political system and curriculum change in Nepal</li> <li>Curriculum construction and role of science teacher</li> <li>Science textbook relevancy in rural context of Nepal</li> <li>Relevancy of present science curriculum</li> <li>Place of chemistry in today's school curriculum</li> <li>The future of chemistry curriculum in Nepalese context</li> <li>Present status of examination and evaluation system of science in Nepal</li> <li>Examination and threats of failure</li> <li>Teacher role in present evaluation system</li> <li>Innovative techniques of student assessment</li> <li>Analysis of science result with special reference to school education of Nepal</li> </ul> | 5 |
| <ul style="list-style-type: none"> <li>To explore and identify the provisions related to the above issues in different educational policies in Nepal.</li> <li>To analytically review the plan/policy documents, related articles, Research report etc. from the perspective of identified issues.</li> <li>To relate theoretical/conceptual (sociological, psychological, curricular, scientific, global,</li> </ul> | <b>Unit 5: Reviewing the issue based on the policy/ plan documents/ articles/ research report</b> <ul style="list-style-type: none"> <li>Discussion above mention issues and problems addressed in/ by <ul style="list-style-type: none"> <li>➤ SSRP (School Sector Reform Program)</li> <li>➤ NCF (National Curriculum Framework)</li> <li>➤ EAR (Education Act and Regulations)</li> <li>➤ Equity strategy</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 7 |

|                                                                  |                                                                                                                                                                                                                                  |  |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| learning etc.) perspectives of different science related issues. | <ul style="list-style-type: none"> <li>➤ Non Formal Education policy/ Guideline</li> <li>➤ TPD guideline etc.</li> <li>➤ Research report/ research articles etc (by using website)</li> <li>➤ Other related materials</li> </ul> |  |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

## Part 2: Practical Understanding of Science Education related Issues

| Specific objectives                                                                                                                                                                                                                                | Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Periods |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <ul style="list-style-type: none"> <li>• To develop plan and strategy to study about the selected science education related issue(s).</li> <li>• To review and finalize the proposal upon approval of the department/supervisor/ mentor</li> </ul> | <b>Unit 1: Proposal development</b> <ul style="list-style-type: none"> <li>• Introduction/context</li> <li>• Objective of the study</li> <li>• Rationale</li> <li>• Methodology</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 9       |
| <ul style="list-style-type: none"> <li>• Undertake theoretical and empirical review on the science related issues.</li> <li>• Review article, policy document and research report exploring the science education issues.</li> </ul>               | <b>Unit 2: Review work</b> <ul style="list-style-type: none"> <li>• Theoretical review</li> <li>• Empirical review</li> <li>• Policy document</li> <li>• Article(s)/research report/dissertation review</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 12      |
| <ul style="list-style-type: none"> <li>• Develop a seminar paper in the given format (Follow APA style)</li> <li>• Present the seminar paper individually.</li> </ul>                                                                              | <b>Unit 3: Writing and presenting the seminar paper</b> <ul style="list-style-type: none"> <li>• Introductory part: Writing the context, objectives, methodology, limitation, if any, review word (500 to 700 words)</li> <li>• Main body: Writing a comprehensive seminar paper based on the analysis of the selected science education related issues, comparing, relating and drawing upon the theoretical perspectives, policy provisions and research finding (2000 to 2500 words)</li> <li>• Conclusion part: Writing major arguments, findings, perspectives, Implications (400 to 500 words)</li> <li>• References (APA format)<br/>(Note: Seminar paper are written APA format)</li> </ul> | 27      |

#### 4. Instructional Delivery and Techniques

Depending upon the nature of the courses. The major instructional modes of techniques and delivery are:

##### **Part 1: Theoretical Understanding of Science Education related Issues**

- Lecture, discussion and document review
  - Present and discuss science education related issues in the classroom
  - Organize seminars with the involvement of guest lectures from the concerned fields.
  - The teacher divide the class into different groups for review work as mentioned in the content
  - Locate, collect and review the materials in relation to the different science education related issues mentioned in part I.

##### **Part 2: Practical Understanding of Science Education related Issues**

- The students will prepare a proposal for writing seminar paper with the help of teacher concerned.
- They will locate, collect and review the materials: theoretical and empirical literature, documents, articles and research reports.
- Students will write comprehensive seminar paper analyzing the selected science education related issues by comparing, relating and drawing upon the theoretical perspectives and research finding along with empirical evidences.
- The students will present the seminar paper in the class

##### **Other specific methods are:**

- Inquiry method
- Collaborative method
- Develop multimedia presentation
- Internet (web) surfing
- Group work, Report writing and presentation
- Individually presentation
- Assignment and class participation

#### 5. Evaluation

Internal and external Assessment:

| <b>Nature of the course</b> | <b>Internal assessment</b> | <b>External/ Semester Examination</b> | <b>Total Marks</b> |
|-----------------------------|----------------------------|---------------------------------------|--------------------|
| Theory cum practical        | 40%                        | 60%                                   | 100%               |

***Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination***

### 5.1. Internal evaluation

**Theory + Practical= 40%**

Internal evaluation will be conducted by course teacher based on following activities

|                                         |           |
|-----------------------------------------|-----------|
| 1) Attendance                           | 5 points  |
| 2) Participation in learning activities | 5 points  |
| 3) First assignment ( Presentation)     | 10 points |
| 4) Second assignment (Term exam)        | 10 points |
| 5) Third assignment (Project work)      | 10 points |
| <hr/>                                   |           |
| Total                                   | 40 points |

### 5.2 External evaluation

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. Fifty percent of the marks are allocated to the final examination. The types and nature of the questions to be included in the final examination are as follows:

|              |                                                                       |                  |
|--------------|-----------------------------------------------------------------------|------------------|
| 1.           | Objective type question (multiple choice: 10 questions x 1 point)     | 10 points        |
| 2.           | Short answer question ( 6 questions x 5 points with two or questions) | 30 points        |
| 3            | Long answer question (2 questions x 10 points with one or question)   | 20 points        |
| <b>Total</b> |                                                                       | <b>60 points</b> |

**Note:** The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic Council.

#### Recommended Reading

- American Psychological Association (2010). *Publication Manual of American Psychological Association* (6<sup>th</sup> edition). Washington DC: APA.
- Anmad, S. (2007). *Teacher's hand Book of science*, New Delhi: Anmol Publication PVT. LTD.
- Bordens, K. S and Abbott, B. B. (2011). *Research Design and Methods*. A Process approach, 8 edition. Indiana University.
- Costa, AL and Kallick, B (eds). (2009). *Habits of mind across the curriculum: Practical and creative strategies for teachers*. Alexandria, Virginia, USA. ASCD.
- Das, R.C. (1985). *Science Teaching in Science in Schools (2nd ed.)*. Sterling Publishers Pvt. Ltd.
- Derry, SJ and Murphy, DA. (1986). Designing systems that train learning ability: from theory to practice. *Review of Educational Research*. Vol 56, number 1. Pp 1–39.
- Erickson, L. (2012). *Concept-based teaching and learning*. IB Position Paper.
- Erozkan, A. (2013). The effect of communication skills and interpersonal problem solving skills on social efficacy. *Educational Sciences: Theory and Practice*. Vol 13, number 2. Pp 739–745.
- Fasko, D.(2003). Critical thinking: origins, historical development, future direction. *Critical thinking and reasoning: Current research, theory and practice*. Pp 3–20.
- Fraser, B J., et. all. (2012). *Second International Hand Book of Science Education*. Springer International Handbooks of Education. Vol II. New York, USA.

- Guy, K. (nd). *Laboratory Organization and Administration*, Mac Millan.
- Herron, T.D., Center L., Ward R., &Srinivasam V. (1997). *Problem Associated Concept Analysis Science Education*. 6, (2) 185-199.
- Hutchings, W. (2007). *Enquiry-Based Learning: Definitions and Rationale*. Manchester, UK. Centre for Excellence in Enquiry-Based Learning, The University of Manchester.
- Joshi, P. R. (2010). *Research Methodology* (4<sup>th</sup> edition). Buddha Academic Publishers and Distributors Pvt. Ltd., Kathmandu, Nepal.
- Judith S. L. and et. all. ().*Teaching and Learning of Nature of Science and Scientific Inquiry: Building Capacity through Systematic Research-Based Professional Development*. Spriner.
- Ladyman, J. (2002). *Understanding philosophy of science*. Routledge, Taylor and Francis group, London and New York.
- Mathew &Kutty,M.(2013). *Science Education: Theoretical Bases of Teaching and Pedagogic Analysis*. Rainbow book publishers, Chengannur, Kerala
- McMahon, et. all. (2006). *Assessment in Science; Practical Experiences and Experiments*. National Association in Research in Science Education, NSTA press.
- Mohan, R. (2010). *Innovative Science Teaching*, New Delhi: PHI learning private limited.
- Pandit, C.N. (2067).*Modern Science Teaching*, Kathmandu: Bidur Prakashan.
- School Science Curriculum, CDC: Government of Nepal
- Sharma, R. C. (2010). *Modern Science Teaching*, New Delhi: DhanpathRai Publishing Company.
- Thurber, W. A., &Colletta, A. (1964). *A Teaching Science in Today's Secondary Schools*. New Delhi: Prentice Hall of India.
- Vaidya, N. (1996). *Science Teaching for the 21st Century*. New Delhi: Deep & Deep Publications.

**Mid-West University**  
**Graduate School of Education**

Course Title: **Art of Science Teaching Strategies (ASTS)**

Course Code: SCED 482

Semester: B.Ed. /VIII

Total Credit: 3

Full Marks: 100

Nature of Course: Theory

Total Period: 48 Periods

### **1. Course Description**

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has theoretical in nature and it consists of different units related to teaching art and strategies in science. The major topics included in this course are the art of teaching science, Inquiry of science teaching, science for all, facilitating learning in the classroom, connecting theory and practice in teaching science, Models and designing of science teaching and Strategies of science teaching. It intends to develop their skills on teaching and fostering the collaborative thinking with a focus on science teaching.

### **2. General Objectives**

On the completion of this course student will be able to following general objectives:

- To provide students with the general knowledge of art of science teaching.
- To provide students with an opportunity to understand inquiry based teaching with its application.
- To interpret the nature of science for all, multicultural perspective of teaching and Globalization perspective of teaching.
- To acquaint the students with facilitating science teaching in classroom and their application in teaching.
- To enable the connections of various theory and practice in classroom teaching and understand the students learning styles.
- To familiarize the students with models and designing of science teaching.
- To enable the students to understand the strategies of science teaching which help the fostering of critical and collaborative thinking.

### **3. Specific Objectives and Contents**

**Part: Theory**

| <b>Specific Objectives</b>                                                                                                                                                                                                                                                                                                                                                                      | <b>Contents</b>                                                                                                                                                                                                                                                                     | <b>Periods</b> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <ul style="list-style-type: none"><li>• Discuss the concept of art of teaching and an artistry of teaching.</li><li>• Elaborate the core idea of teaching science on the basis of Stewards of student learning, Pedagogical content knowledge specialist, Facilitators of student learning and lifelong learners.</li><li>• Justify learning to teach from experience and reflection.</li></ul> | <b>Unit 1: The art of teaching science</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• An Artistry of teaching</li><li>• Core idea of teaching science</li><li>• Learning to teach from experience and reflection</li><li>• Nature of science teaching</li></ul> | <b>6</b>       |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <ul style="list-style-type: none"> <li>• Describe the nature teaching on the basis of science and courage, Human imagination and creativity, Science and human values, And Science and democracy.</li> <li>• Discuss the scientific enterprises and teaching on the basis of nature of science.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>- Science and courage</li> <li>- Human imagination and creativity</li> <li>- Science and human values</li> <li>- Science and democracy</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |          |
| <ul style="list-style-type: none"> <li>• Define inquiry and inquiry based teaching.</li> <li>• Discuss the inquiry and constructivism.</li> <li>• List out the key elements linking constructivist learning with inquiry learning.</li> <li>• Describe the inquiry in the science classroom on the basis of top-down and bottom-up approach of teaching.</li> <li>• Discuss the classroom environment which affect the fostering of inquiry learning.</li> <li>• Describe the life beyond inquiry on the perspectives of cooperative and collaborative teaching.</li> <li>• Compare and contrast the scientists and students (Two culture).</li> <li>• Discuss the gap of bridging scientist and science students.</li> <li>• Draw the Mary Budd Rowe's model of science education</li> <li>• Describe the features of practice based science teaching and Humanistic science teaching.</li> <li>• List out the characteristics features of effective science teacher.</li> </ul> | <b>Unit 2: Inquiry and science teaching</b> <ul style="list-style-type: none"> <li>• Inquiry and constructivism</li> <li>• Inquiry in the science classroom</li> <li>• Environment that foster inquiry learning.</li> <li>• Life beyond inquiry <ul style="list-style-type: none"> <li>-Cooperative and collaborative teaching</li> </ul> </li> <li>• The scientist and the students (Two culture) <ul style="list-style-type: none"> <li>- Mary Budd Rowe's model of science education</li> </ul> </li> <li>• Practice based science teaching</li> <li>• Humanistic science education</li> <li>• The Effective Science teacher</li> </ul> | <b>6</b> |
| <ul style="list-style-type: none"> <li>• Introduce science for all</li> <li>• Lis out the fundamental characteristics of learners on the basis of science for all.</li> <li>• Explain the perspectives of global thinking on the basis of fostering events, rationale, activities and curricula, changing social structure of the world, global consciousness, and globalization.</li> <li>• Point out the goals of global thinking and discuss their implication of science teaching.</li> <li>• Discuss global thinking on multiculturalism perspectives.</li> <li>• Define and discuss multicultural education.</li> </ul>                                                                                                                                                                                                                                                                                                                                                     | <b>Unit 3: Science for all</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Global thinking <ul style="list-style-type: none"> <li>- Goals of global thinking</li> </ul> </li> <li>• Global thinking and multiculturalism.</li> <li>• Multicultural education <ul style="list-style-type: none"> <li>- Definition, Characteristics, goals and status</li> </ul> </li> <li>• Teaching for multicultural perspectives. <ul style="list-style-type: none"> <li>- Multicultural science teaching</li> </ul> </li> </ul>                                                                                                    | <b>8</b> |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• List out the characteristics of multicultural education.</li> <li>• Write the status and goals of multicultural education</li> <li>• Discuss the need and importance of multicultural science teaching in school level.</li> <li>• Describe the key aspects of multicultural education on the basis of Alternative way of knowing, Linguistic pluralism, cultural inclusive science, student's world view and critical multicultural perspectives.</li> <li>• Explain effective teaching practice on the basis of Cultural response teaching, Cooperative learning, Instructional conversation, Cognitive guided instruction and Technology-enriched instruction.</li> <li>• Discuss the strategies to encourage females in science courses and careers.</li> <li>• Describe the successful teaching strategies for participation of women on the basis of Content and activities, Social arrangement, Confidence building and sex-role awareness.</li> <li>• Discuss the exceptional student in the science classroom on the way of science for all.</li> </ul> | <ul style="list-style-type: none"> <li>- Key aspects of multicultural science education</li> <li>- Effective teaching practice</li> <li>• Participation of women in science</li> <li>• Science for all exceptional students.</li> <li>.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                  |   |
| <ul style="list-style-type: none"> <li>• Describe the facilitation and leadership in the science classroom on the basis of Wong's effective attributes of classroom leadership.</li> <li>• Discuss the teacher centered facilitation on the basis of Effective management behavior, Overlapping, Smoothness, momentum etc.</li> <li>• Explain the different phases for management plan in the science laboratory activity.</li> <li>• Describe the student centered facilitation on the basis of social constructivism, cooperative learning, Individual accountability, Face to face communication and interpersonal skills.</li> <li>• Discuss effecting teaching for the beginning of the year on the basis of Classroom arrangement, Consideration of rules and procedure, Rules for the science classroom,</li> </ul>                                                                                                                                                                                                                                                                                | <p><b>Unit 4: Facilitating learning in the classroom</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Facilitation and leadership in the science classroom</li> <li>• The facilitative science teacher <ul style="list-style-type: none"> <li>- Teacher centered facilitation-traditional perspectives</li> <li>- Student-centered facilitation – humanistic perspectives</li> </ul> </li> <li>• Effective teaching for the starting phase <ul style="list-style-type: none"> <li>- Plan for teaching first day</li> </ul> </li> <li>• Science teaching materials and Facilities</li> </ul> | 7 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <p>Beginning and end of class, Handling materials and equipment etc.</p> <ul style="list-style-type: none"> <li>• Develop the plan for first day lesson on the basis of teacher centered classroom and Student centered classroom.</li> <li>• Explain the science teaching materials and facilities on the basis of Materials for science teaching, Inventorying science materials, Science kit, Facilities of science teaching, Space for learning etc.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |
| <ul style="list-style-type: none"> <li>• Introduce and discuss Learner's schooling and education.</li> <li>• Discuss the theories of how students learn from theory to practice or practice to theory?</li> <li>• Describe the Dewey's theory of experience on the basis of Conception of learning, Experience and ideas based teaching.</li> <li>• Elaborate the Dewey's principle of teaching on the basis of Student's active participations in learning and Value on indirect teaching,</li> <li>• Write the major implication of Dewey's principle for school and non-school learning.</li> <li>• Describe the Jerome Bruner and process of science education on the basis of Discovery learning, Curiosity and uncertainty, Structure of knowledge, Sequencing, Motivation, Cognitive learning theory, Importance of content knowledge etc.</li> <li>• Discuss the Jean Piaget and the development of knowledge on the basis of Mental structure and Cognitive processes.</li> <li>• Compare traditional teaching with Radical constructivism.</li> <li>• Describe the cycle of learning processes on the basis of Glasersfeld's theory.</li> <li>• Discuss the theory of conceptual change teaching.</li> <li>• Describe the theory of Zone of Proximal development (ZPD) and their implication of science teaching.</li> <li>• Describe the situated cognition and authentic learning.</li> </ul> | <p><b>Unit 5: Connecting theory and practice in science teaching</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Learners, Schooling and Education</li> <li>• Theories of how students learn</li> <li>• John Dewey and the experience of learning. <ul style="list-style-type: none"> <li>- Dewey's principle of Teaching and learning</li> </ul> </li> <li>• Jerome Bruner and the process of science education</li> <li>• Jean Piaget and the development of knowledge</li> <li>• Glasersfeld and radical constructivism <ul style="list-style-type: none"> <li>- Cycle of learning processes</li> <li>- Conceptual change teaching</li> </ul> </li> <li>• Vygotsky and sociocultural perspectives of learning <ul style="list-style-type: none"> <li>- ZPD</li> <li>- Collaborative learning</li> <li>- Situated cognition and Authentic learning</li> <li>- Feminist perspectives and participations</li> </ul> </li> </ul> | 8 |

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• Discuss the sociocultural perspectives of collaborative learning.</li> <li>• Discuss the Feminist perspective and participation of learning.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |
| <ul style="list-style-type: none"> <li>• List out the various types of teaching models developed by different learning theories.</li> <li>• Explain the constructivist model of conceptual change.</li> <li>• Write the different stages, teacher and students activities of Conceptual change model (CCM).</li> <li>• Describe the sociocultural models of constructing knowledge.</li> <li>• Prepare the constructivist lesson planning template</li> <li>• Discuss the direct and interactive teaching model.</li> <li>• List out the major characteristics and important of direct/ interactive model of teaching.</li> <li>• Describe the different phases of designing a mini unit with examples.</li> <li>• Design the mini unit and science course of study.</li> </ul>                     | <b>Unit 6: Models and Designing of science teaching</b> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Constructivist model of conceptual change</li> <li>• Sociocultural models of constructing knowledge</li> <li>• Direct / Interacting teaching model</li> <li>• The design process</li> <li>• Designing a mini unit</li> <li>• Designing a science course of study</li> </ul>                                                                                                                                                     | 6 |
| <ul style="list-style-type: none"> <li>• Discuss the strategies for assessing active science learning and assessing classroom learning.</li> <li>• Describe the assessment in the science classroom on the basis of formative and summative assessment.</li> <li>• List out the characteristics of assessment.</li> <li>• Elaborate the multiple methods of classroom assessment on the basis of Diagnostic methods, Group-T-chart, Pictorial and Drawing, Concept mapping, Probing activities, Asking questions, Conferencing, Homework etc.</li> <li>• Explain the strategies of fostering critical and creative thinking.</li> <li>• List and explain the specific strategies of interactive teacher.</li> <li>• Point out the interactive teaching skills and their teacher actions.</li> </ul> | <b>Unit 7: Strategies of science teaching</b> <ul style="list-style-type: none"> <li>• Assessing active science learning</li> <li>• Assessing Classroom learning</li> <li>• Assessment of the science classroom</li> <li>• Multiple methods of classroom assessment</li> <li>• Strategies of fostering critical and creative thinking</li> <li>• Interactive teaching strategies</li> <li>• Strategies for fostering collaborative thinking <ul style="list-style-type: none"> <li>- Basic and integrated science thinking skills</li> </ul> </li> </ul> | 7 |

|                                                                                                                                                                                                                                                                                                                                                     |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| <ul style="list-style-type: none"> <li>• Discuss the major strategies that foster independent and collaborative thinking on the basis of problem solving, Scientific thinking and cognitive/constructivist approach for integrating process and contents.</li> <li>• Differentiate between basic and integrated science thinking skills.</li> </ul> |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|

*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

#### 4. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion
- Inquiry method
- Project method
- Cooperative and collaborative learning methods
- Home assignments
- Team teaching and feedback session
- Group activities

#### 5. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

***Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination***

##### 5.1. Internal evaluation

##### a. Internal Evaluation ..... 40%

Internal evaluation will be conducted by course teacher based on following activities:

|                                                         |                  |
|---------------------------------------------------------|------------------|
| 1) Attendance                                           | 5 points         |
| 2) Participation in learning activities                 | 5 points         |
| 3) First assignment ( written assignment)               | 10 points        |
| 4) Second assignment ( project work with presentation ) | 10 points        |
| 5) Third assignment/ Exam                               | 10 points        |
| <b>Total</b>                                            | <b>40 points</b> |

##### 5.2 External Evaluation (Final Examination)..... 60%

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. The types and nature of the questions to be included in the final examination are as follows:

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Examination Division, office of the Dean, Faculty of Education will conduct final examination at the end of semester.

|                                                                |          |
|----------------------------------------------------------------|----------|
| 1) Objective type question (Multiple choice 10questionsx1mark) | 10 marks |
| 2) Short answer questions (6 questions x 5 marks)              | 30 marks |
| 3) Long answer questions (2 questions x 10 marks)              | 20 marks |
| <hr/>                                                          |          |
| Total                                                          | 60 marks |

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**Note: All questions are compulsory**

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

### **Recommended books**

- Aikenhead, G.S. (2006). *Science Education for Everyday Life*. New York: Teacher College Press.
- Bergmann, J. & Sams, A. (2012). Flip your classroom: Reach every student in every class every day. *International Society for Technology in Education*.
- Borich, G. D. (2006). *Effective Teaching Methods*. Upper Saddle River, NJ: Prentice Hall.
- Bronowsky, J. (1958). *Science and Human Values*. New York: Harper & Row.
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**Mid-West University**  
**Graduate School of Education**

Course Title: **Science, Society and Environment (SSE) Education**

Course Code: SCED 483

Semester: B.Ed. /VIII

Total Credit: 3

Full Marks: 100

Nature of Course: Theory

Total Period: 48 Periods

## **6. Course Description**

This course is designed for the students who specialize in science education at Bachelor level of Mid-Western University. This course has theoretical in nature and it consists of different units related to basic and advanced concept of Science, Society and Environment. The major topics included in this course are Science, Technology and Society, Physics and Society, Chemistry and Society, Environmental problems and Society, Pollution and Society, Economic environment of society, and Environmental worldview and ethics. It intends to develop their skills on societal problems and tackle them. This course aim is to link science in society in various perspectives and aware the different societal phenomena.

### **General Objectives**

On the completion of this course student will be able to following general objectives:

- To provide students with the general knowledge of Science, Technology and Society.
- To provide students with an opportunity to understand their relationship between Physics and society as well as Chemistry and society with its application.
- To interpret the nature of environmental problems in society and tackle the different issues socially.
- To acquaint the students with economic environment of society and adopt ways of reducing poverty in society.
- To familiarize the students with different types of pollution causes in society and ways to controlling them.
- To provide students with an opportunity to understand the important environmental world view and their ethics.

## **7. Specific Objectives and Contents**

### **Part: Theory**

| <b>Specific Objectives</b>                                                                                                                                                                                                                                                                                                                  | <b>Contents</b>                                                                                                                                                                                                          | <b>Periods</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <ul style="list-style-type: none"><li>• Discuss the nature of STS</li><li>• Point out the characteristics of STS programs.</li><li>• Discuss the nature of human society and technology.</li><li>• Discuss the different ways to connect science into society</li><li>• Draw the Interdisciplinary thinking model and explain it.</li></ul> | <b>Unit 1: Science, Technology and society (STS)</b> <ul style="list-style-type: none"><li>• Introduction</li><li>• The nature of STS</li><li>• Characteristics of STS</li><li>• Connecting science to society</li></ul> | <b>6</b>       |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <ul style="list-style-type: none"> <li>• Collect different evidences to support STS teaching.</li> <li>• Discuss the nature of humanistic science teacher.</li> <li>• Describe the various strategies for teaching STS in the classroom.</li> <li>• Write the major theme of STS and discuss how to teach them.</li> <li>• Point out the STS evaluation criteria.</li> <li>• Define scientific literacy and their types.</li> <li>• Discuss the Need and importance scientific literacy in society.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>• Holistic/ Interdisciplinary thinking</li> <li>• Evidence to support STS teaching</li> <li>• Strategies for teaching STS</li> <li>• STS Themes</li> <li>• STS evaluation criteria</li> <li>• Scientific literacy and their types.</li> <li>• Need and important of scientific literacy in society.</li> </ul>                                                                                                                                                                                                                                                                                           |   |
| <ul style="list-style-type: none"> <li>• Discuss the relation of physics in society.</li> <li>• List out the scope of physics in society.</li> <li>• Point out the importance of physics for the development of society.</li> <li>• Discuss the various examples of energy and energy is indispensable.</li> <li>• List out the importance of energy in everyday life.</li> <li>• List out the importance of energy for the development of nation.</li> <li>• Discuss the solar energy and point out the application of solar energy on earth.</li> <li>• Explain the different types of solar devices and their application.</li> <li>• Describe the major principle for generation of hydroelectricity.</li> <li>• Point out the application, advantage and disadvantage of hydroelectricity in society.</li> <li>• Discuss the impact of Nuclear, Biomass, tidal, wind and geo-thermal energy in society.</li> <li>• Describe energy crisis problem in society and suggest the remedy to the probable energy crisis.</li> <li>• Discuss the Energy Scenario in Nepal.</li> <li>• Discuss the physics, technology and society.</li> <li>• Link between technology and physics</li> <li>• Compare and contrast hypothesis, axioms and model.</li> </ul> | <p><b>Unit 2: Physics and Society</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Scope of physics</li> <li>• Physics and development</li> <li>• Energy and their sources</li> <li>• Importance of energy</li> <li>• Solar energy and solar device</li> <li>• Hydroelectric energy</li> <li>• Nuclear, Biomass, tidal, wind and geo-thermal energy</li> <li>• Energy crisis and their impact on society.</li> <li>• Energy Scenario in Nepal.</li> <li>• Physics, Technology and Society</li> <li>• Hypothesis, axioms and model</li> <li>• Fundamental forces of nature.</li> <li>• Nature of physical law</li> </ul> | 7 |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                             |   |
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| <ul style="list-style-type: none"> <li>Describe the fundamental forces of nature on the basis of Gravitational, Electromagnetic, Nuclear and Towards Unification forces.</li> <li>Discuss the different domain of nature and their conservation law.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                             |   |
| <ul style="list-style-type: none"> <li>Point out the scope of chemistry in society.</li> <li>Discuss the relation of chemistry in society.</li> <li>Point out the importance of Chemistry for the development of society.</li> <li>Explain the impact of chemistry on society.</li> <li>Discuss the role of chemistry in society.</li> <li>List out the different kitchen chemicals (oil, Zinzer, etc.) and discuss their advantage and disadvantage of human health.</li> <li>Describe the fermentation process of ethyl alcohol with diagram and their principle reaction.</li> <li>Discuss the advantage and disadvantage of alcoholic beverage in society.</li> <li>List the different chemicals used in agro farming (Urea, pesticides etc) and point out their advantage and disadvantage.</li> <li>List out the different non-food chemicals (Soap, Detergent, cleaning product, cosmetics, paints, wax etc) and discuss positive and negative aspect of society.</li> <li>Discuss the chemical and biological contamination of water.</li> <li>Discuss the who use it and how much drink water?</li> <li>Describe the water filtration techniques with self-explanatory diagram.</li> <li>Explain the waste water treatment techniques</li> <li>List out the quantity and calories of food in different age level.</li> <li>Discuss the weight loss- diet and excise</li> <li>List the commonly used drugs and write their physiochemical function.</li> <li>Discuss the drug use, misuse and abuse.</li> <li>List the different hazardous chemicals used in daily life and their impact on society.</li> </ul> | <b>Unit 3: Chemistry and Society</b> <ul style="list-style-type: none"> <li>Scope of Chemistry</li> <li>Chemistry and development</li> <li>Chemistry and its role in society</li> <li>Chemistry and kitchen</li> <li>Chemistry and agriculture</li> <li>Alcohols</li> <li>House hold chemicals</li> <li>Water</li> <li>Food calories</li> <li>Drugs</li> <li>Hazardous materials</li> </ul> | 7 |
| <ul style="list-style-type: none"> <li>Introduce the major environmental problems in society.</li> <li>Differentiate among Environment, Ecology and Environmental Science</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Unit 4: Environmental Problems in society</b> <ul style="list-style-type: none"> <li>Introduction</li> </ul>                                                                                                                                                                                                                                                                             | 5 |

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| <ul style="list-style-type: none"> <li>• Discuss the environmentally sustainable society.</li> <li>• Explain the problems of Population growth, Economic growth, development and globalization of society</li> <li>• Discuss some bad but challenging news about economic development.</li> <li>• Describe the Globalization on the basis of economic development, Information and communication and environmental effect.</li> <li>• Connect environmental problems their causes in society.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>• Environment, Ecology and Environmental Science</li> <li>• Environmentally sustainable society</li> <li>• Population growth, Economic growth, development and globalization.</li> <li>• Environmental problems causes and connections.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |   |
| <ul style="list-style-type: none"> <li>• Discuss the pollution and where do pollution come from.</li> <li>• List out the common pollutants in surrounding society.</li> <li>• Describe the effect of pollution on human beings, plants, Animals, Non-living beings in society.</li> <li>• List out the different types of pollution occurs in society.</li> <li>• Point out the major sources, Major pollutants and causes of water pollution in society.</li> <li>• Discuss the water pollution of Nepal and its causes.</li> <li>• Point out the ways to minimize water pollution in Nepalese society.</li> <li>• Discuss the noise pollution on society on the basis of Threshold of hearing, intensity level of various sources in decibel unit, Sources, effect in human and criteria for hearing loss.</li> <li>• Discuss the noise pollution in Nepal and point out the ways to controlling noise pollution.</li> <li>• Point out the major function of atmosphere in society.</li> <li>• Write the major, minor and trace component of atmosphere.</li> <li>• List out the major sources and effect of air pollution in society.</li> <li>• Discuss the air pollution in Nepal and point out the ways of controlling air pollution.</li> <li>• List the main sources, effect and ways of controlling terrestrial pollution in society.</li> <li>• List the major sources, effect and safety measures of radiation pollution.</li> </ul> | <p><b>Unit 5: pollution and society</b></p> <ul style="list-style-type: none"> <li>• Pollution</li> <li>• Pollution and pollutant</li> <li>• Effect of pollution</li> <li>• Types of pollution</li> <li>• Water pollution <ul style="list-style-type: none"> <li>- Major sources, pollutants, and causes</li> <li>- Water pollution in Nepal</li> <li>- Minimize water pollution</li> </ul> </li> <li>• Noise pollution <ul style="list-style-type: none"> <li>- Threshold of hearing, intensity level of various sources in decibel unit, Sources, effect in human and criteria for hearing loss.</li> <li>- Noise pollution in Nepal</li> </ul> </li> <li>• Air pollution <ul style="list-style-type: none"> <li>- Function of atmosphere in society</li> <li>- Composition of atmosphere</li> <li>- Sources and effect of air pollution in society.</li> </ul> </li> </ul> | 8 |

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| <ul style="list-style-type: none"> <li>• Suggest to minimizing ways to control the pollution in society.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <ul style="list-style-type: none"> <li>- Air pollution in Nepal</li> <li>• Terrestrial pollution</li> <li>• Radiation Pollution</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |   |
| <ul style="list-style-type: none"> <li>• Introduce economic resources in society</li> <li>• List out main support and drives economics in society (Natural, human, financial manufactured resources etc.)</li> <li>• Explain the major types of economic systems on the basis of free-market, Capitalist market and governments intervened in market in economic system.</li> <li>• Discuss the pros and cons of global market.</li> <li>• Differentiate conventional and economical economists differs in their view of market based economic system.</li> <li>• List the ways of environmentally sustainable economic development.</li> <li>• Describe the process of Monitoring economics and environmental progress in society.</li> <li>• Discuss economics of pollution control and resources management on the basis of how much are we prepared to pay to control pollution?, assign monetary values to resources and pollution costs, Natural resources is used or manage and Benefit cost-analysis</li> <li>• Discuss the Pros and cons of using regulations to improve environmental quality.</li> <li>• Explain how economic incentives and disincentives can be used to improve environmental quality and reduce resources waste.</li> <li>• Point out the pros and cons of using tradeable pollution and resources-used rights.</li> <li>• Discuss the ways for environmental management change.</li> <li>• Discuss the factors affecting external and internal validity.</li> <li>• Describe the ways of Reducing poverty to improve environmental quality and Society.</li> </ul> | <p><b>Unit 6: Economic environment of society</b></p> <ul style="list-style-type: none"> <li>• Introduction</li> <li>• Economic Resources</li> <li>• Types of economic system</li> <li>• Pros and cons of global market</li> <li>• Conventional and ecological economic system</li> <li>• Environmentally sustainable economic development.</li> <li>• Monitoring economics and environmental progress in society.</li> <li>• The economics of pollution control and resources management</li> <li>• Using regulations and markets forces to improve environmental quality in society. <ul style="list-style-type: none"> <li>- Pros and cons of using regulations to improve environmental quality</li> <li>- Reduce resources waste</li> <li>- Using tradeable pollution and resource use rights</li> <li>- Environmental management change</li> </ul> </li> <li>• Reducing poverty to improve environmental quality and Society</li> </ul> | 8 |

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| <ul style="list-style-type: none"> <li>• Define and discuss the environmental worldview.</li> <li>• Differentiate between Instrumental and Intrinsic world view.</li> <li>• Draw the flowsheet diagram of Environmental world view.</li> <li>• Explain the Human centered world view by using different variations of environmental world view.</li> <li>• Discuss the life-centered environmental world view.</li> <li>• Write the some major Biocentric and Ecocentric world view.</li> <li>• Draw the flowsheet diagram of life-centered environmental world view.</li> <li>• Explain ecofeminist environmental worldview.</li> <li>• Discuss social ecology worldview.</li> <li>• Write and discuss the ethical guidelines for working with the earth.</li> <li>• Explain, how can we implement earth education.</li> <li>• Discuss the major factors to shift the culture in society.</li> <li>• Describe the major component of environmental revolution.</li> </ul> | <b>Unit 7: Environmental World view and ethics</b> <ul style="list-style-type: none"> <li>• Environmental world view <ul style="list-style-type: none"> <li>- Instrumental and Intrinsic view</li> </ul> </li> <li>• Human centered world view</li> <li>• Life- centered environmental worldview <ul style="list-style-type: none"> <li>- Ecofeminist environmental worldview</li> <li>- Social ecology worldview</li> </ul> </li> <li>• Ethical guidelines for working with the earth</li> <li>• Implement earth education.</li> <li>• Cultural shift</li> <li>• Environmental Revolution</li> </ul> | 7 |
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*Note: The figure with in the parentheses indicates the approximate periods for respective units.*

## 8. Instructional Techniques

The instructional techniques for this course general instructional techniques to most of the units and some of the unit also used model, chart etc. depending upon the nature of the courses. The major instructional techniques are:

- Lecture method
- Discussion
- Inquiry method
- Project method
- Cooperative and collaborative learning methods

- Proposal writing and presentation in the classroom
- Home assignments
- Team teaching and feedback session
- Group activities

## 9. Evaluation

Internal and external Assessment:

| Nature of the course | Internal assessment | External/ Semester Examination | Total Marks |
|----------------------|---------------------|--------------------------------|-------------|
| Theory cum practical | 40%                 | 60%                            | 100%        |

**Note: Students must pass separately in internal assessment, external practical exam/viva or semester examination**

### 5.1. Internal evaluation

#### b. Internal Evaluation ..... 40%

Internal evaluation will be conducted by course teacher based on following activities:

- |                                                         |           |
|---------------------------------------------------------|-----------|
| 6) Attendance                                           | 5 points  |
| 7) Participation in learning activities                 | 5 points  |
| 8) First assignment ( written assignment)               | 10 points |
| 9) Second assignment ( project work with presentation ) | 10 points |
| 10) Third assignment/ Exam                              | 10 points |

#### 5.2 External Evaluation (Final Examination)..... 60%

Examination Division, Office of the Dean, Faculty of Education will conduct final examination at the end of the semester. The types and nature of the questions to be included in the final examination are as follows:

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|                                                                                                                       |          |
|-----------------------------------------------------------------------------------------------------------------------|----------|
| Examination Division, office of the Dean, Faculty of Education will conduct final examination at the end of semester. |          |
| 4) Objective type question (Multiple choice 10questionsx1mark)                                                        | 10 marks |
| 5) Short answer questions (6 questions x 5 marks)                                                                     | 30 marks |
| 6) Long answer questions (2 questions x 10 marks)                                                                     | 20 marks |
| <hr/>                                                                                                                 |          |
| Total                                                                                                                 | 60 marks |

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**Note: All questions are compulsory**

**Note: The marking system will be changed to CGPA system as per the rules and regulations of the university's Academic council.**

### Recommended books

Agarwal, O. P. (2004). *Chemistry of Organic Natural Products (Vol. 1)*. Meerut: Goel Publishing house.

Aikenhead, G.S. (2006). *Science Education for Everyday Life*. New York: Teacher College Press.

- Bahl, A., & Bhal, B.S. (2008). *A textbook of organic chemistry*. New Delhi: S. Chanda and company limited.
- Bronowsky, J. (1958). *Science and Human Values*. New York: Harper & Row.
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- Derry, SJ & Murphy, DA. 1986. Designing systems that train learning ability: from theory to practice. *Review of Educational Research*. Vol 56, number 1. Pp 1–39.
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- IUCN, (2000). *Environmental Education, Source Book*, Nepal: The World Conservation union, Kathmandu.
- Katyal, T.& Satake, M. (1989). *Environmental pollution*. India: Anmol Publication Pvt.Ltd. New Delhi.
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- Miller G.T.(2005). *Living in the Environment Principles, Connections, and Solutions (13ed.)*. Singapore: Thomson Asia Pte.Ltd. ISBN 981-265-632-4.
- Pandit, C.N & Subedi, R.R. (2012). *Environmental Chemistry*. Kathmandu: Cambrige publication Pvt. Ltd. kalimati.
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- Sears, F.W., Zemansky, M. W., Yong, H.D., Freedman, R.A. & Ford, A.L. (2009). *University physics*. Singapore: Pears on Education.
- Subrahmanyam, N. and Brij, L.(1996). *Principles of physics*. New Delhi: S. chanda and company Ltd.

**Mid-West University**  
**Graduate School of Education**

Course Title: **Student Teaching: On-campus**  
Course Code: SCED 484  
Semester: B.Ed. /VIII

Total Credit: 1+2 (Th. + Pr.)  
Nature of Course: Theory + Practical

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### **1. Course Introduction**

This course is designed to provide students an opportunity to prepare for their practice teaching towards the end of the semester. The students will learn to make lesson plans and prepare the teaching-learning materials during the course work. In addition to this, they will also do the micro-teaching and observe some of the classes in the schools and bring their comments on them. Finally, the students will go to the school and teach the assigned course.

### **2. Course Objectives**

The objectives of the course are:

- a) to give students practical experience in preparing lesson plans
- b) to expose students to micro-teaching experience as a preparation for real teaching in schools.
- c) to provide students an opportunity to prepare teaching-learning materials for real teaching
- d) to develop students' class observation skills.
- e) to give them real teaching experience in schools.

### **3. Course Contents**

The objective of the on-campus activities is to prepare students with the required skills for their real classroom teaching in schools. On-campus activities will have four major components viz. field observation and class seminars; preparation of lesson plans; preparation of teaching-learning materials; and supervised micro-teaching. The details of each component are given below:

#### **1. Field Observation and Class Seminars**

Each student will be assigned a school and an internal supervisor at the beginning of the eighth semester. The student will visit the school, build a rapport with the Science teacher, discuss the practical issues of science in the classroom, and observe some of the lessons in class. The observation will focus on the key areas of Science practical pedagogy, classroom management, lesson sequence, activities, students' engagement patterns of classroom interaction etc. Prior to the school visit, the supervisor and the students will prepare an observation form and the students will be given due orientation at the campus on what to observe, how to observe and how to keep a record of what was observed in class. Each student will observe at least five lessons in certain intervals and prepare a report for the class seminar. The seminar will discuss the issues observed in schools and the students will draw implicative lessons from the discussion for their practice teaching. After the class seminar, the students will submit an individual report of their observations along with their critical reflections in about 1000-1500 words.

#### **2. Preparation of Lesson Plans**

The students will prepare 20 lesson plans from different areas of Science teaching. The supervisor will review the lesson plans and provide his/her feedback for their improvement

before the students submit them for final grading. The grading of the lesson plan will be made based on the criteria such as the format of the lesson, learning goals, activities, and lesson sequence.

### **3. Preparation of Teaching and Learning Materials**

A weeklong materials preparation workshop will be organized on-campus and the students will prepare all the required materials for their real classroom teaching. Flash cards, posters, worksheets, activities, audio recordings, collection of pictures, drawing etc. will be prepared during the workshop. The supervisor will review the materials and sign them.

### **4. Supervised Micro-teaching**

Students will teach five to ten micro-lessons during their supervised micro-teaching. All the micro-teaching sessions will be observed by the supervisor and necessary feedback will be provided to the students. After the micro-teaching post observation seminar will be organized in order to share the reflection of the students and the feedback of the supervisor and peers. Some of the classes will be videotaped and the students will be asked to make comments on their own lessons.

### **5. Evaluation Scheme**

|                                              |         |
|----------------------------------------------|---------|
| • Field observation and class seminar        | 20marks |
| • Preparation of lesson plan                 | 20marks |
| • Preparation of teaching learning materials | 20marks |
| • Supervised Micro-teaching                  | 40marks |

### **6. Prescribed Texts**

- a) Cohen, L., Manion, L. and Morrison, K. (2008). *A guide to teaching practice*. Oxon. Routledge.
- b) Richards, J. C. and Farrell, T. S. C. (2011). *Practice teaching; a reflective approach*. Cambridge. Cambridge University Press.



**Mid-West University**  
**Graduate School of Education**

Course Title: **Student Teaching: Off-campus**  
Course Code: SCED 485  
Semester: B.Ed. /VIII

Total Credit: 3  
Nature of Course: Practical

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### **1. Course Introduction**

This is a course that is designated to the real teaching of students in the schools. The students will go to the assigned schools and work with the regular teachers. They plan the lessons in consultation with the regular teacher and deliver the lessons in class. The school teacher will be requested to observe the student-teacher's class and provide their feedback.

### **2. Course Objectives**

The objectives of the course are:

- a) to give students real teaching experience in schools
- b) to expose students to the school environment so that they learn the school culture
- c) to train them in real teaching and other extra-curricular activities.

### **3. Course Contents**

#### **Off-Campus Activities:**

The students will go to the schools and start their real teaching. In addition to teaching, students will also learn other school activities such as test item construction, organizing and managing extra-curricular activities, case studies, and so on. Major activities that the students will be engaged in during this teaching are as follows:

#### **a) Actual Teaching**

Each student will be required to teach a minimum of 30 lessons not exceeding one lesson per day. The students will prepare a daily lesson plan and all the necessary teaching learning materials along with the worksheet in close coordination with the school teacher and campus supervisor in advance and deliver the lesson in school. Out of thirty, at least five lessons will be observed by the campus supervisor at different time intervals.

#### **b) Case Study**

The student will identify a particular case for a detailed study. The case could be a student with a unique learning style, a teacher who has been well-recognized for his/her Science lessons, a group of students with different needs, a group of students from an indigenous community, or a student with a different ability. The case should be studied in detail and a report of about 2000 words should be produced and submitted to the campus supervisor.

#### **c) Teaching Logbook and Test Item Construction**

Students will be required to maintain a log book of their teaching every day. The logbook should record the class, the subject they teach, and the main activities they carried out. Similarly,

students will also prepare test items from the course they teach in the school. The test items will include at least 20 objective questions and ten subjective questions of various types.

**d) Extra-curricular Activities**

Students should organize at least one extra-curricular event in the school and a report of the event should be submitted to the campus supervisor.

**5. Evaluation Scheme**

|                                            |          |
|--------------------------------------------|----------|
| • Classroom teaching                       | 50marks  |
| • Case study                               | 10marks  |
| • Logbook record                           | 10marks  |
| • Test items construction                  | 20marks  |
| • Extra-curricular activities event report | 10 marks |

**6. Prescribed Texts**

- a) Cohen, L., Manion, L. and Morrison, K. (2008). *A guide to teaching practice*. Oxon. Routledge.
- b) Richards, J. C. and Farrell, T. S. C. (2011). *Practice teaching; a reflective approach*. Cambridge. Cambridge University Press.