MID-WEST UNIVERSITY

FACULTY OF ENGINEERING

Surkhet, Nepal

CURRICULUM OF BACHELOR IN CIVIL ENGINEERING

2021

Contents

GENERAL POLICY

ON

BACHELOR OF CIVIL ENGINEERING PROGRAM OF
MID-WEST UNIVERSITY

1. Introduction

Mid-West University (MU) is offering undergraduate (Bachelor level) program in Civil Engineering with the objective of producing high-level technical manpower as per the nation's need and equipping with capacity to undertake any kinds of Civil Engineering works using the latest technologies. Basic information regarding the general policy of Mid-West University related to Bachelor of Civil Engineering Program is stated in below sections

2. Title

The title of the program is Bachelor of Civil Engineering (B.E. Civil)

3. Objective

The objective of the Civil Engineering Program at Mid-West University is to prepare students with appropriate technical & analytical knowledge and skills to produce high quality Civil engineers and researchers.

4. Duration of the Course

The total duration of the course is 4 years (eight semesters). Each year consists of two semesters.

5. Medium of Instruction and Examination

The medium of instruction and examination of Civil Engineering Program shall be in English.

6. Entry Requirement for New Students

The entry requirement for students in B.E. Civil is Intermediate in Science (I.Sc.), or Higher Secondary level (10+2) or Diploma in Engineering or Architecture or equivalent from a recognized institution with at least a second division marks at their respective Intermediate level. Besides the basic academic requirement, the candidate must have passed entrance examination conducted by the University.

7. Admission Procedure

The entrance test application form and the information brochure shall be provided on request at the Dean's Office (MU) or at the concerned college. The concerned college scrutinizes the applications. The eligible candidates are informed to appear in the entrance test. The exact date for the entrance test is communicated to the applicants by the college. The candidates shall be admitted on merit basis.

The college may also hold interviews for the candidates before their final selection for admission. Eligible foreign national students may be admitted against limited seats on the basis of an interview to be conducted by the college.

The candidates, who are given provisional admission pending submission of the qualifying certificates, are required to submit all necessary documents within a week of the beginning of regular classes. Otherwise, the admission will be annulled.

8. The Credit System

Each course is assigned a certain number of credits depending generally upon its lecture, tutorial and practical work hours in a week. In theory subjects, one lecture hour per week is assigned one credit as a general rule.

9. Academic Schedule

The academic session of the University consists of two semesters per year. The Fall semester starts in November and the Spring Semester starts in May. For the Bachelor's program in engineering, student admission may commence either in the Fall semester or in the Spring semester, as approved by the University. Mid-West University publishes its yearly academic calendar. The affiliated colleges are required to follow the calendar.

10. Student Evaluation

The students' academic performance during a semester is evaluated using the system of continuous assessment (evaluation of internal assessment plus the final examination). The college and the University conduct the internal assessment and the final examinations, respectively. Each course shall have internal assessment marks of 50% evaluated by the assigned teacher. Generally, each course will have a written semester examination of 50% marks at the end of each semester.
In the Practical courses, except subject surveying and engineering geology, final examination will not be conducted and the internal assessment marks shall be awarded on the basis of continual assessment.

Grading System

The grade (marks) awarded to a student in a course is based on his/her consolidated performance in internal assessments and final examinations. The letter grade in any particular subject is an indication of a student's relative performance in that course. The pattern of grading is as follows:

Letter	Range	Grade	Grade Point Description
A	85-100	4.0	Outstanding
A-	80-84	3.67	Distinction
B	75-79	3.33	Excellent
B-	70-74	3.00	Very Good
C	65-69	2.50	Good
C-	60-64	2.00	Average
D	55-59	1.50	Fair
D-	50-54	1	Satisfactory
F	Below 50	0	Failing

Only in very rare and unusual circumstances, if a student cannot finish all the required work for the course, he/she may be awarded an incomplete grade "I". If all the required work is not completed within the following semester, the grade of I will automatically be converted to an "F". A student receiving an I grade do not need to register for that subject in the following semester to complete the required works.

The performance of a student in a semester shall be evaluated in terms of the Semester Grade Point Average (SGPA) which is the grade point average for the semester. The cumulative grade point average (CGPA) is the grade point average for all completed semesters.

SGPA = total honor points earned in a semester / total number of credits registered in a semester CGPA = total honor points earned / total number of credits completed

11. Attendance Requirement

The students must attend every lecture, tutorial and practical classes. However, to accommodate for sickness and other contingencies, the attendance requirement shall be a minimum of 80% of the classes actually held. If a student fails to attend 80% of the classes in any particular subject, he/she shall not be allowed to take the final examination in that subject. If a student is continuously absent in the college for more than four weeks without notifying the Campus, his/her name will be removed from the college registration.

12. Normal and Maximum Duration of Stay at the College

The normal duration for completing the Bachelor of Civil Engineering program at the university will be four years. The maximum duration for the completion of the requirements shall be the normal duration plus four years.

13. Course Registration

The academic record of a student is maintained in terms of the courses for which he/she registers in any semester, and the grades he/she obtains in those courses. Registration for courses is done at the beginning of each semester. Since registration is a very important procedural part of the credit system, it is absolutely essential that all students present themselves at the campus. In case of illness or any exceptional circumstance during the registration period, he/she must inform the Campus.

14. Repeating a Course

A course may be taken only once for a grade, except when a student receives a D or F grade. Since passing of all core courses individually is a degree requirement, the student must retake the failing core course when offered and must successfully complete the course. Retaking a course in which a student has earned a D grade is optional. However, a student cannot retake more than two courses in which he/she has received D grade. The grade earned on the retake will be substituted for the grade earned first time the course was taken.

15. Transfer of Credit Hours

A maximum of 15 credit hours of course work completed in an equivalent program of a recognized institution may be transferred for credit. For transfer of credit, a student must have received a grade of B or better in the respective course. Courses taken earlier than five years from the time of transfer may not be accepted for transfer of credit.

The concerned Subject Committee of the University will make an evaluation of the applicant for transfer of credit. The awarding of transferred credit will be based on the applicant's score in the college or University, which he/she attended previously.

16. Course Coding for Civil Engineering

Each course is identified by two letters followed by a three-digit number. The two letters indicate the subject area (e.g., SH for Science & Humanities, EL for Electrical Engineering, EX for Electronics & communication Engineering, ME for Mechanical Engineering, AR for Architectural Engineering, CO for Computer Engineering, CE for Civil Engineering, HE for Hydropower Engineering, MS for Management Science etc.). The first digit of each number indicates the 4-year bachelor level, second digit indicates semester (1 for first, 2 for second and so on 8 for eighth semester) and last or third digit indicates course sequence.

Example,
SH411 is the code for the subject Engineering Mathematics I which is offered in the Bachelor first year, where Science and Humanities is the subject area.

17. Elective Courses

The curriculum is oriented to have intensive study in the field of interest with course registration flexibility at least for three courses, but in future, course registration flexibility shall be increased to more number of courses.

18. Award of Degree

The Mid-West University awards Bachelor of Civil Engineering degree upon completion of all requirements as prescribed in the curriculum. MU awards grades as explained in the curriculum on the basis of individual student's relative performance. The minimum credit hours needed for B.E. Civil Engineering is 150 Credit hours.

Cumulative Grade Point Average (CGPA) for the degree shall be awarded upon completion of all requirements.

19. Scrutinizing of Final Examination Paper

Students may apply for re-totaling or rechecking of their grades as per University rule, upon payment of prescribed fee.

20. Final Examination

The MU conducts final examination at the end of each semester. The procedure of final examination conduction will be as per the examination rules of the MU.

Note: The provisions of this document are not to be regarded as a binding contract between the University and the students. The University reserves the right to change any provisions requirements contained in this document at any time, without pre-notification, within the students' term of residence.

BACHELOR IN CIVIL ENGINEERING
COURSE STRUCTURE

Year/Part: I/I

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	SH411	Engineering Mathematics I	3	3	2	0	5
2	CE411	Applied Mechanics I (Statics)	3	3	2	0	5
3	SH412	Engineering Physics	4	4	1	2	7
4	ME411	Engineering Drawing I	2	1	0	3	4
5	ME412	Workshop Technology	1	1	0	3	4
6	CE412	Construction Materials	3	3	0	2	5
7	CO411	Basic Computer Concept and Programming	3	3	0	3	6
Total			19	18	5	13	36

Year/Part: I/II

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	SH421	Engineering Mathematics II	3	3	2	0	5
2	CE421	Applied Mechanics II (Dynamics)	3	3	2	0	5
3	SH422	Engineering Chemistry	3	3	1	2	6
4	ME421	Engineering Drawing II	2	1	0	3	4
5	ME422	Fundamental of Thermodynamics and Heat Transfer	3	3	1	1.5	5.5
6	EL421	Basic Electrical Engineering	3	3	1	1.5	5.5
7	EX421	Basic Electronics Engineering	3	3	1	1.5	5.5
Total			20	19	8	9.5	36.5

Year/Part: II/I

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	SH431	Engineering Mathematics III	3	3	2	0	5
2	CE431	Strength of Materials	3	3	1	1	5
3	CE432	Fluid Mechanics	3	3	2	1	6
4	CE433	Surveying I	3	3	1	3	7
5	CE434	Engineering Geology	3	3	0	1	4
6	CE435	Building Construction and Building Drawings	3	3	1	2	6
7	SH432	Communication English	3	3	1	1	5
Total			21	21	8	9	38

Year/Part: II/II

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	CE441	Theory of Structures I	3	3	1	1	5
2	SH441	Probability and Statistics	3	3	2	0	5
3	CE442	Surveying II	3	3	1	3	7
4	CE443	Hydraulics	4	4	2	1	7
5	CE444	Soil Mechanics	3	3	2	1	6
6	CE445	Concrete Technology and Masonry Structures	3	3	1	1	5
7	CO441	Numerical Methods	3	3	1	2	6
Total			22	22	10	9	41

Year/Part: III/I

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	CE451	Theory of Structures II	4	4	2	1	7
2	CE452	Survey Camp	1	1	0	2	3
3	CE453	Water Supply and Sanitary Engineering	3	3	1	1	5
4	MS451	Engineering Economics	3	3	1	0	4
5	CE454	Foundation Engineering	4	4	2	1	7
6	CE455	Transportation Engineering I	3	3	1	1	5
7	CE456	Engineering Hydrology	3	3	1	1	5
Total			21	21	8	7	36

Year/Part: III/II

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	CE461	Design of Steel and Timber Structures	4	4	2	0	6
2	CE462	Transportation Engineering II	3	3	1	1	5
3	CE463	Irrigation Engineering	3	3	2	1	6
4	CE464	Sanitation Engineering	3	3	1	1	5
5	MS461	Project Management	3	3	1	0	4
6	CE46*	Elective I	3	3	1	1	5
7	CE465	Engineering Professional Practices	2	2	0	0	2
Total			21	21	8	4	33

Year/Part: IV/I

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	CE471	Civil Engineering Project I	2	0	0	4	4
2	CE472	Hydropower Engineering	3	3	2	1	6
3	MS471	Construction Management	3	3	1	0	4
4	CE473	Estimating and Valuation	3	3	2	0	5
5	CE47*	Elective II	3	3	1	1	5
6	CE47*	Elective III	3	3	1	1	5
7	CE474	Design of Reinforced Cement Concrete Structures	4	4	2	1.5	7.5
Total			21	19	9	8.5	36.5

Year/Part: IV/II

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	CE481	Civil Engineering Project II	3	0	0	6	6
2	CE482	Internship	2	3 Months			
Total			5	0	0	9	9

Elective I

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	CE466	Structural Dynamics	3	3	1	1	5
2	CE467	Environmental Impact Assessment	3	3	1	1	5
3	CE468	Low Volume Road Engineering	3	2	1	1	5
4	CE469	Advanced Structural Analysis	3	3	1	1	5

Elective II / Elective III

S.N.	Course Code	Course Description	Credits	Lecture	Tutorial	Laboratory	Total
1	CE475	Geographical Information System	3	3	1	1	5
2	CE476	Airport and Railway Engineering	3	3	1	1	5
3	CE 477	Earthquake Engineering	3	3	1	1	5
4	CE478	Solid Waste Management	3	3	1	1	5
5	CE479	Design of Reinforced Concrete Bridge	3	3	1	1	5

B.E. (CIVIL) FIRST YEAR DETAIL SYLLABUS

(FIRST SEMESTER)

ENGINEERING MATHEMATICS I

COURSE CODE: SH411

Year: I

Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objective: The basic objective of the course is to provide the students a sound knowledge of calculus, analytic geometry and other related topics.

1. Limit and Continuity (3 hours)
   - 1.1. Limit of a function with examples
   - 1.2. Infinity as a limit
   - 1.3. Continuity of a function with their properties

2. Derivatives and their Applications (14 hours)
   - 2.1. Introduction
   - 2.2. Higher order derivatives (Leibnitz's theorem)
   - 2.3. Mean value theorem: Rolle 's Theorem, Lagrange's mean value theorem, and Cauchy's mean value theorem (Statement only).
   - 2.4. Power series of single valued function (Taylor's series, and Maclaurin's series)
   - 2.5. Indeterminate forms; L'Hospital rule
   - 2.6. Asymptotes to Cartesian and polar curves
   - 2.7. Curvature and radius of curvature

3. Integration and its Applications (12 hours)
   - 3.1. Introduction (Basic integration formulas, Methods of integration, and standard integrals)
   - 3.2. Definite integrals and its properties
   - 3.3. Improper integrals
   - 3.4. Differentiation under integral sign
   - 3.5. Reduction formula; Beta Gama functions
   - 3.6. Application of integrals for finding areas, arc length, surface andsolid of revolution in the plane for Cartesian and polar curves

4. Plane Analytic Geometry (8 hours)
   - 4.1. Transformation of coordinates: Translation and rotation
   - 4.2. Ellipse and hyperbola; Standard forms, tangent, and normal
   - 4.3. General equation of conics in Cartesian and polar forms

5. Vector Algebra (8 hours)
   - 5.1. Vector components and types of vector
   - 5.2. Vector addition and subtraction
   - 5.3. Direction Cosines and space coordinates (Cartesian cylinder, and Spherical)
   - 5.4. Scalar products and vector products
   - 5.5. Product of three and four vectors
   - 5.6. Vector equation of lines and planes

Reference books:

1. E. Kreyszig, "Advance Engineering Mathematics", Wiley, New York.
2. G.B. Thomas, and R.L. Finney, "Calculus and Analytic geometry", Addison Wesley.
3. G.D. Pant, G. S. Shrestha, "Integral Calculus and Differential Equations", Sunila Prakashan,Nepal
4. L. Prasad, "Higher Coordinate Geometry", Paramount Publication, Patna, India.
5. M. B. Singh, B. C. Bajrachrya, "Differential calculus", Sukunda Pustak Bhandar,Nepal
6. M. B. Singh, S. P. Shrestha, "A text book of Vector Analysis", Sukunda Pustak Bhandar,Nepal
7. M. R. Joshi, "Analytical Geometry", SukundaPustak Bhandar,Nepal
8. S. M. Maskey, "Calculus", Ratna Pustak Bhandar, Nepal

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	3	4
2.	14	16
3.	12	16
4.	8	8
5.	8	6
Total	**45**	**50**

* There may be minor deviation in marks distribution.

APPLIED MECHANICS I (STATICS)

COURSE CODE: CE411

Year: I
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objective: The basic objective of the course is to provide the students a sound knowledge of Newton's laws of motion and mechanical equilibrium so that it would be helpful for them to understand structural engineering stress analysis principles in later courses or to use basics of mechanics in their branch of engineering.

1. Introduction (2 hours)
   - 1.1. Fundamental concepts and principles
   - 1.2. Concept of particles in rigid and deformed bodies
   - 1.3. Concept of statistics and dynamics
   - 1.4. Physical meaning of equilibrium and its essence in structural application
   - 1.5. System of units

2. Statics of Particles (12 hours)
   - 2.1. Concept of forces and free body diagram
   - 2.2. Equation of equilibrium in 2D and 3D
   - 2.3. Introductions of vectors (Vector & scalar quantities, laws of vectors and their applications, units of vectors, and scalar and vector triple product)
   - 2.4. Different types of forces: Point, Surface traction and Body Forces
   - 2.5. Resolution and composition of forces: Relevant examples
   - 2.6. Principle of transmissibility and equivalent forces: Relevant examples
   - 2.7. Moments and couples: Relevant examples
   - 2.8. Resolution of a force into forces and a couple
   - 2.9. Resultant of force and moment for a system of force: Examples
   - 2.10. Introduction of friction (Definition, Types, Coefficient of friction, Angle of friction, Laws of friction)

3. Distributed Forces: Center of Gravity, Centroid and Moment of Inertia (6 hours)
   - 3.1. Concepts and calculation of centre of gravity and centroid: Examples
   - 3.2. Calculation of second moment of area /moment of inertia and radius of gyration
   - 3.3. Use of parallel and perpendicular axis theorem: Relevant examples
   - 3.4. Moment of inertia of common figures, built up section and uniform thin rod

4. Introduction of Structures (4 hours)
   - 4.1. Introduction to structures: Discrete and continuum
   - 4.2. Definition and types of beam, frame and truss
   - 4.3. Difference between mechanism and structure
   - 4.4. Concept of load estimating and support idealizations
   - 4.5. Concept of rigid joints/distribute loads in beams/frames.
   - 4.6. Concept of statically/kinematically determinate and indeterminate beams, frames, and truss: Relevant examples

5. Analysis of Beam and Frame (8 hours)
   - 5.1. External and internal forces in beam
   - 5.2. Determinacy and stability of frame
   - 5.3. Sign convention of different internal forces
   - 5.4. Calculation of axial force, shear force and bending moment for determinate beams and frames (Joint and section method)
   - 5.5. Axial force, shear force and bending moment diagrams and examples for drawing them
   .

6. Analysis of Trusses (6 hours)
   - 6.1. Determinacy and stability of truss
   - 6.2. Analysis of plane truss (Method of joints and sections)
   - 6.3. Introduction to space truss

7. Introduction of Kinematics and Kinetics (7 hours)
   - 7.1. Rectilinear kinematics: Continuous motion
   - 7.2. Position, velocity and acceleration of a particle and rigid body
   - 7.3. Curvilinear motion: Rectangular components with examples of particles
   - 7.4. Newton's second law of motion and momentum

7.5. Equation of motion and dynamic equilibrium
7.6. Angular momentum and rate of change
7.7. Equation of motion-rectilinear and curvilinear

Reference books:

1. A.K. Dubey, and A. Kumar, "Engineering Mechanics", New Age International Publishers, New Delhi.
2. F.P. Beer, and E.R. Johnston, "Mechanics of Engineers-Statics and Dynamics", Mc Graw-Hill, New Delhi.
3. R.C. Hibbeler, and A. Gupta, "Engineering Mechanics-Statics and Dynamics", Pearson, New Delhi.
4. R.S. Khurmi, "A Text Book of Engineering Mechanics", S. Chand & Company Ltd., New Delhi.
5. R.S.Khurmi, "Applied Mechanics and Strength of Materials", S. Chand & Company Ltd., New Delhi.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	**Hours**	**Mark Distribution***
1	2	4
2	12	12
3	6	8
4	4	4
5	8	10
6	6	8
7	7	4
Total	**45**	**50**

* There may be minor deviation in marks distribution.

ENGINEERING PHYSICS

COURSE CODE: SH412

Year: I
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
4	2	1	50	-	50	50	150	

Course Objective: The basic objective of the course is to use the concept and knowledge of physics in different engineering fields.

1. Simple Harmonic Motion (6 hours)
   - 1.1. Introduction
   - 1.2. Equation of simple harmonic motion
   - 1.3. Application of simple harmonic motion (Suspended spring mass system)
   - 1.4. Free, damped, forced oscillation
   - 1.5. Angular simple harmonic motion and its application in physical pendulum, Torsion Pendulum

2. Wave motion (4 hours)
   - 2.1. Introduction to waves and particles,
   - 2.2. Types of waves
   - 2.3. Energy and power in travelling waves, intensity in wave motion
   - 2.4. Principle of superposition, reflection and interference of waves
   - 2.5. Standing waves and resonance.

3. Acoustics (4 hours)
   - 3.1. Nature and propagation of sound waves
   - 3.2. Displacement wave and pressure wave
   - 3.3. Speed of sound waves in solids, liquids and gases
   - 3.4. Beat phenomena and Doppler's effect
   - 3.5. Production and uses of ultrasound

4. Physical Optics (12 hours)
   - 4.1. Interference,
     - 4.1.1. Coherent source
     - 4.1.2. Intensity in double slit interference,
     - 4.1.3. Interference in thin films,
     - 4.1.4. Newton's rings, wedge shape
   - 4.2. Diffraction,
     - 4.2.1. Fresnel and Fraunhoffer's diffraction,
     - 4.2.2. Intensity due to a single slit
     - 4.2.3. Diffraction grating
     - 4.2.4. X-ray diffraction
   - 4.3. Polarization,
     - 4.3.1. Double refraction,
     - 4.3.2. Nichol prism, wave plates
     - 4.3.3. Plane, circular, elliptical polarization of light waves
     - 4.3.4. Optical activity, specific rotation

5. Geometrical Optics (7 hours)
   - 5.1. Lenses, combination of lenses (Contact and separation)
   - 5.2. Cardinal points,
   - 5.3. Chromatic and achromatic combination
   - 5.4. Monochromatic aberration (Spherical aberration, Coma, Curvature of field, distortion, astigmatism causes and their remedy)
   - 5.5. Fiber optics (Self focusing, Application of optical fiber)
   - 5.6. Laser: Production and uses of laser

6. Electrostatics (7 hours)
   - 6.1. Electric charge and interaction between electric changes
   - 6.2. Electric field and potential due to dipole and quardupole
   - 6.3. Gauss law: Application of Gauss law to spherical, linear and planer symmetric distribution of charges
   - 6.4. Electrostatic potential energy
   - 6.5. Capacitors, capacitor with dielectric,
   - 6.6. Charging and discharging of a capacitor

7. Electromagnetism (12 hours)
   - 7.1. Direct current: Electric current,
     - 7.1.1. Ohm's law, resistance and resistivity, atomic view of resistivity
     - 7.1.2. Semiconductor and superconductor (Introduction)
     - 7.1.3. Energy loss, heat production, verification of Joules law, maximum power theorem
     - 7.1.4. Krichhoff's law and its applications
   - 7.2. Magnetism and Magnetic fields:
     - 7.2.1. Source of magnetic fields
     - 7.2.2. Magnetic force and torque, Hall effect
     - 7.2.3. Magnetic scalar potential and potential gradient
     - 7.2.4. Biot-savart law and its applications
     - 7.2.5. Ampere's circuit law; magnetic fields straight conductors
     - 7.2.6. Faraday's laws, calculation of self-inductance of solenoid.
     - 7.2.7. LR circuit, induced magnetic field
     - 7.2.8. Displacement current

8. Electromagnetic Waves (5 hours)
   - 8.1. Maxwell's equations (Differential and integral form)
   - 8.2. Application of Maxwell's equations and wave equations in free space and medium
   - 8.3. continuity of electric current
   - 8.4. Energy density and intensity

9. Electromagnetic Oscillation (3 hours)
   - 9.1. LC oscillation
   - 9.2. Damped oscillation
   - 9.3. Forced oscillation, resonance, quality factor

Laboratory/Practical:

1. To determine the value of acceleration due to gravity (in the lab) and radius of gyration using bar pendulum.
2. To determine the value of modulus of elasticity of the given materials and moment of inertia of a circular disc using torsion pendulum.
3. To find the wave length of sodium light by measuring the diameters of Newton's rings
4. To find out the refractive index of the liquid using convex lens by parallax method.
5. To find the refractive index of the material (of given prism) using a spectrometer.
6. To determine the frequency of AC mains using sonometer.
7. To determine the wavelength of the sodium light using a plane diffraction grating
8. To determine the velocity of sound in air at room temperature with the first resonance air column and two tuning forks.
9. To find the (low) resistance using Carry Foster Bridge.
10. To determine the capacitance of a given capacitor by charging and discharging through resistor
11. To plot a graph between current and frequency in an LCR series circuit and find (i) Resonant frequency and (ii) Quality factor.
12. To determine pole strength of a bar magnet by neutral point method.

Reference books:

1. D. Halliday, R. Resnick, and J. Walker, "Fundamentals of Physics", Wiley India Pvt. Ltd., India.
2. N. Subrahmanyam, B. Lal, and M.N. Avadhanuly, "A text book of Optics", S. Chand Limited, India.
3. A. S. Vasudeva, and K. Kishore, "Concept of Modern Engineering Physics", S. Chand & Company Ltd., New Delhi.
4. R.K Gaur, and S.L. Gupta, "Engineering Physics", Dhanpat Rai and Sons, India
5. R.N. Chaudhuri, "Waves and Oscillation", New Age International Publishers, New Delhi.
6. C.L. Arora, "Practical Physics", S. Chand & Company Ltd., India.

Evaluation Scheme:

There will be questions covering all the chapters in the syllabus. The evaluation scheme for the question will be as indicated:

Chapter	Hours	Mark distribution*
1	6	4
2	4	4
3	4	4
4	12	10
5	7	6
6	7	6
7	12	10
8	5	4
9	3	2
Total	**60**	**50**

***** There may be minor deviation in mark distribution.

ENGINEERING DRAWING I

COURSE CODE: ME411

Year: I
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
1	3	-	-	50	-	50	100	

Course Objective: The basic objective of the course is to develop sketching, lettering and drafting skills. The course also emphasized basic projection concepts with reference to points, lines, planes and geometrical solids.

1. Instrumental Drawing, Technical Lettering Practices, Dimensioning and Techniques (6 hours)
   - 1.1. Manual drawing equipment and its use
   - 1.2. Description of drawing instruments, auxiliary equipment and drawing materials
   - 1.3. Techniques of instrumental drawing pencil sharpening, securing paper, proper use of T- squares, Triangles, Scales dividers, Compasses, Erasing shields, French curves, and Inking pens
   - 1.4. Lettering strokes, letter proportions, use of pencils and pens, uniformity and appearance of letters, freehand techniques, inclined and vertical letters and numerals, upper and lower cases, standard English lettering forms
   - 1.5. Dimensioning: Fundamentals and techniques, size and location dimensioning, SI conversions, use of scales, measurement units, reducing and enlarging drawings, and placement of dimensions: aligned and unidirectional

2. Engineering Geometry (4 hours)
   - 2.1. Plane geometrical construction: Proportional division of lines, arc & line tangents
   - 2.2. Methods for drawing standard curves such as ellipses, parabolas, hyperbolas, involutes, spirals, cycloids and helices (cylindrical and conical)

3. Freehand Sketching and Visualization (4 hours)
   - 3.1. Sketching and design; Value of sketching as part of design
   - 3.2. Techniques of Sketching; Pencil hardness, squared paper, line densities techniques for horizontal, vertical and circular lines
   - 3.3. Multiview sketches; Choice of views, adding detail, dimensioning, title, notes proportioning and comparative sizing
   - 3.4. Sketching pictorial views; General pictorial sketching mechanical methods of sketching and proportioning isometric sketching oblique sketching perspective sketching conventional treatment of fillets, rounds and screw threads sketches of an exploded view to show assembly of components

4. Basic Descriptive Geometry (14 hours)
   - 4.1. Introduction to orthographic projection, principal planes, four quadrants or angles
   - 4.2. Projection of points on first, second, third and fourth quadrants
   - 4.3. Projection of lines: Parallel to one of the principal plane, inclined to one of the principal plane and parallel to other, inclined to both principal planes
   - 4.4. Projection planes: Perpendicular to both principal planes, parallel to one of the principal planes and inclined to one of the principal planes, perpendicular to other and inclined to both principal planes
   - 4.5. True length of lines: Horizontal, inclined and oblique lines
   - 4.6. Rules for parallel and perpendicular lines
   - 4.7. Point view or end view of a line
   - 4.8. Shortest distance from a point to a line
   - 4.9. Edge view and true shape of an oblique plane
   - 4.10. Angle between two intersecting lines
   - 4.11. Intersection of a line and a plane
   - 4.12. Angle between a line and a plane
   - 4.13. Dihedral angle between two planes
   - 4.14. Shortest distance between two skew lines
   - 4.15. Angle between two non- intersecting (skew) lines

5. Multi View (orthographic) Projections (16 hours)
   - 5.1. Orthographic projections
     - 5.1.1. First and third angle projection
     - 5.1.2. Principal views: Methods for obtaining orthographic views, projection of lines, angles and plane surfaces, analysis in three views, projection of curved lines and surfaces, object orientation and selection of views for best representation, full and hidden lines
     - 5.1.3. Orthographic drawings: Making an orthographic drawing, visualizing objects (pictorial view) from the given views
     - 5.1.4. Interpretation of adjacent areas, true-length lines , representation of holes, conventional practices

5.2. Sectional views: Full, half, broken revolved, removed (detail) sections, phantom of hidden section, auxiliary sectional views, specifying cutting planes for sections, conventions for hidden lines, holes, ribs, spokes

5.3. Auxiliary views: Basic concept and use, drawing methods and types, symmetrical and unilateral auxiliary views. projection of curved lines and boundaries, line of intersection between two planes, true size of dihedral angles, true size and shape of plane surfaces

6. Developments and Intersections (16 hours)

6.1. Introduction and projection of solids

6.2. Developments: General concepts and practical considerations, development of a right and oblique prism, cylinder, pyramid, and cone, development of truncated pyramid and cone, triangulation method for approximately developed surfaces, transition pieces for connecting different shapes, development of a sphere

6.3. Intersections: Lines of intersection of geometric surfaces, piercing point of a line and a geometric solid, intersection lines of two planes, intersections of -prisms and pyramids, cylinder and an oblique plane. Constructing a development using auxiliary views, intersection of two cylinders, a cylinder & a cone

Laboratory/Practical: 3 hours/week; 15 weeks

1. Drawing sheet layout, freehand lettering, sketching of parallel lines, circles
2. Dimensioning (Unified, Aligned)
3. Applied geometry(sketch and instrumental drawing)
4. Freehand sketching and visualization
5. Descriptive geometry I: Projection of point and lines (sketch and instrumental drawing)
6. Descriptive geometry II: Projection of planes (sketch and instrumental drawing)
7. Descriptive geometry III: Applications in three dimensional space (sketch and instrumental drawing)
8. Multiview drawings (sketch and instrumental drawing)
9. Multiview, sectional drawings and dimensioning I(sketch and instrumental drawing)
10. Multiview, sectional drawings and dimensioning II (sketch and instrumental drawing)
11. Auxiliary view, sectional drawings and dimensioning (sketch and instrumental drawing)
12. Projection of regular geometrical solids (sketch and instrumental drawing)
13. Development and intersection I (sketch and instrumental drawing)
14. Development and intersection II (sketch and instrumental drawing)
15. Development and intersection III (sketch and instrumental drawing)

Reference books:

1. W. J. Luzadder, and J. M. Duff, “Fundamentals of Engineering Drawing”, Prentice Hall of India, New Delhi.
2. T. E. French, C. J. Vierck, and R. J. Foster, “Engineering Drawing and Graphic Technology”, Mc Graw Hill Publishing Co., New York.
3. N. D. Bhatt, “Elementary Engineering Drawing”, Charotar Publshing House, India.
4. P. S. Gill, “A Text Book of Engineering Drawing”, S. K. Kataria and Sons, India.
5. R. K. Dhawan, “A Text Book of Engineering Drawing”, S. Chand and Company Limited, India.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution *
1,3,5	26	20
2	4	6
4	14	12
6	16	12
Total	**60**	**50**

* There may be minor deviation in marks distribution.

WORKSHOP TECHNOLOGY

COURSE CODE: ME412

Year: I

Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
1	3	-	-	25		25	50	

Course Objective: The objective of the course aims at imparting knowledge and skill components in the field of basic workshop technology. It deals with different hand and machine tools required for manufacturing simple metal components.

1. Basic Workshop Materials (1 hours)
   - 1.1. Introduction to workshop technology
   - 1.2. Mechanical properties of steels and cutting materials
   - 1.3. Classification of manufacturing processes

2. General Safety Considerations (2 hours)
   - 2.1. Safety measures in construction works
   - 2.2. Safety in handling hoisting equipment and conveyors
   - 2.3. Protection in storage and manual handling of material
   - 2.4. Concept of accident and its causes
   - 2.5. Common sources of accidents
   - 2.6. Common methods of protection
   - 2.7. Electrical hazards
   - 2.8. Common precautions against electric shocks, damages and fires

3. Hand Working Operations (1 hours)
   - 3.1. Sawing
   - 3.2. Filing
   - 3.3. Threading
   - 3.4. Scribing
   - 3.5. Shearing
   - 3.6. Soldering
   - 3.7. Riveting

4. Basic tools (1 hours)
   - 4.1. Bench tools
   - 4.2. Machinist’s hammers
   - 4.3. Screw drivers
   - 4.4. Punches
   - 4.5. Chisels
   - 4.6. Scrapers
   - 4.7. Scribers
   - 4.8. Files
   - 4.9. Pliers and Cutters
   - 4.10. Wrenches
   - 4.11. Hacksaw
   - 4.12. Bench vise
   - 4.13. Hand drill
   - 4.14. Taps and Dies
   - 4.15. Hand shears
   - 4.16. Tapes and Squares
   - 4.17. Soldering iron
   - 4.18. Rivets

5. Measurement and Measuring Equipments(1hours)
   - 5.1. Introduction
   - 5.2. Semi – precision tools – calipers (Inside/ Outside), depth gauge, feeler gauge
   - 5.3. Precision tools – Micrometers, vernier calipers, vernier height gauge, telescopic gauge, hole gauge, bevel protractor, dial indicator, gauge blocks and surface plate

6. Drills and Drilling Processes (1 hours)
   - 6.1. Introduction
   - 6.2. Types of drill presses
   - 6.3. Work holding devices and accessories

6.4. Cutting tools
6.5. Geometry of drill bits
6.6. Grinding of drill bits
6.7. Operations – Drilling, counter - boring, counter - sinking, reaming, honning, lapping
6.8. Cutting speeds
6.9. Drilling safety

7. Machine Tools (4 hours)
7.1. Engine lathes
7.1.1. Introduction
7.1.2. Physical construction
7.1.3. Types of lathe
7.1.4. Lathe operations (facing, turning and threading)
7.2. Shapers
7.2.1. Introduction
7.2.2. Types of shapers
7.2.3. Physical construction
7.2.4. General applications
7.3. Milling Machines
7.3.1. Introduction
7.3.2. Types of milling machines
7.3.3. Physical construction
7.3.4. Milling cutters – Plain, side, angle, end, form
7.3.5. Milling operations – Plain, side, angular, gang, end, form, keyway
7.3.6. Work holding devices
7.3.7. Cutter holding devices

7.4. Grinding Machines
7.4.1. Abrasives, bonds, grinding wheels
7.4.2. Rough grinders – Portable grinders, bench grinders, swing frame grinders, abrasive belt grinders
7.4.3. Precision grinders – Cylindrical grinders, surface grinders

8. Material Properties (1 hours)
8.1. Tool materials – Low, medium and high carbon steels; Hot and cold rolled steels; Alloy steels; Carbide and ceramic materials
8.2. Heat treating methods for steels – Annealing, tempering, normalizing, hardening, case hardening, and quenching
8.3. Non–ferrous metals

9. Sheet Metal Works (1 hours)
9.1. Introduction
9.2. Sheet metal tools
9.3. Marking and layout
9.4. Operations – Bending, cutting, rolling

10. Foundry and Forging Practice (1 hours)
10.1. Introduction
10.2. Foundry and forging tools
10.3. Foundry process: Core making, melting furnace – Cupola, sand casting
10.4. Forging operations – Upsetting, drawing, cutting, bending, punching
10.5. Forging presses and hammers
10.6. Advantages and limitations

11. Joining Processes (1 hours)
11.1. Introduction
11.2. Riveting
11.3. Soldering
11.4. Brazing
11.5. Welding – Gas welding, arc welding, resistance welding, tungsten inert gas welding (TIG), metal inert gas welding (MIG)

Laboratory/Practical: 3 hours/week; 15 weeks

Project work and Report on any four of the following:

1. Bottle opener
2. Dust bin
3. Book stand

4. Pen holder
5. Hammer
6. Gate clipper

Industrial Visit (1-day):

A visit to a local industrial area and submission of field report

Reference books:

1. B.S. Raghubanshi, “A Course in Workshop Technology-Volume I”, Dhanpat Rai & Co. (P) Ltd., New Delhi.
2. B.S. Raghubanshi, “A Course in Workshop Technology-Volume II”, Dhanpat Rai & Co. (P) Ltd., New Delhi.
3. H.S. Bawa, “Workshop Technology-Volume I”, Tata McGraw- Hill Publishing Company Ltd., New Delhi.
4. H.S. Bawa, “Workshop Technology-Volume II”, Tata McGraw- Hill Publishing Company Ltd., New Delhi.
5. J. Anderson, and E. E. Tatro, “Shop Theory”, McGraw–Hill Publishing Company Ltd., India.
6. R.S. Khurmi, and J.K. Gupta, “A text book of Workshop Technology”, S. Chand and Company Ltd, New Delhi.
7. S.K. H. Choudhury, A.K. H. Choudhury, and N. Roy, “Elements of Workshop Technology: Volume I Manufacturing Processes”, Media Promotes & Publishers Pvt. Ltd., Mumbai.
8. S.K. H. Choudhury, A.K. H. Choudhury, and N. Roy, “Elements of Workshop Technology: Volume II Machines Tools”, Media Promotes & Publishers Pvt. Ltd., Mumbai.

CONSTRUCTION MATERIALS

COURSE CODE: CE412

Year: I

Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	2	-	50	-	50	25	125	

Course Objective: The basic objective of the course is to introduce the students to a wide range of materials that can be used in construction and maintenance of civil engineering project. Emphasis in the course is placed on the properties and uses of the construction material.

1. Introduction (6 hours)
   - 1.1. Scope of the subject
   - 1.2. Types of construction material
   - 1.3. Classification of construction material
   - 1.4. Properties of construction material (Physical, mechanical, thermal, chemical, and electrical)
   - 1.5. Characteristics of construction materials
     - 1.5.1. Stress/Strain diagram and their relationship
     - 1.5.2. Modulus of elasticity and poisson's ratio

2. Basic Construction Materials (5 hours)
   - 2.1. Stones
     - 2.1.1. Types of stones
     - 2.1.2. Characteristics of good stones
     - 2.1.3. Selection and use of stone
     - 2.1.4. Deterioration and preservation of stone
     - 2.1.5. Natural bed of stone
     - 2.1.6. Dressing of stone
   - 2.2. Aggregates
     - 2.2.1. Classification of aggregates
     - 2.2.2. Characteristics of aggregates
     - 2.2.3. Deleterious materials and organic impurities
     - 2.2.4. Testing of aggregates

3. Structural Clay Products (6 hours)
   - 3.1. Introduction
   - 3.2. Clay and its classification
   - 3.3. Physical properties of clay
   - 3.4. Constituents of brick earth
   - 3.5. Ingredients of good brick earth
   - 3.6. Harmful ingredients of brick
   - 3.7. Manufacture of bricks
   - 3.8. Good qualities of bricks
   - 3.9. Classification of bricks
   - 3.10. Standard test for bricks
   - 3.11. Tiles and their type
   - 3.12. Earthen ware and glazing
   - 3.13. Application of clay product

4. Lime, Cement and Mortar (8 hours)
   - 4.1. Introduction
   - 4.2. Type, properties and uses of lime and cement
   - 4.3. Pozzolanic material
   - 4.4. Ingredients of cement
   - 4.5. Manufacture of cement (flow diagram)
   - 4.6. Composition and function of cement clinker
   - 4.7. Standard test of cement
   - 4.8. Cement water proofers
   - 4.9. Admixtures
   - 4.10. Classification of mortar
   - 4.11. Function of mortar
   - 4.12. Selection of mortar for civil engineering works

5. Wood and Wood Products (4 hours)
   - 5.1. Introduction
   - 5.2. Classification of tree and timber
   - 5.3. Characteristics of good timber
   - 5.4. Growth and structure of tree
   - 5.5. Defect of timber
   - 5.6. Seasoning of timber
   - 5.7. Deterioration and preservation of timber
   - 5.8. Commercial product of timber

6. Metals and Alloys (6 hours)
   - 6.1. Introduction
   - 6.2. Type, properties and uses of metal
   - 6.3. Formation of steel
   - 6.4. Composition and properties of steel
   - 6.5. Heat treatment process / Mechanical treatment
   - 6.6. Steel corrosion and its treatment
   - 6.7. Alloy of steel
   - 6.8. Non ferrous metals
   - 6.9. Commercial product of metals

7. Paint, Enamels, and Varnishes (4 hours)
   - 7.1. Characteristics of an ideal paint
   - 7.2. Function, ingredient, type and uses of paint and varnishes
   - 7.3. Enamels
   - 7.4. Distemper
   - 7.5. Anti – termite treatment

8. Asphalt, Bitumen, Tar and Miscellaneous Materials (6 hours)
   - 8.1. Type, properties and uses of asphalt, bitumen and tar
   - 8.2. Type, properties and uses of glass
   - 8.3. Plastic materials
   - 8.4. Insulating materials
   - 8.5. Gypsum products
   - 8.6. Composite materials

Laboratory/Practical:

1. Sieve analysis of mixtures (clay, sand, gravel and crushed rock)
2. Water absorption test and bulk specific gravity test on brick sample
3. Compressive strength test of brick
4. Consistency test of cement
5. Setting time test of cement
6. Soundness test of cement
7. Compressive strength of cement
8. Toughness test (Izode/charpy) to determine the toughness of metal
9. Tensile test of ductile materials
10. Abrasion, stability and flow tests on asphalt concrete specimens

Reference books:

1. A. M. Neville, " Properties of Concrete", ELBS
2. M. S. Shetty, " Concrete Technology", S. Chand & Company Ltd., New Delhi
3. P. A. Thornton, and V. J. Colangelo, "Fundamental of Engineering Materials", Prentice Hall Publishing Company, Eaglewood Cliffs, New Jersy.
4. P. Singh, "Civil Engineering Material",Katson Books, India
5. R.K.Rajput, "Engineering Material", S. Chand & Company Ltd, New Delhi.
6. R.S. Kurmi, and R.S. Sedha, "Material Science and Processes", S. Chand & Company Ltd, New Delhi.

Evaluation Scheme:

There will be questions covering all the chapters in the syllabus. The evaluation schemes for the question will be as indicated in the table below

Chapters	Hours	Marks distribution*
1	6	4
2	5	8
3	6	6
4	8	10
5	4	6
6	6	6
7	4	4
8	6	6
Total	**45**	**50**

* There may be minor deviation in marks distribution

BASIC COMPUTER CONCEPT AND PROGRAMMING

COURSE CODE: CO411

Year: I

Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	3	-	50	-	50	50	150	

Course Objective: The basic objective of the course is to provide the fundamental knowledge of computer software and high level programming languages. Emphasis will be given on developing computer programming skills using computer programming in C languages.

1. Introduction to computer (4 hours)
   - 1.1. Introduction to computer
   - 1.2. Computer System
   - 1.3. Function of Computer
   - 1.4. Features of Computer
   - 1.5. Generation of Computer.
     - 1.5.1 First to Fifth Generation
   - 1.6. Block diagram of Computer.
     - 1.6.1. Discussion on Input Device/ Output Device
     - 1.6.2. CPU
     - 1.6.3. Memory and its types
     - 1.6.3. Uses of Computer
     - 1.6.4. Computer network
     - 1.6.5. LAN, MAN, WAN
     - 1.6.6. Managing data and Information

2. Introduction of Programing (4 hours)
   - 2.1. Introduction to Programming and Programming Languages
   - 2.2. History of C
   - 2.3. Introduction to C
   - 2.4. Importance/ Advantages of C
   - 2.5. Basic Structure of C Program
   - 2.6. Desirable program characteristic
   - 2.7. Introduction to compiler and interpreter
   - 2.8. Problem Solving using Computer
     - 2.8.1. Problem analysis
     - 2.8.2. Algorithm development
     - 2.8.3. Flowchart
     - 2.8.4. Coding
     - 2.8.5. Compilation and Execution
     - 2.8.6. Debugging and Testing
     - 2.8.7. Documentation

3. Datatypes, operators and some statement (5 hours)
   - 3.1. Character Sets
   - 3.2. Identifiers & Keywords
   - 3.3. Constant
     - 3.2.1. String Constant
     - 3.2.2. Numeric Constant
     - 3.2.3. Character Constant
   - 3.4. Symbolic Constant
   - 3.5. Data Types
   - 3.6. C Operators
     - 3.6.1. Arithmetic Operators (+,-,*, /, %)
     - 3.6.2. Assignment Operators
     - 3.6.3. Logical Operators
     - 3.6.4. Relational Operators
     - 3.6.5. Increment and Decrement Operators
     - 3.6.6. Bitwise Operators
     - 3.6.7. Special Operators
   - 3.7. Arithmetic Expression
   - 3.8. Operator Precedence and Associativity
   - 3.9. Type Conversions in Expressions
   - 3.10. Token in C

4. Variables, input and output (5 hours)
   - 4.1. Variable Declaration
   - 4.2. The Scope of Variable
     - 4.2.1. Register Variable
     - 4.2.2. Static Variable
     - 4.2.3. External Variable
     - 4.2.4. Automatic Variable
   - 4.3. Statements
   - 4.4. Simple C programs
   - 4.5. Input Statement
   - 4.6. Output Statement
   - 4.7. Feature of stdio.h

5. Control structure (5 hours)
   - 5.1. Conditional Statements
     - 5.2.1. if statement
     - 5.2.2. if-else statement
     - 5.2.3. switch statement
   - 5.2. Loop Statements
     - 5.2.1. for loop
     - 5.2.2. while loop
     - 5.2.3. do-while loop
   - 5.3. Breaking Control Statements
     - 5.2.1. break statement
     - 5.2.2. continue statement
     - 5.2.3. go-to statement

6. Array (4 hours)
   - 6.1. One-Dimensional Array
     - 6.2.1. One-Dimensional Array Notation
     - 6.2.2. One-Dimensional Array Declaration
     - 6.2.3. One-Dimensional Array Initialization
   - 6.2. Multidimensional Array
     - 6.2.1. Multidimensional Array Notation
     - 6.2.2. Multidimensional Array Declaration
     - 6.2.3. Multidimensional Array Initialization
   - 6.3. Processing with one dimensional Array and Multidimensional Array
   - 6.4. Array and Strings

7. Function (4 hours)
   - 7.1. Defining Function
   - 7.2. Use of Function
   - 7.3. Types of Function
   - 7.4. User-defined and Library Functions
   - 7.5. Components Associated with Function
   - 7.6. Category Of functions According to return value and Arguments
   - 7.7. Different types of Function Calls
   - 7.8. Return Statement
   - 7.9. Recursive Function
   - 7.10. Concept of Local, Global and Static Variables

8. Pointer (5 hours)
   - 8.1. Introduction to Pointer
   - 8.2. Pointer Declaration
     - 8.2.1. Indirection Or Deference Operator
     - 8.2.2. Address Operator
   - 8.3. Pointer initialization
     - 8.3.1. Bad Pointer
   - 8.4. Pointer Arithmetic
   - 8.5. Void Pointer
   - 8.6. Null Pointer
   - 8.7. Pointer Function
     - 8.7.1. Passing Pointer to a Function
   - 8.8. Pointer & Array
     - 8.8.1. Array of Pointer
     - 8.8.2. Relationship between pointer and 1-D array
   - 8.9. Pointers to pointers

8.10. Dynamic Memory Allocation
8.11. Application Pointer

9. Structure and Unions (5 hours)
   9.1. Defining a structure
   9.2. Structure Initialization
   9.3. Arrays of Structures, Structures with in Structures
      9.3.1. Processing a Structure
      9.3.2. Structures Pointers
      9.3.3. Passing Structures to Functions
      9.3.4. Union and its importance

10. Data Files (4 hours)
   10.1. Introduction
   10.2. Opening and Closing a Data File
   10.3. File Opening Modes
   10.4. Library Functions for Reading /Writing from / To a File
   10.5. Creating a Data File
   10.6. End of File (EOF)
   10.7. Processing a Data File
      10.7.1. Record Input / Output
      10.7.2. Direct/ Random Access

Laboratory/Practical:

Several laboratory classes (Minimum 6 sets of computer program) will be conducted as devised by concerned course instructor. Basic demonstration of computer hardware system will be also conducted.

Student (maximum 4 persons in a group) should submit a mini project at the end of course. (20 marks out of 50 marks)

Reference Book:

1. "Let USC", Yashavant Kanetker
2. A. Kelly, and I. Pohl, "A Book on C", Benjamin/Cumming Pub. Co.
3. B.W. Keringhan, and D. M. Ritchie, "The C Programming Language", Prentice-Hall of India Pvt. Ltd., New Delhi
4. B. S. Gotterfried, "Programming with C", Tata McGrawhill, India
5. P.K.Sinha, "Computer Fundamentals", BPB Publications
6. P. Norton, "Introduction to Computers", Tata McGraw-Hill Publishing Company Limited
7. E.Balaguruswamy, "Programming in C", Tata McGraw-Hill Publishing Company Limited
8. E.Balaguruswamy, "Graphic under C"

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1	4	4
2	4	4
3	5	5
4	5	5
5	5	7
6	4	5
7	4	6
8	5	4
9	5	6
10	4	4
Total	**45**	**50**

* There may be minor deviation in marks distribution.

B.E. (CIVIL) FIRST YEAR DETAIL SYLLABUS
(SECOND SEMESTER)

ENGINEERING MATHEMATICS II

COURSE CODE: SH421

Year: I

Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objective: The basic objective of the course is to provide a sound knowledge of vector calculus, 3-D analytical geometry, Calculus of several variables, infinite series, and ordinary differential equations.

1. Calculus of Several Variables (5 hours)
   - 1.1. Introduction
   - 1.2. Partial derivatives, homogeneous function, Euler's theorem for the function of two and three variables, and total differential coefficients
   - 1.3. Extrema of functions of two and three variables; Lagrange's multiplier

2. Multiple Integrals (5 hours)
   - 2.1. Double integrals in cartesian and polar form; change of order of integration
   - 2.2. Triple integrals in cartesian, cylindrical and spherical coordinates;
   - 2.3. Area and volume by double and triple integrals

3. Analytical Geometry of Three Dimensional (11 hours)
   - 3.1. Plane
   - 3.2. Straight line (Co-planer lines, and the shortest distance)
   - 3.3. Sphere (Standard equation of sphere)
   - 3.4. Right circular cone and right circular cylinder

4. Vector Calculus (6 hours)
   - 4.1. Differentiation and integration of vectors
   - 4.2. Gradients , divergent, and curl

5. Infinite Series (5 hours)
   - 5.1. Introduction
   - 5.2. Convergence and divergence of a sequence
   - 5.3. Root test
   - 5.4. Absolute convergence
   - 5.5. Power series
   - 5.6. Radius and interval of convergence

6. Differential Equations (13 hours)
   - 6.1. First order and first degree differential equations
   - 6.2. Homogenous differential equations
   - 6.3. Linear differential equations
   - 6.4. Equations reducible to linear differential equations; Bernoulli's equation
   - 6.5. Second order and first degree linear differential equations with constant coefficients.
   - 6.6. Second order and first degree linear differential equations with variable coefficients; Cauchy's equations
   - 6.7. Legendre's equation
   - 6.8. Legendre polynomial function; Properties and applications.
   - 6.9. Bessel's equation and Bessel's function

Reference books:

1. E. Kreyszig, "Advance Engineering Mathematics", Wiley, New York.
2. G.B. Thomas, and R.L. Finney, "Calculus and Analytic geometry", Addison Wesley.
3. G.D. Pant, G. S. Shrestha, "Integral Calculus and Differential Equations", Sunila Prakashan,Nepal
4. M. B. Singh, B. C. Bajrachrya, "Differential calculus", Sukunda Pustak Bhandar,Nepal
5. M. B. Singh, B. C. Bajrachrya, "A text book of Vectors", Sukunda Pustak Bhandar,Nepal
6. S. M. Maskey, "Calculus", Ratna Pustak Bhandar, Nepal
7. Y. R. Sthapit, B. C. Bajrachrya, "A text book of Three Dimensional Geometry", Sukunda Pustak Bhandar,Nepal.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	5	4
2.	5	6
3.	11	12
4.	6	6
5.	5	6
6.	13	16
Total	**45**	**50**

* There may be minor deviation in marks distribution.

APPLIED MECHANICS II (DYNAMICS)

COURSE CODE: CE421

Year: I
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objective: The objective of the course is to provide basic knowledge of engineering mechanics to the students such that they can understand the basics of kinematics and kinetics for both particles and rigid bodies and their motion.

1. Introduction to Dynamics (2 hours)
   - 1.1. Definition and branches of dynamics
   - 1.2. Importance of dynamics

2. Kinematics of Particles (8 hours)
   - 2.1. Rectilinear motion of particles
     - 2.1.1. Position, velocity and acceleration
     - 2.1.2. Determination of motion of a particle
     - 2.1.3. Uniform rectilinear and accelerated rectilinear motion
     - 2.1.4. Graphical solution of rectilinear- motion problem
   - 2.2. Curvilinear motion of particles
     - 2.2.1. Position vector, velocity and acceleration
     - 2.2.2. Derivatives of vector functions
     - 2.2.3. Rectangular component of velocity and acceleration
     - 2.2.4. Tangential and normal components
     - 2.2.5. Radial and transverse components

3. Kinetics of Particles (12 hours)
   - 3.1. Newton's law of motion
     - 3.1.1. Introduction
     - 3.1.2. Equation of motion
     - 3.1.3. Dynamic equilibrium
     - 3.1.4. Linear and angular momentum of a particle
     - 3.1.5. Rate of change of linear and angular momentum
     - 3.1.6. Radial and transverse component of equation of motion
     - 3.1.7. Conservation of momentum
     - 3.1.8. Newton's law of gravitation
   - 3.2. Energy and momentum methods
     - 3.2.1. Work done by a force
     - 3.2.2. Potential and kinetic energy of particles
     - 3.2.3. Principles of work and energy: applications
     - 3.2.4. Power and efficiency
     - 3.2.5. Conservation of energy
     - 3.2.6. Principle of impulse and momentum
     - 3.2.7. Impulsive motion and impact
     - 3.2.8. Direct central and oblique impact

4. System of Particles (5 hours)
   - 4.1. System of particles
   - 4.2. Linear and angular moment for a system of particles
   - 4.3. Motion of the mass centre
   - 4.4. Conservation of momentum
   - 4.5. Kinetic energy of system of particles
   - 4.6. Work energy principles; Conservation of energy for a system of particles
   - 4.7. Principles of impulse and momentum for a system of particles
   - 4.8. Steady stream of particles
   - 4.9. System with variable mass

5. Kinematics of Rigid Bodies (6 hours)
   - 5.1. Introduction
   - 5.2. Translation and rotation
   - 5.3. General plane motion
   - 5.4. Absolute and relative velocity in plane motion
   - 5.5. Instantaneous centre of rotation
   - 5.6. Absolute and relative frame; Coriolis acceleration in plane motion
   - 5.7. Rate of change of a general vector with respect to a rotating frame; Coriolis acceleration
   - 5.8. Motion about a fixed point
   - 5.9. Three-dimensional motion of a particle relative to a rotating frame; Coriolis acceleration

6. Plane Motion of Rigid Bodies (6 hours)
   - 6.1. Definitions
   - 6.2. Equation of motion for a rigid body in plane motion
   - 6.3. Angular momentum of a rigid body in plane motion
   - 6.4. Plane motion of rigid body: D'Alembert's principle
   - 6.5. Application of rigid body motion in the plane
   - 6.6. System of rigid bodies
   - 6.7. Constrained motion in the plane

7. Plane Motion of Rigid Bodies: Energy and Momentum Methods (6 hours)
   - 7.1. Principle of work and energy for a rigid body
   - 7.2. Work done by external forces
   - 7.3. Kinetic energy for a system
   - 7.4. Conservative and non-conservative systems
   - 7.5. Work – energy applications
   - 7.6. Impulse and momentum for systems for rigid bodies
   - 7.7. Conservation of angular and linear momentum
   - 7.8. Impulsive motion and eccentric impact

Reference books:

1. F.P. Beer, and E.R. Johnson, "Vector Mechanics for Engineers", Tata McGraw Hill Publishing Co. Ltd.
2. I. H. Shames, "Engineering Mechanics – Statics and Dynamics", New Delhi, Prentice Hall of India.
3. P. P. Egor, "Engineering Mechanics of Solids", New Delhi, Prentice Hall of India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	2	4
2	8	10
3	12	12
4	5	6
5	6	8
6	6	4
7	6	6
Total	**45**	**50**

*There may be minor deviation in marks distribution.

ENGINEERING CHEMISTRY

COURSE CODE: SH422

Year: I
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	2	1	50	-	50	50	150	

Course Objective: The objective of the course is to analyze chemical behavior of materials, water quality and environmental aspects of various elements and compounds.

1. Atomic Structure (4 hours)
   - 1.1. Bohr's theory
   - 1.2. De-Broglie's equation
   - 1.3. Heisenberg uncertainty principle
   - 1.4. Quantum number and shape of s, p, d orbitals

2. Electro-Chemistry (4 hours)
   - 2.1. Strong and weak electrolytes
   - 2.2. Electro-chemical cells
   - 2.3. Electrode potential and standard electrode potential
   - 2.4. Measurement of standard reduction potential
   - 2.5. Nernst's equation
   - 2.6. EMF of cell
   - 2.7. Electrochemical series and its application
   - 2.8. Buffer: its type and mechanism
   - 2.9. Henderson's equation for pH of buffer and related problems
   - 2.10. Corrosion and its type
   - 2.11. Factors influencing corrosion
   - 2.12. Prevention of corrosion

3. Catalyst (4 hours)
   - 3.1. Introduction
   - 3.2. Action of catalyst (catalytic promoters and catalytic poisons)
   - 3.3. Characteristics of catalyst
   - 3.4. Types of catalyst
   - 3.5. Theories of catalysis
   - 3.6. Industrial applications of catalysts

4. Environmental Chemistry (4 hours)
   - 4.1. Air pollution and pollutants
   - 4.2. Effects of air pollutants on human beings and their possible remedies
   - 4.3. Ozone depletion and its photochemistry
   - 4.4. Water pollution and pollutants (ref of surface water and pound water)
   - 4.5. Soil pollution and pollutants (effects and possible remedies)

5. Polymers and Polymerizations (6 hours)
   - 5.1. Definition and types of polymers
   - 5.2. General properties of inorganic polymers
   - 5.3. Polyphosphazines
   - 5.4. Sulpher based polymers
   - 5.5. Chalcogenide glasses
   - 5.6. Silicones
   - 5.7. Types of organic polymers
   - 5.8. Preparation and application of polyurethane, polystyrene, polyvinylchloride, teflon and nylon
   - 5.9. Concept of bio-degradable, non-biodegradable and conducting polymers

6. Transition Elements and their Applications (5 hours)
   - 6.1. Introduction
   - 6.2. Electronic configuration
   - 6.3. Metallic character
   - 6.4. Variable valency
   - 6.5. Complex formation tendency
   - 6.6. Color formation
   - 6.7. Magnetic properties

6.8. Alloy formation
6.9. Applications of transition elements

7. Chemical Bonding (5 hours)
   7.1. Introduction
   7.2. Types of bond
   7.3. Valence bond theory of complexes
   7.4. Application of valence bond theory in the formation of (i) Tetrahedral complexes, (ii) Square planar complexes and (iii) Octahedral complexes
   7.5. Limitations of valence bond theory
   7.6. Hybridization
   7.7. General introduction of coordination compounds

8. Explosives (3 hours)
   8.1. Introduction
   8.2. Types of explosives
   8.3. Preparation and application of TNT, TNG, Nitrocellulose and Plastic explosives

9. Lubricants and Paints (2 hours)
   9.1. Introduction
   9.2. Function of lubricants
   9.3. Classification of lubricants (oils, greases and solid)
   9.4. Paints
   9.5. Types of paint
   9.6. Application of paints

10. Stereochemistry (4 hours)
   10.1. Introduction
   10.2. Geometrical isomerism (cis trans isomerism), Z and E concept of geometrical isomerism
   10.3. Optical isomerism with reference to two asymmetrical carbon center molecules

11. Organic Reactions (4 hours)
   11.1. Substitution reaction and its types
   11.2. Elimination reaction and its type
   11.3. Factors governing SN1, SN2, El and E2 reaction mechanism path

Reference books:

1. A. Bahl, and B.S. Bahl, "Advance Organic Chemistry", S. Chand & Company Ltd. New Delhi.
2. A. K. De, "Environmental Chemistry", New Age International Ltd., New Delhi.
3. B.S. Bahl, G.D. Tuli, and A. Bahl, "Essential of Physical Chemistry", S. Chand & Company Ltd. New Delhi.
4. B. H. Mhan, "University Chemistry", Narosa Publishing House, New Delhi.
5. G.S. Mishra, "Introduction to Polymer Chemistry", New Age International Ltd., New Delhi.
6. J. D. Lee, "Concise Environmental Chemistry", Chapman & Hall, London.
7. M. Boyd, "Organic Chemistry", Prentice-Hall of India Ltd., New Delhi.
8. R.K. Sharma, B.P. Panthi, and Y.N. Gotame, "Engineering Practical Chemistry", Benchmark Education Support Pvt. Ltd., Kathmandu.
9. V.R. Gowariker, N.V. Viswanathan, and J. Shreedhar, "Polymer Science", New Age International Ltd., New Delhi.

Laboratory/Practical:(3 hours per week)

1. Compare the alkalinity of different water samples by double indicator method
2. Determine the temporary and permanent hardness of water by EDTA complexo-metric method
3. Determine residual and combined chlorine present in the chlorinated sample of water by iodometric method
4. Prepare organic polymer nylon 6,6/ Bakelite in the laboratory
5. Determine the pH of different sample of buffer solution by universal indicator method
6. Prepare inorganic complex in the laboratory
7. Determine surface tension of the given detergent solution and compare its cleansing power with other detergent solutions
8. Construct an electrochemical cell in the laboratory and measure the electrode potential of it
9. Estimate the amount of iron present in the supplied sample of ferrous salt using standard potassium permanganate solution (redox titration)

Evaluation Scheme:

There will be questions covering all the chapters in the syllabus. The evaluation scheme for the question will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1	4	5
2	4	5
3	4	5
4	4	5
5	6	5
6	5	5
7	5	5
8	3	2
9	2	3
10	4	5
11	4	5
Total	**45**	**50**

* There may be minor deviation in marks distribution.

ENGINEERING DRAWING II

COURSE CODE: ME421

Year: I
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
1	3	-	-	50	-	50	100	

Course Objective: The objective of the course is to make familiar with the orthographic, sectional views and pictorial drawing. The course also emphasized with standard symbols of different engineering fields and machines.

1. Review for Orthographic and Sectional Views (6 hours)
   - 1.1. Conventional practices in orthographic views: Half views and partial views, representation of fillets and rounds
   - 1.2. Conventional practices in sectional views: Conventions for ribs, webs and spokes in sectional view, broken section, removed section, revolved section, offset section, phantom section and auxiliary sectional views

2. Pictorial Drawings (20 hours)
   - 2.1. Introduction, classifications: Advantages and disadvantages
   - 2.2. Axonometric projection
     - 2.2.1. Procedure for making an isometric drawing
     - 2.2.2. Isometric and non-isometric lines; isometric and non-isometric surfaces
     - 2.2.3. Angles in isometric drawing
     - 2.2.4. Circles and circular arcs in isometric drawing
     - 2.2.5. Irregular curves in isometric drawing
     - 2.2.6. Isometric sectional views
   - 2.3. Oblique projection and oblique drawing (rules and procedures)
   - 2.4. Perspective projection (parallel and angular)

3. Different Components and Conventions (14 hours)
   - 3.1. Limit dimensioning and machining symbols
     - 3.1.1. Limit, fit and tolerances
     - 3.1.2. Machining symbols and surface finish
   - 3.2. Threads, bolts and nuts
     - 3.2.1. Thread terms and nomenclature, forms of screw threads, symbols for bolts and nuts
     - 3.2.2. Detailed and simplified representation of internal and external threads
     - 3.2.3. Thread dimensioning
     - 3.2.4. Standard bolts and nuts: Hexagonal head square head and eye bolt
   - 3.3. Welding and riveting
     - 3.3.1. Types of welded joints and types of welds, welding symbols
     - 3.3.2. Forms and proportions for rivet heads, rivet symbols, types of riveted joints: Lap joints, butt joint
   - 3.4. Graphical symbols and conventions in different engineering fields
     - 3.4.1. Standard symbols for civil, structural and agricultural components
     - 3.4.2. Standard symbols for electrical, mechanical and industrial components
     - 3.4.3. Standard symbols for electronics, communication and computer components
     - 3.4.4. Topographical symbols
   - 3.5. Standard piping symbols and piping drawing

4. Assembly and Detail Drawings (20 hours)
   - 4.1. Introduction to working drawing
   - 4.2. Components of working drawing: Drawing layout, drawing numbers
   - 4.3. Detail drawing
   - 4.4. Assembly and detail drawing
   - 4.5. Practices of detail and assembly drawing

Laboratory/Practical:(3 hours per week)

1. Review for orthographic and sectional views (full and half section)
2. Review for orthographic and sectional views (other type sections)
3. Isometric drawing
4. Isometric drawing (consisting of curved surfaces and sections)
5. Oblique drawing(cavalier and cabinet)
6. Perspective projection(parallel and angular)
7. Familiarization with graphical symbols (limit, fit, tolerances and surface texture symbols)

8. Familiarization with graphical symbols (symbols for different engineering fields)
9. Detail drawing
10. Assembly drawing I
11. Assembly drawing II

Reference books:

1. K. Venugopal, “Engineering Drawings and Graphics”, New Age International Publishers, New Delhi.
2. W. J. Luzadder, and J. M. Duff, “Fundamentals of Engineering Drawing”, Prentice Hall of India, New Delhi.
3. T. E. French, C. J. Vierck, and R. J. Foster, “Engineering Drawing and Graphic Technology”, Mc Graw Hill Publishing Co., New York.
4. N. D. Bhatt, “Elementary Engineering Drawing”, Charotar Publshing House, India.
5. P. S. Gill, “A Text Book of Engineering Drawing”, S. K. Kataria and Sons, India.
6. R. K. Dhawan, “A Text Book of Engineering Drawing”, S. Chand and Company Limited, India

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	**Hours**	**Mark Distribution***
1	6	6
2	20	20
3	14	8
4	20	16
Total	**60**	**50**

*There may be minor deviation in mark distribution.

FUNDAMENTAL OF THERMODYNAMICS AND HEAT TRANSFER

COURSE CODE: ME422

Year: I
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1.5	1	50	-	50	25	125	

Course Objective: The objective of the course is to understand basic concepts, laws of thermodynamics and heat transfer and their applications.

1. Basic Concept of Thermodynamics (4 hours)
   - 1.1. Definition and scope of engineering thermodynamics
   - 1.2. Value of energy to society
   - 1.3. Concepts and definitions
     - 1.3.1. System; Closed systems, open systems, and isolated systems
     - 1.3.2. Properties: Intensive, extensive and specific
     - 1.3.3. Thermodynamic equilibrium
     - 1.3.4. State, process, and path (cyclic process, quasi-equilibrium process, reversible and irreversible process)
     - 1.3.5. Common properties: Pressure, specific volume, temperature
   - 1.4. Zeroth law of thermodynamics, equality of temperature

2. Energy, Work and Heat (3 hours)
   - 2.1. Energy and its type(stored energy and transient energy; total energy)
   - 2.2. Energy transfer
     - 2.2.1. Heat transfer
     - 2.2.2. Work transfer
   - 2.3. Expressions for displacement work transfer

3. Properties of Pure Substances (6 hours)
   - 3.1. Definition of pure substance
   - 3.2. Ideal gas and its relations
   - 3.3. Phase change terminology and definition (saturated liquid, triple point, critical point, moisture content, saturated vapor, superheated vapor and degree of superheat)
   - 3.4. Properties of two phase mixtures
   - 3.5. Internal energy, enthalpy, and specific heats

4. First Law of Thermodynamics (8 hours)
   - 4.1. Statements of the first law
   - 4.2. Perpetual motion machine of the first kind
   - 4.3. First law of thermodynamics for control mass undergoing cyclic process
   - 4.4. First law of thermodynamics for control volume
   - 4.5. Steady and unsteady state analysis
   - 4.6. Control volume application: Work and flow applications (steady and unsteady)

5. Second Law of Thermodynamics (8 hours)
   - 5.1. Limitations of first law of thermodynamics
   - 5.2. Statements of second law of thermodynamics
   - 5.3. Perpetual motion machine of the second kind
   - 5.4. Entropy and second law of thermodynamics for an isolated system
   - 5.5. Reversible and irreversible processes
   - 5.6. Relation for an ideal gases and incompressible substances
   - 5.7. Control mass and control volume formulation of second law
   - 5.8. Isentropic process (ideal gas and incompressible substances)
   - 5.9. Carnot cycle, carnet efficiency (heat engine, thermal efficiency, heat pump, refrigerator and coefficient of performance)

6. Thermodynamic Cycles (8 hours)
   - 6.1. Classification of cycles
   - 6.2. Otto cycle
   - 6.3. Diesel cycle
   - 6.4. Brayton cycle
   - 6.5. Rankine cycle
   - 6.6. Vapor compression refrigeration cycle

7. Heat Transfer (8 hours)
   7.1. Definition and modes of heat transfer
   7.2. Heat transfer by conduction(plane wall, hollow cylinder, composite plane wall and multilayer tube)
   7.3. Electrical analogy for thermal resistance
   7.4. Combined heat transfers and overall heat transfer coefficient for plane wall and tube
   7.5. Heat transfer by convection
   7.6. Heat transfer by radiation (Stefan's law, absorptivity, reflectivity and transmissivity (black body, white body and gray body))

Laboratory/Practical:

1. Temperature and pressure measurement
2. Compression and expansion of gases and heat equivalent of work
3. Refrigerator and/or heat pump.
4. Heat conduction and convection.
5. Heat radiation

Reference Books:

1. P.K. Nag, “Engineering Thermodynamics”, Tata Mc Graw Hill, India.
2. R.K. Rajput, “Engineering Thermodynamics”, Laxmi Publication, India.
3. E. Rathakrishnan, “Engineering Thermodynamics”, Tata Mc Graw Hill, India.
4. J. R. Howell, and R. O. Buckius, “Fundamentals of Engineering Thermodynamics", McGraw Hill Publishers, India.
5. Y. A. Cengel, and M.A. Boles, "Thermodynamics: An Engineering Approach", McGraw-Hill, India.
6. J. P. Holman, "Heat Transfer", McGraw-Hill, India.
7. Y. A. Cengel, "Heat Transfer: A Practical Approach", McGraw-Hill, India.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution *
1	4	6
2	3	4
3	6	8
4	8	8
5	8	8
6	8	8
7	8	8
Total	**45**	**50**

* There may be minor deviation in marks distribution.

BASIC ELECTRICAL ENGINEERING

COURSE CODE: EL421

Year: I
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1.5	1	50	-	50	25	125	

Course Objective: The objective of the course is to provide the fundamental concept of electric circuit (AC & DC). Emphasis will be also given to operate, distinguish and use of electrical devices and machines.

1. Preliminaries and Basic Concepts (6 hours)
   - 1.1. Constituent parts of an electrical system
   - 1.2. Electrical units
   - 1.3. Current flow in a circuit
   - 1.4. Electromotive force and potential difference
   - 1.5. Ohm's law, resistors and resistivity
   - 1.6. General concept of capacitance and inductance
   - 1.7. Temperature rise & temperature coefficient of resistance
   - 1.8. Voltage & current sources

2. Basic DC Circuit Analysis and Network Theorems (12 hours)
   - 2.1. Series and parallel circuits
   - 2.2. Star-delta & delta-star transformation
   - 2.3. Kirchoff's laws
   - 2.4. Application of krichhoff's laws: Nodal analysis, mesh analysis
   - 2.5. Power and energy
   - 2.6. Superposition theorem
   - 2.7. Thevninn's theorem
   - 2.8. Nortan's theorem
   - 2.9. Maximum power transfer theorem

3. Alternating Circuits (12 hours)
   - 3.1. AC systems, wave form, terms & definitions
   - 3.2. Average and rms values of current & voltage
   - 3.3. Phasor representation
   - 3.4. AC in resistive, capacitive and inductive circuits
   - 3.5. Concept of complex impedance and admittance
   - 3.6. AC series and parallel circuit
   - 3.7. RL, RC and RLC circuit analysis & phasor representation
   - 3.8. Power in resistive, inductive and capacitive circuits
   - 3.9. Power in circuit with resistance and reactance
   - 3.10. Active and reactive power, power factor, its practical importance

4. Three-Phase Circuit Analysis (6 hours)
   - 4.1. Basic concept & advantage of three-phase circuit
   - 4.2. Phasor representation of star & delta connection
   - 4.3. Voltage & current computation in 3-phase balance & unbalance circuits
   - 4.4. Real and reactive power computation

5. Introduction to Transformers (4 hours)
   - 5.1. Operating principle and types
   - 5.2. EMF equation and phasor diagrams
   - 5.3. Efficiency : OC and SC tests

6. D.C Machines and Motors (5 hours)
   - 6.1. Introduction to generators: Working principle and applications
   - 6.2. Introduction to motors: Working principle and applications

Laboratory/Practical:
1. Measurement of voltage, current& power in DC circuit
2. Verification of Ohm's Law
3. Krichoff's voltage & current Law
4. Measurement amplitude, frequency and alternating quantities

5. Measure currents and voltages in three-phase balanced AC circuits
6. Measurement of voltage, current& power in a three-phase circuit
7. Short circuit and open circuit tests

Reference books:

1. I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. I.M. Smith,” Haughes Electrical Technology”, Addison-Wesley, ISR print.
3. J.R Cogdell, “Foundations of Electrical Engineering”, Printice Hall, Englewood Chiffs, New Jersy.
4. S. N. Tiwari, and A. S. Bin Saroor, “A first course in Electrical Engineering”, Wheeler Publishing, Allahabad.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	**Hours**	**Marks Distribution***
1	6	8
2	12	12
3	12	12
4	6	8
5	4	4
6	5	6
Total	**45**	**50**

* There may be minor deviation in marks distribution.

BASIC ELECTRONICS ENGINEERING

COURSE CODE: EX421

Year: I
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1.5	1	50	-	50	25	125	

Course Objective: The objective of the course is to provide the knowledge of use of electronic equipment and instruments. Emphasis will be also given to the analog and digital systems and their applications in the field of engineering.

1. Introduction to Basic Circuits Concepts (6 hours)
   - 1.1 Resistor, capacitors, inductor
   - 1.2 Linear and non-linear circuits
   - 1.3 Resistive circuits: Series and parallel combinations
   - 1.4 Kirchhoff's law: Voltage, current; linearity
   - 1.5 Signal sources: Voltage and current sources; concept of gain, transconductance, transimpedance.
   - 1.6 Superposition theorem; Thevenin's theorem, norton's theorem
   - 1.7 Introduction to filter and types

2. Introduction to Diodes and its Applications (6 hours)
   - 2.1 Semiconductor devices: P type and N type
   - 2.2 Semiconductor diode characteristics
   - 2.3 Diode circuits: clipper; Clamper circuits
   - 2.4 Zener diode, LED, photodiode, varactors diode, tunnel diodes
   - 2.5 DC power supply: Rectifier-half wave, full wave (center tapped, bridge), zener regulated power supply

3. Transistor (7 hours)
   - 3.1 BJT configuration and biasing; CE, CC, and CB amplifiers and their characteristics
   - 3.2 Concept of differential amplifier using BJT
   - 3.3 Applications of transistor: BJT as a switch and logic circuits
   - 3.4 Construction and working principle of MOSFET (N type and P type)
   - 3.5 MOSFET as logic circuits

4. Amplifiers and Oscillators (6 hours)
   - 4.1 Introduction to operational amplifiers, inverting amplifier; non-inverting amplifier
   - 4.2 Amplifier applications: Adder, substractor, integrator, differentiator, multiplier
   - 4.3 Basic feedback theory; Positive and negative feedback; concept of stability;
   - 4.4 Introduction to oscillator; generation of square wave, triangular wave using op-amps, wien bridge oscillators

5. Basic Communication Systems (5 hours)
   - 5.1 Introduction to wired and wireless communication system
   - 5.2 Block diagram of communication systems
   - 5.3 EMW and propagation, antennas and its types
   - 5.4 Introduction to FM and AM Communications
   - 5.5 Introduction to optical fibers

6. Digital Logic (11 hours)
   - 6.1 Number systems and binary arithmetic
   - 6.2 Logic gates: OR, NOT, AND NOR, NAND, XOR, XNOR gate
   - 6.3 Multiplexers, DeMUX, encoder, decoder
   - 6.4 Logic function representation
   - 6.5 Combinational circuits: SOP, POS form; K-map
   - 6.6 Latch, flip-flop: S-R flip-flop; JK master slave flip-flop; D-flip flop

7. Types and Applications of Transducers (4 hours)
   - 7.1 Introduction to instrumentation
   - 7.2 Transducer, types and its applications
   - 7.3 Strain gauge and applications

Laboratory/Practical:

1. Familiarization with passive components, function generator and oscilloscope
2. Diode characteristics, rectifiers, zener diodes
3. Bipolar junction transistor characteristics and single stage amplifier
4. Voltage amplifiers using op-amp, comparators
5. Wave generators using op-amp (oscillators)
6. Combinational circuits

Reference books:

1. A.S. Sedra, and K.C. Smith, "Microelectronic Circuits", Oxford University Press.
2. B.L. Theraja, "Basic Electronics" S. Chand and Company Ltd., New Delhi.
3. P. B. Zbar, A. P. Malvino, and M. A. Miller, "Basic Electronics", Tata McGraw-Hill Publishing Company Ltd., New Delhi
4. R. Boylestad, and L. Nashelsky, "Electronic Devices and Circuit Theory", PHI.
5. T.L. Floyd, "Electronic Devices", Pearson Education, Inc.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1	6	6
2	6	8
3	7	8
4	6	8
5	5	6
6	11	10
7	4	4
Total	**45**	**50**

* There may be minor deviation in marks distribution.

B.E. (CIVIL) SECOND YEAR DETAIL SYLLABUS

(FIRST SEMESTER)

ENGINEERING MATHEMATICS III

COURSE CODE: SH431

Year: II
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objective: The basic objective of the course is to round out the students' preparation for more sophisticated applications with an introduction to linear algebra, Fourier series, Laplace Transforms, integral transformation theorems and linear programming.

1. Matrices and Determinants (10 hours)
   - 1.1. Algebra of matrices
   - 1.2. Determinant and its properties
   - 1.3. Properties of skew-symmetric determinant
   - 1.4. Complex matrices
   - 1.5. Rank of matrices
   - 1.6. System of linear equations
   - 1.7. Vector spaces
   - 1.8. Linear transformations
   - 1.9. Eigen value and Eigen vectors
   - 1.10. The Cayley-Hamilton theorem and its uses

2. Laplace Transform (8 hours)
   - 2.1. Definitions and properties of laplace transform
   - 2.2. Derivations of basic formulae of laplace transform
   - 2.3. Inverse laplace transform: Definition and standard formulae of inverse laplace transform
   - 2.4. Applications of laplace transform to ordinary differential equations

3. Fourier Series (6 hours)
   - 3.1. Fourier series
   - 3.2. Periodic functions
   - 3.3. Odd and even functions
   - 3.4. Fourier series for arbitrary range
   - 3.5. Half range fourier series

4. Integral Theorems (9 hours)
   - 4.1. Green theorems in the plane
   - 4.2. Triple integrals and divergence theorem of gauss
   - 4.3. Stroke's theorem
   - 4.4. Consequences and applications of stroke's theorem
   - 4.5. Time integrals and independence of path

5. Line, Surface and Volume Integrals (12 hours)
   - 5.1. Line integrals
   - 5.2. Evaluation of line integrals
   - 5.3. Line integrals independent of path
   - 5.4. Surfaces and surface integrals
   - 5.5. Green's theorem in the plane and its applications
   - 5.6. Stoke's theorem and its applications
   - 5.7. Volume integrals; Gauss divergence theorem and its applications

Reference books:

1. E. Kreyszig, "Advance Engineering Mathematics", Wiley, New York.
2. M.M. Gutterman and Z.N.Nitecki, "Differential Equation, a First Course", Saunders, New York.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	10	12
2.	8	10
3.	6	6
4.	9	10
5.	12	12
Total	**45**	**50**

* There may be minor deviation in marks distribution.

STRENGTH OF MATERIALS

COURSE CODE: CE431

Year: II
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Objective: The objective of the course is to provide basic knowledge in material behavior, stress-strain relations, types and their analysis. At the end students will have basic concept on theory of flexure and column buckling.

1. Introductions (1 hours)
   - 1.1. Types of loads and supports
   - 1.2. Statically determinate and indeterminate structures

2. Stresses and Strains (8 hours)
   - 2.1. Introductions
   - 2.2. Stress-strain diagram for steel
   - 2.3. Hook's law: axial and typical stress strain diagram for characteristics of mild steel
   - 2.4. Shear deformation and shear angle
   - 2.5. Hook's law for shearing deformations
   - 2.6. Allowable stresses and factor of safety
   - 2.7. Elongation of bars: Varying cross-sections, tapered section
   - 2.8. Compound bars subjected to axial tension and compression
   - 2.9. Relationship between modulus of elasticity, modulus of rigidity, bulk modulus and poisson's ratio
   - 2.10. Temperature stresses

3. Geometrical Properties of Sections (6 hours)
   - 3.1. Axes of symmetry
   - 3.2. Centre of gravity of built-up plane figures
   - 3.3. Centre of gravity of built-up standard steel sections
   - 3.4. Moment of inertia of standard and built-up sections
   - 3.5. Polar moment of inertia
   - 3.6. Radius of gyration
   - 3.7. Product of inertia
   - 3.8. Principle moment and principle axes of inertia

4. Principal Stresses (6 hours)
   - 4.1. Introduction
   - 4.2. Principle stresses and principle planes
   - 4.3. Stresses acting on plane inclined to the direction of the applied force
   - 4.4. Stresses acting on an inclined plane subjected to two mutually perpendicular normal and shear stresses and principal strain
   - 4.5. Mohr's circle for stress and strain

5. Axial Forces, Shearing Forces and Bending Moments (8 hours)
   - 5.1. Plotting shearing force, bending moment and axial force diagrams for determinate structures (beams and frames)
   - 5.2. Concept of superposition for shear forces, bending moments and axial forces due to various combinations of loads
   - 5.3. Maximum shear force and bending moments and their positions
   - 5.4. Relationship between loads, shear forces, bending moment

6. Theory of Flexure (5 hours)
   - 6.1. Coplanar and pure bending
   - 6.2. Elastic curve
   - 6.3. Radius of curvature, flexural stiffness
   - 6.4. Analysis of beams of symmetric cross-sections and composite beams
   - 6.5. Shear stress variation in rectangular beams
   - 6.6. Bending stress
   - 6.7. Flexural formula, differential equation of deflected shape
   - 6.8. Introduction to deflection

7. Torsion (4 hours)
   - 7.1. Introduction and assumptions
   - 7.2. Derivation of torsion formulas
   - 7.3. Torsional moments in shaft
   - 7.4. Torsional stress in shaft
   - 7.5. Angle of twist

8. Introduction to Buckling (4 hours)
   - 8.1. Definition of buckling
   - 8.2. Theory of columns according to support systems
   - 8.3. Effective length
   - 8.4. Long column by Euler's formula
   - 8.5. Limitations of Euler's formula
   - 8.6. Buckling of compression member in truss

9. Thin Walled Vessels (3 hours)
   - 9.1. Definition and characteristics of thin walled vessels
   - 9.2. Types of stresses in thin walled vessels
   - 9.3. Calculation of stresses in thin walled vessels

Laboratory/Practical:

1. Stress-Strain curve in tension
2. Torsion test to determine modules of rigidity
3. Column behavior due to buckling
4. Deflection of simple beam
5. Impact strain of steel

Reference books:

1. R.K. Rajput, "Strength of Materials", S. Chand & Company Ltd., New Delhi.
2. F.P. Beer, and E.R. Johnson "Mechanics of Materials", Tata McGraw Hill Publishing Co. Ltd.
3. E.P. Popov,"Mechanics of Material", New Delhi, Prentice Hall of India
4. A.Pytel, and F.L. Singer, "Strength of Materials", Harper Collins, India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	1	4
2	8	8
3	6	6
4	6	6
5	8	6
6	5	6
7	4	6
8	4	4
9	3	4
Total	**45**	**50**

*There may be minor deviation in marks distribution.

FLUID MECHANICS

COURSE CODE: CE432

Year: II
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	2	50	-	50	25	125	

Course Objective: This course is aimed at teaching students the concept of water resources engineering and their application in the field of civil engineering. Fundamentals of fluid mechanics are taught in this semester to proceed in the application phase covered in the irrigation and hydropower engineering courses.

1. Properties of Fluids (5 hours)
   - 1.1. Definition of fluid, application in civil engineering
   - 1.2. Matter as solid, liquid and gas
   - 1.3. Concept of control volume and continuum in fluid mechanics
   - 1.4. Effect of shear stress on solid
   - 1.5. Classification of fluid: Ideal and real fluids, Newtonian and non-Newtonian fluids, compressible and incompressible fluids with examples
   - 1.6. Viscosity:
     - 1.6.1. Newton's law of viscosity
     - 1.6.2. Effect of temperature on viscosity
     - 1.6.3. Effect of pressure on viscosity
     - 1.6.4. Methods for finding viscosity of fluids by viscometer
   - 1.7. Definitions of common terms: Mass density, specific weight, specific gravity, specific volume, viscosity, compressibility, capillarity, surface tension, and vapor pressure

2. Fluid Statics (15 hours)
   - 2.1. Introduction, application in civil engineering, concept about the absolute and relative equilibrium.
   - 2.2. Atmospheric, gauge and absolute pressure.
   - 2.3. Pascal's law
   - 2.4. Hydrostatics law of pressure distribution (pressure-depth relationship)
   - 2.5. Measurement of pressure:
     - 2.5.1. Simple manometer as piezometer,
     - 2.5.2. U-tube manometer
     - 2.5.3. Differential manometer
     - 2.5.4. Bourden gauge
   - 2.6. Pressure on submerged surfaces
     - 2.6.1. Total pressure and centre of pressure
     - 2.6.2. Pressure diagram on plane surfaces
     - 2.6.3. Pressure on curved surfaces
     - 2.6.4. Computation of pressure forces on gates (plane and curve), dams, retaining structures and other hydraulic structures
   - 2.7. Equilibrium stability of floating bodies
     - 2.7.1. Buoyancy, flotation concept,
     - 2.7.2. Thrust on immersed surface and Archimedes' principle
     - 2.7.3. The stability of floating and submerged bodies.
     - 2.7.4. Metacentre, determination of metacentric height.
     - 2.7.5. Liquid in relative equilibrium (pressure variation in the case of uniform linear and radial acceleration)

3. Fluid Kinematics (5 hours)
   - 3.1. Description of fluid motion
     - 3.1.1. Langrangian method
     - 3.1.2. Eulerain method
   - 3.2. One, two- and three-dimensional flow
   - 3.3. Types of fluid flow (uniform and non-uniform, steady and unsteady, laminar and turbulent)
   - 3.4. Rotational and irrotational motion, stream function and potential function.
   - 3.5. Types of flow lines (Streamline, streak line, path line and stream tube)
   - 3.6. Principle of conservation of mass
   - 3.7. Continuity equation in cartesian and cylindrical polar coordinates (one, two and three dimensional)

4. Fluid Dynamics (12 hours)
   - 4.1. Various forces acting on fluid and introduction to navier-stroke's equation
   - 4.2. Various forms of energies in fluid flow
   - 4.3. Eulers's equation for motion and its application

4.4. Bernoulli's equation and its physical meaning
4.5. Practical application of Bernoulli's equation
  4.5.1. Venturimeter
  4.5.2. Orifice meter
  4.5.3. Nozzle meter
  4.5.4. Pitot tube
4.6. Flow through orifice (small orifice, large orifice, partially submerged orifice as well as submerged orifice)
4.7. Different hydraulic coefficients (Cv, Cc and Cd) and their determination.
4.8. Definition and classification of notches and weirs
4.9. Varying head flow such as emptying and filling of tanks
4.10. Flow past through submerged bodies
  4.10.1. Drag and lift forces
  4.10.2. Drag on a sphere and cylinder
4.11. Boundary layer definition, concept, thickness and theory

5. Momentum Analysis(5 hours)
  5.1. Momentum principle and equations
  5.2. Application of momentum equations to calculate forces on pipe bends, enlargements and reducers
  5.3. Forces exerted by the jet on stationary and moving vanes of different shapes
  5.4. Concept of angular momentum with examples

6. Similitude and Physical Modeling (3 hours)
  6.1. Introduction to dimensional analysis (physical quantities and their dimensions)
  6.2. Principal of dimensional homogeneity
  6.3. Methods of dimensional analysis (Rayleigh and Buckingham π-Theorem)
  6.4. Similitude, laws of similarity, distorted and undistorted model Physical model and modeling criteria (Reynolds, Froude, Euler, Weber and Mach's law with some examples)
  6.5. Introduction to scale effects in model studies

Laboratory/Practical:

1. Newton's law of viscosity
2. Hydrostatic force on submedrged body
3. Stability of a floating body
4. Verification of Bernoulli's equation
5. Impact of jet
6. Flow through edged orifice
7. Flow over broad-crested weir

Reference books:

1. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria and Sons.
2. D. P. Sangroula, "Fundamentals of Fluid Mechanics", Nepal Printing Support, Anamnagar, Kathmandu.
3. K. L. Kumar, "Engineering Fluid Mechanics", Eurasia Publishing house (P) Ltd. Ram Nagar New Delhi.
4. Victor and Street, "Elementary Fluid Mechanics", John Wiley and Sons Inc., Third Avenue, New York.
5. N.B. Webber, "Fluid Mechanics for Civil Engineers", Chapman and Hall.
6. P.N. Modi, and S. M. Seth, "Fluid Mechanics and Hydraulics", Standard Book House.
7. P.K. Bansal, "A text book of fluid Mechanics" Laxmi Publishers.
8. R.K. Rajput, "A text book of Fluid Mechanics", S. Chand & Company Ltd.
9. S. Ramamrutham, "Hydraulics FluidMechanics and Fluid Machines", Dhanpat Rai Publishing Company (P) Ltd., New Delhi.

Evaluation Scheme:

The question will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below

Chapters	Hours	Marks distribution*
1	5	5
2	15	15
3	5	5
4	12	15
5	5	5
6	3	5
Total	**45**	**50**

*There may be minor deviation in marks distribution.

SURVEYING I

COURSE CODE: CE433

Year: II
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	3	1	50	50	50	25	175	

Course Objective: This course is to provide the basic knowledge of land measurement and surveying techniques. After completing this course students will be able to prepare a plan and topographic maps using various instruments.

1. Introduction and Basic Concept (2 hours)
   - 1.1. Historical background, definition, objectives and classification
   - 1.2. Principle of surveying
   - 1.3. Scales, conventional symbols
   - 1.4. Precision in surveying

2. Survey Measurements and Error (2 hours)
   - 2.1. Principles of different methods of measurements
   - 2.2. Reliability of measurements
   - 2.3. Concept of error in measurements
   - 2.4. Types of errors

3. Linear Measurements (3 hours)
   - 3.1. Methods of linear measurements
   - 3.2. Instruments for linear measurements
   - 3.3. Procedure for linear measurements
   - 3.4. Accuracy, precision, errors, sources of errors and types of errors in linear measurements
   - 3.5. Correction applied in linear measurements
   - 3.6. EDM and its working principle

4. Angular Measurements (3 hours)
   - 4.1. Angles and directions
   - 4.2. Methods of determining angles and directions
   - 4.3. Angle and direction measurements with theodolite
   - 4.4. Angle measurements using a tape, plane table, and compass

5. Chain and Compass Surveying (4 hours)
   - 5.1. Methods and principle of chain survey
   - 5.2. Obstacles in chaining/ranging
   - 5.3. Meridian, bearing and azimuth
   - 5.4. System of bearing, conversion from one system to another
   - 5.5. Calculation of angles from bearings and vice versa
   - 5.6. Dip of magnetic needle
   - 5.7. Magnetic declination
   - 5.8. Errors in chain and compass survey

6. Traverse Surveying (5 hours)
   - 6.1. Introduction
   - 6.2. Uses of traverse surveying
   - 6.3. Methods of traversing
   - 6.4. Traversing procedure
   - 6.5. Compatibility of linear and angular measurements
   - 6.6. Checks in closed and open traverse
   - 6.7. Traverse computation
   - 6.8. Plotting a traverse survey
   - 6.9. Graphical method of adjustment of error and permissible precision
   - 6.10. Omitted measurements

7. Leveling (8 hours)
   - 7.1. Definition and importance of leveling
   - 7.2. Methods of leveling
   - 7.3. Levels and level rods, foot plates, rod bubbles
   - 7.4. Temporary and permanent adjustment of level
   - 7.5. Collimation or two peg tests

7.6. Methods of booking and calculation of reduced level
7.7. Curvature and refraction correction
7.8. Classification of leveling, fly leveling, profile leveling, cross sectioning, reciprocal leveling, precise leveling
7.9. Error and adjustment in leveling

8. Plane Table Survey (3 hours)
   8.1. Introduction and principles in plane table
   8.2. Methods of plane tabling
   8.3. Advantages and disadvantages of plane tabling
   8.4. Error in plane tabling

9. Theodolite (5 hours)
   9.1. Basic definition
   9.2. Construction principle and parts of theodolite
   9.3. Temporary adjustment of theodolite
   9.4. Measurement of horizontal angle, vertical angles and zenith angle
   9.5. Errors in theodolite

10. Triangulation and Trilateration (4 hours)
   10.1. Principles for triangulation and trilateration
   10.2. Introduction of EDM and total station for triangulation and trilateration
   10.3. Classification of triangulation system
   10.4. Specification of different types of triangulations

11. Area and Volume (6 hours)
   11.1. Methods of calculating the area
   11.2. Area from field measurements
   11.3. Area from plan
   11.4. Planimeter
   11.5. Area of cross-sections
   11.6. Sources of errors in computation of area
   11.7. Partition of land
   11.8. Measurement of volume from cross section, use of trapezoidal formula and prismoidal formula for computation of volume, volume by spot leveling, volume by contour plan

Field/Practical Works:

1. Linear measurement technique in plane and sloping ground with tape, ranging rod, arrow and use of abney level and clinometers
2. Traversing using chain, tape and compass
3. Two peg test and fly leveling
4. Leveling field survey to determine profile and cross section
5. Measuring two sets of horizontal angles and one set of zenithal angles
6. Traverse angle distance measurement using theodolite
7. Area measurement by using planimeter

Reference books:

1. A.M. Chandra, “Plane Surveying”, New Age International Publishers, New Delhi.
2. A.M. Chandra, “Higher Surveying”, New Age International Publishers, New Delhi.
3. B.C. Punmia, “Surveying Volume I”, Standard Book House, New Delhi.
4. B.C. Punmia, “Surveying Volume II”, Standard Book House, New Delhi.
5. N. Basnet, and M. Basnet, “Basic Surveying- II”, Benchmark Education Support Pvt. Ltd., Kathmandu.
6. N.B. Basak, “Surveying and Leveling”, Tata McGraw Hill Publishing Company Ltd., New Delhi.
7. R. Agor, “A Text Book of Surveying and Levelling”, Khanna Publishers, New Delhi.
8. S.K. Duggal, “Surveying”, Tata McGraw Hill Education Private Limited New Delhi.

Evaluation Scheme:
There will be questions covering all the chapters in the syllabus. The evaluation schemes for the question will be as indicated in the table below

Chapter	Hours	Marks Distribution*
1	2	2
2	2	3
3	3	4
4	3	4
5	4	6
6	5	6
7	8	8
8	3	2
9	5	5
10	4	5
11	6	5
Total	**45**	**50**

* There may be minor deviation in marks distribution

ENGINEERING GEOLOGY

COURSE CODE: CE434

Year: II
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	0	50	25	50	25	150	

Course Objective: This main objective of the course is to introduce different types of rock, rock structures and their defects. The students will be able to identify the different types of rocks, minerals, geological structures, geological processes and their impacts on engineering structures etc. The students will also be able to use the geological maps including the drawing of dips, strikes, outcrop, faults and folds in maps. Furthermore, the course will help students to know about geological setting of Himalaya, geological structures for development of infrastructures.

1. Introduction and Scope (8 hours)
   - 1.1. Scope, objective and importance of geology in civil engineering
   - 1.2. Different branches of geology and their interrelations
   - 1.3. Relationship of geology with other branches of science and engineering
   - 1.4. Definition of engineering geology (according to IAEG), role and tasks of an engineering geologist, scope, objectives and its importance in the context of Nepal
   - 1.5. Structure and composition of earth
   - 1.6. Physical features of the earth surface: Continental & oceanic features, mountains, plateau and shields
   - 1.7. Difference between erosion and weathering
   - 1.8. Geological cycle
   - 1.9. Earth dynamism:
     - 1.9.1. Plate tectonics
     - 1.9.2. Earthquake (classification, cause and effect of earthquakes)
     - 1.9.3. Volcanism

1. Basic Reviews of Earth (6 hours)
   - 1.1. The origin of Earth and different hypothesis
   - 1.2. Age, Component &structures (Internal & External) of the Earth
   - 1.3. History of the Earth, Geological Time Scale, origin and evolution of life
   - 1.4. Internal & External Geological Processes
   - 1.5. Plate Tectonics: Theory, Plate and Plate Boundaries
   - 1.6. Mountain and mountain Building Processes
   - 1.7. Physical features of Earth: Oceanic, continental, Plateau, Shields
2. Mineralogy& Crystallography (8 hours)
   - 2.1. Crystals & Minerals: Formation processes
   - 2.2. Elements of crystals, Symmetry elements of crystals, Crystal form, Crystal habit, Crystal System
   - 2.3. Mineral: Introduction, Physical, Chemical & Optical Properties , Classification
   - 2.4. Rock Forming Minerals
   - 2.5. Megascopic study of Quartz, Feldspars Micas, Pyroxenes, Amphiboles, Carbonates, Oxides, Halites, Carbonaceous, Evaporates, and other Minerals
   - 2.6. Civil Engineering significances of different minerals
3. Petrology (6 hours)
   - 3.1. Petrology, Petrography, Petrogenesis
   - 3.2. Rock & Rock Cycle
   - 3.3. Classification of Rocks and it's processes of formation (Magmatism, Sedimentation, Metamorphism)
   - 3.4. Textures, Structures and classification of different types of Rocks
   - 3.5. Physical & basic engineering properties of different rock types
   - 3.6. Macroscopic study of common rocks(Igneous, Sedimentary, Metamorphic)

4. Structural Geology (12 hours)
   - 4.1. Rock deformation: stage, Mechanism and reasons
   - 4.2. Attitudes of geological planes

4.3. Measurement of orientation of geological strata in map and using geological compass in field
4.4. Geological Compass and it's types
4.5. Plotting of geological data on map
4.6. Geological Structures: Introduction and Types(Primary and Secondary)
4.7. Primary geological structures: (Beds and Bedding Planes, lamination, Cross bedding, gradded bedding, ripple marks, Mudcracks etc.
4.8. Secondary Geological structures: Lineation, Foliation, Boudinage,, Cleavage, Folds, Fractures, Joints, Faults, Thrusts.
4.9. Identification criteria of secondary geological structures in field
4.10. Civil Engineering significances of geological structures

5. Physical Geology (6 hours)
5.1. Introduction
5.2. Geological Agents
5.3. Weathering, Erosion (Types and Factors)
5.4. Geological works of Geological agents (Water: Running, Underground, Lake, Sea, Wind, Glacier)
5.5. Landform developed by geological works of geological agents

6. Geological and Geomorphologic division of Himalaya (3 hours)
6.1. Geomorphological of Physiographic division
6.2. Geological Division
6.3. Geological Units

Practical

Following practical exercises will be performed in this course (including three days field study in real project site compulsory)
Study of Geological Time Scale
Study of Crystal system in Crystal Models
Study and Identification of Minerals
Study and Identification of Rocks
Study and Interpretation of Geological structures in Block Diagrams

References:

A. Holmes " Principles of Physical Geology' ELBS English Language Society
M.P. Beillings: Principles of Structural Geology", Prentice Hall of India, New Delhi
P.C. Ghimire& M.S. Dhar, " Engineering Geology"
M. R. Dhital, " Geology of Himalaya, Elsevier

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	4	5
2	6	6
3	8	10
4	6	6
5	12	12
6	6	6
7	3	5
Total	**45**	**50**

*There may be minor deviation in marks distribution.

BUILDING CONSTRUCTION AND BUILDING DRAWINGS

COURSE CODE: CE435

Year: II

Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	2	1	50	25	50	25	150	

Course Objective: The objective of the course is divided into two broad segments viz. i) Building Construction, and ii) Building Drawings

i) This main objective of the course is to make the students familiar with building components, building services, causes and prevention of cracks, rehabilitation of building, and alternative building components and technologies.

ii) The basic objective of the course is to make students familiarize with the fundamentals of building drawing and drafting skill using design software package (e.g. AutoCAD). Emphasis is placed on drafting floor plan, elevation, section and details of building

1. Building Science (10 hours)
   - 1.1. Buildings and their types
   - 1.2. Heat phenomena in building
   - 1.3. Ventilation (requirements, standards, design) & air conditioning
   - 1.4. Lighting (illumination requirements, daylight, artificial lighting)
   - 1.5. Sound and acoustics (sound & noise, acoustic defects, sound insulation)
   - 1.6. Moisture & its movement through building components and
   - 1.7. The use of vapor barriers and other damp proof courses in building
   - 1.8. Orientation & planning of buildings (principles, site-selection, economy, setting-out)
   - 1.9. Environmental issue related to building materials
   - 1.10. Building in different climate regions
   - 1.11. Environmental friendly and cost effective building technology

2. Foundations and Basements (6 hours)
   - 2.1. Purpose of foundations and basements
   - 2.2. Site exploration and its methods
   - 2.3. Foundation and its types
   - 2.4. Earthwork excavation of foundations (soft soil, hard rock, wet excavation)
   - 2.5. Excavation of trenches for pipes, cables etc. and refilling works
   - 2.6. Earthquake effects on foundations
   - 2.7. Some common problems with existing foundations
   - 2.8. Retaining properties and water proofing of basements
   - 2.9. Sealing of cracks in basements

3. Mortars & Masonry works (4 hours)
   - 3.1. Mortars (types, properties, preparation process, estimating mortar requirement)
   - 3.2. Brick masonry (types, specifications)
   - 3.3. Stone masonry (random rubble, course rubble, ashlar)
   - 3.4. Walls: Retaining walls, cavity walls, parapet walls

4. Roofs (3 hours)
   - 4.1. Roofs &its classification
   - 4.2. Timber roofs (single/double/ multiple timber roofs)
   - 4.3. Steel trusses and their components
   - 4.4. Roof coverings (titles, slates, asbestos cement sheets, shingles)

5. Stair, Lifts and Escalators (3 hours)
   - 5.1. Stair and its elements
   - 5.2. Essential requirements &types of stair
   - 5.3. Design of stairs (dog-legged and open well)
   - 5.4. Ladders, ramps, lifts &escalators

6. Doors and Windows (3 hours)
   - 6.1. Doors: Types and their fixing details
   - 6.2. Windows & ventilators: Types and their fixing details

7. Joints (2 hours)
   7.1. Types of joints
   7.2. The need for provision of joints
   7.3. Treatment and detailing of joints (roof and floor level)

8. Flooring (2 hours)
   8.1. Flooring and its types
   8.2. Special types of floor finishing (smooth cast, rough cast, pebble dash, scrapped finish, and texture finish)
   8.3. Floor and wall ties

9. Temporary Construction (5 hours)
   9.1. Scaffolding and its types
   9.2. Formwork for excavations & trenches
   9.3. Formworks for RCC construction
   9.4. Shoring and its types
   9.5. Underpinning and its procedures

10. Finishing Works (2 hours)
   10.1. Cladding (types, fixing process)
   10.2. Plastering &pointing (types and process of application)
   10.3. Painting works in wooden, metal and masonry surfaces
   10.4. Internal finishing : Non-load bearing partitions and suspended ceiling

11. Other Services in Building (2 hours)
   11.1. Water supply & sanitation
   11.2. Electrification, CCTV and telephone network
   11.3. Fire protection
   11.4. Rainwater harvesting

12. Alternative Building Material and Technologies (3 hours)
   12.1. Fiber reinforced cement and polymer composites
   12.2. Building materials from agro and industrial wastes
   12.3. Alternatives for wall construction (types of walls, construction techniques)
   12.4. Alternative roofing systems (filter slab roofs and composite beam and panal roofs)

Practical

1. Introduction to Building and Building Drawing (1 hour)
   1.1. Structural system of building
   1.2. Anatomy of building
   1.3. Elements of building
   1.4. Scale of building drawing

2. Symbols and Conventional Signs used for Building Drawing (1hour)

3. Introduction to AutoCAD (2D) (4 hours)
   3.1. Introduction
   3.2. Basic drawing and editing commands
   3.3. Dimensioning and units
   3.4. Making changes in your drawing
   3.5. Organizing your drawing with layers
   3.6. Advanced object types
   3.7. Advanced editing commands
   3.8. Printing your drawing
   3.9. Introduction to AutoCAD (3D)

4. Standard Views used in Building Drawing (2 hours)
   4.1. Location plan
   4.2. Site plan
   4.3. Floor plans
   4.4. Elevations/Facades
   4.5. Cross section
   4.6. Detail drawings
   4.7. Land layout plan

5. Types of Building Drawing (4 hours)
   - 5.1. Concept drawing
   - 5.2. Presentation drawing
   - 5.3. Municipality drawing
   - 5.4. Measured drawing
   - 5.5. Working drawing (architect's drawing, structural drawing and service drawing)
   - 5.6. As built drawing

6. Introduction to Building Bye-Laws (1 hour)

Drawing Sheet to be prepared by the students:

S.N	Description	Remarks
1	Floor plans of Sample building	Both manually and using Auto CAD
2	Elevations, Cross sections of sample building	Both manually and using Auto CAD
3	Details of sample building	Both manually and using Auto CAD
4	Working drawings (Architect's, Structural, Electrical, Sanitary drawings etc.)	Using Auto CAD

Note: Sample building means minimum two story's residential building.

Field Trip:

A visit to a high-rise building construction site and student should compulsory prepare a building plan.

Reference books:

1. B.C. Punmia, "Building Construction", Laxmi Publications (P) Ltd., India.
2. K.S. Jagadish, B.V.V. Reddy, and K.S.N. Rao, "Alternative Building Materials and Technologies", New Age International Publishers, New Delhi.
3. S.K. Duggal, "Building Materials", New Age International Publishers, New Delhi.
4. S.P. Arora, and S.P. Bindra, "Building Construction", Dhanpat Rai and Sons, India.
5. S. Kumar, "Building Construction", Standard Publishers Distributors, New Delhi.
6. D. Dernie, "Architectural Drawing", Laurence King Publishing Ltd., London.
7. F.D.K. Ching, "Architecture: Form, Space and Order", VNR, New York.
8. B. Givoni, "Man Climate and Architecture", Applied Science, Barking ESSEX.
9. E. D.Mills, "Planning and Architects Handbook", Butterworth, London.
10. S. Tikko, "AutoCAD 2012: A Problem Solving Approach", Autodesk Press, USA
11. Building Bye-laws.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution*
1	10	10
2	6	6
3	4	4
4	3	4
5-6	6	10
7-8	4	5
9-10	7	6
11-12	5	5
Total	**45**	**50**

* There may be minor variation in marks distribution

COMMUNICATION ENGLISH

COURSE CODE: SH432

Year: II
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Description: This course is a compulsory course designed to equip the learners with the communication skills required for their professional competence in English with emphasis on speaking, reading and writing.

Course Objectives: To make students able to:

1.1. Comprehend reading materials both technical and semi-technical in nature
1.2. Develop grammatical competence
1.3. Write notice, agenda, minutes
1.4. Write proposals
1.5. Write report
1.6. Write research articles
1.7. Listen and follow instruction, description and conversation in native speakers' accent
1.8. Do discussion in group, deliver talk and present brief oral reports

Course Detail:

Unit I: Oral Communication (10 hours)

2. General Rules of Pronunciation
   2.1. English sound
   2.2. Concept of affixes

3. Fundamentals of Effective Speaking: Posture, Gesture, Facial expression, Voice, Eye contact, Space distancing etc.

4. Technical Talk or Professional Talk
   4.1. Talk and speech
   4.2. Preparation and presentation of technical talk.
   4.3. Making presentation based on manuscript.
   4.4. Presenting talks based on notes.

5. Meeting
   5.1. Notice preparation
   5.2. Agenda preparation
   5.3. Minutes preparation
   5.4. Procedures of meeting conduction

Unit II: Reading (10 hours)

1. Intensive Reading
   1.1. Comprehension
   1.2. Note-taking and summary writing
   1.3. Contextual questions based on facts and imagination
   1.4. Interpreting text
2. Extensive Reading
   2.1. Title/Topic speculation
   2.2. Finding theme
   2.3. Sketching character

Unit III: Writing (25 hours)

1. Fundamentals of Effective Writing
   1.1. Unity
   1.2. Coherence
   1.3. Conciseness
   1.4. Clarity
   1.5. Accuracy
   1.6. Composing and editing strategies

2. Writing Notices with Agenda and Minutes
   2.1. Introduction

2.2. Purpose
2.3. Process

3. Proposal Writing
   3.1. Types of proposal
   3.2. Structure/ Format for technical proposals
   3.3. Writing technical proposals

4. Report Writing
   4.1. Format for memo report writing: Introduction, Parts
   4.2. Field/ Project report writing: Introduction, Parts
   4.3. Format for Formal Report- Progress Report, Feasibility Report, Empirical/ Research Report, Technical Report
   4.4. Parts and Components for formal reports

5. Letter Writing
   5.1. Qualities of good letter
   5.2. Structure of letter
   5.3. Preparation of bio-data
   5.4. Official letter format
   5.5. Application letter format

6. Writing Research Articles
   6.1. Introduction
   6.2. Procedures

Practical:

Language Lab		30 hours
Module I: Listening Lab		12 hours
Activity I	General instruction on effective listening, factors influencing listening, note-taking to ensure attention. (Equipment required: Laptop, multimedia, laser pointer, overhead projector, power point, DVD, video set, screen)	2 hours
Activity II	Listening to recorded authentic instruction followed by exercises. (Equipment required: Cassette player or Laptop)	2 hours
Activity III	Listening to recorded authentic description followed by exercises. (Equipment required: Cassette player or Laptop)	4 hours
Activity IV	Listening to recorded authentic conversation followed by exercises. (Equipment required: Cassette player or Laptop)	4 hours
Module II: Speaking		18 hours
Activity I	General instruction on effective speaking ensuring audience's attention, comprehension and effective use of audio-video aids. (Equipment required: Laptop, multimedia, laser pointer, overhead projector, power point, DVD, video set, screen)	2 hours
Activity II	Making students express their individual views on the assigned topics (Equipment required: Microphone, movie camera)	2 hours
Activity III	Getting students to participate in group discussion on the assigned topics	4 hours
Activity IV	Making students deliver talk either individually or in group on the assigned topics (Equipment required: Overhead projector, microphone, power point, laser pointer, multimedia, video camera, screen)	8 hours
Activity V	Getting students to present their brief oral reports individually on the topic of their choice (Equipment required: Overhead projector, microphone, power point, laser pointer, multimedia, video camera, screen)	2 hours

Reference books:

1. G. Leech, and F. Svartvik, "A Communicative Grammar of English", Pearson Education Ltd., England.
2. P. Riordan, "Technical Report Writing Today", Houghton Mifflin Company, USA.
3. N. P. Nyaupane, B. R. Pokhrel, S. Bandari, and B. P. Pokhrel, " English for Engineering", Jupiter Publishers and Distributors Ltd., Kathmandu, Nepal.
4. N. Konar, "Communication Skills for Professional", PHI LearningPrivate Ltd., New Delhi.
5. S.J. Gerson, and S. M. Gerson, "Technical Writing Process and Product", Addison Wesley Longman (Singapore) Pte. Ltd., India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Unit	Hours	Marks Distribution*
I	10	12
II	10	12
III	25	26
Total	**45**	**50**

* There may be minor deviation in marks distribution.

B.E. (CIVIL) SECOND YEAR DETAIL SYLLABUS

(SECOND SEMESTER)

THEORY OF STRUCTURE I

COURSE CODE: CE441

Year: II
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Objective: The basic objective of the course is to concept and knowledge of structural analysis with the emphasis of statically determinate structure. By the end of this course, it is expected that the students will be able to perform analysis of determinate structures.

1. Introduction (4 hours)
   - 1.1. Types of structures based on material used
   - 1.2. Structural mechanics
   - 1.3. Two basic approaches of structural analysis
   - 1.4. Linearly elastic structures
   - 1.5. Non-linearity in structural analysis
   - 1.6. Principle of superposition

2. Methods of Analysis (10 hours)
   - 2.1. Analysis by the strain energy method
     - 2.1.1. Strain energy and complementary strain
     - 2.1.2. Strain energy due to gradually and suddenly applied direct load: Dynamic multipliers
     - 2.1.3. Strain energy due to axial force, bending, shear and torsion
   - 2.2. Analysis by the virtual work method
     - 2.2.1. Work and complementary work
     - 2.2.2. Displacement of beams, frames and trusses by method of real work
     - 2.2.3. Calculation of real work from bending
     - 2.2.4. Limitations of the method of real work
     - 2.2.5. Displacements by the methods of virtual work in beam, frame and truss
     - 2.2.6. Direct axial and bending effects
     - 2.2.7. Effect of temperature change and misfit in fabrication of truss

3. Deformation of Beam (7 hours)
   - 3.1. Differential equation of flexure
   - 3.2. Theorems on moment area method
   - 3.3. Macaulay's method
   - 3.4. Deflection of cantilever beams
   - 3.5. Deflections in simply supported beams with and without overhangs
   - 3.6. Mid-span deflections
   - 3.7. Conjugate-beam method
   - 3.8. Deflections by the method of superposition

4. Influence Lines for Simple Structures (10 hours)
   - 4.1. Concept of influence lines
   - 4.2. Moving loads and influence lines
   - 4.3. Influence lines diagram for support reactions, support moment, shear force and bending moment for statically determinate beams
   - 4.4. Criterion of maximum reaction or shear force and bending moment in simple beam and their values
   - 4.5. Determination of reactions, bending moments and shear forces from influence line diagrams due to different loadings: Point load, distributed load, couple
   - 4.6. Loading of influence line diagrams using standard load trains
   - 4.7. Most critical position of a load on a beam span, values and location of absolute maximum bending moment and shear force
   - 4.8. Influence lines for statically determinate trusses
   - 4.9. Criterion of maximum axial force in a member of plane truss

5. Statically Determinate Arches (7 hours)
   - 5.1. Various types of arches
   - 5.2. Three-hinged circular and parabolic structures with support at same and different Level
   - 5.3. Determination of support reactions, shearing forces, normal forces and bending moments
   - 5.4. Analysis of three-hinged arches by the graphical method
   - 5.5. Influence line diagrams for reactions, bending moments, shearing forces and normal forces in three-hinged arches

6. Structures with Suspension Cable (7 hours)
   6.1. General equation of cable
   6.2. Catenary and parabolic cables
   6.3. Cable under uniformly distributed load
   6.4. Elements of a simple suspension bridges
   6.5. Suspension bridge with un-stiffened cable and 3-hinge stiffening girder
   6.6. Stress determination in three-hinged stiffening girder
   6.7. Influence line diagrams

Laboratory/Practical:

1. Deflection of beam
2. Experimental analysis of suspension bridges
3. Analysis of plane frames
4. Influence lines for beams and girders
5. Influence lines for frames
6. Measurement of reactions in three-hinged arches under different loading arrangements

Reference books:

1. C.H. Norris, J.B. Wilbur, and S.Utku, "Elementary structural Analysis", New York: McGraw-Hill Book Co.
2. W. Jr.Weaver, J. M. Gere, "Matrix Analysis of Frames Structures", CBS Publishers and Distributers, India
3. A. Darkov, and Kuznetsov, "Structural Mechanics", Mir Publishers.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Mark distribution *
1	4	6
2	10	12
3	7	8
4	10	10
5	7	8
6	7	6
Total	**45**	**50**

* There may be minor deviation in marks distribution.

PROBABILITY AND STATISTICS

COURSE CODE: SH441

Year: II
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objective: The basic objective of the course is to provide the students with practical knowledge of the principles and concept of probability and statistics and their application in engineering field.

1. Introduction and Descriptive Statistics (5 hours)
   - 1.1. Concept and importance of probability
   - 1.2. Addition theorem, multiplication theorem, conditional probability, and byer's theorem
   - 1.3. Introduction to statistics and its importance in engineering
   - 1.4. Describing data with graphs (bar, pie, line diagram, box plot)
   - 1.5. Describing data with numerical measure (measuring center, measuring variability)

2. Discrete Probability Distributions (5 hours)
   - 2.1. Discrete random variable
   - 2.2. Probability distribution of discrete random variables
   - 2.3. Binomial probability distribution
   - 2.4. Negative binomial distribution
   - 2.5. Poison distribution
   - 2.6. Hyper geometric distribution

3. Continuous Probability Distributions (6 hours)
   - 3.1. Continuous random variable and probability densities
   - 3.2. Probability distribution of continuous random variables
   - 3.3. Normal distribution
   - 3.4. Gama distribution
   - 3.5. Chi square distribution

4. Sampling (3 hours)
   - 4.1. Population and sample
   - 4.2. Sampling distribution and error in sampling
   - 4.3. Types of sampling

5. Estimation (5 hours)
   - 5.1. Point estimate
   - 5.2. Method of point estimation
   - 5.3. Interval estimation
   - 5.4. Confidence interval for mean
   - 5.5. Confidence interval for proportion

6. Correlation and Regression (6 hours)
   - 6.1. Simple linear regression model and principle of least square
   - 6.2. Correlation and coefficient of determination
   - 6.3. Standard errors of regression line and standard errors of parameters
   - 6.4. Multiple correlation and regression

7. Hypothesis Testing (11 hours)
   - 7.1. Errors in hypothesis testing
   - 7.2. Level of significance
   - 7.3. Hypothesis test concerning one mean
   - 7.4. Hypothesis test concerning two mean
   - 7.5. One-way ANOVA
   - 7.6. Hypothesis concerning one proportion
   - 7.7. Hypothesis concerning two proportion
   - 7.8. Chi square test of independence

8. Application of computer on statistical data computing (4 hours)
   - 8.1. Application of computer in computing statistical problem. E.g., scientific calculator, EXCEL, SPSS, Matlab, etc.

Reference books:

1. J. L. Devore, "Probability and Statistics for Engineering and the Sciences", Brooks/Cole publishing Company, Monterey, California.
2. R. A. Johnson, "Probability and Statistics for Engineers", Miller and Freund's publication.
3. S. C. Gupta, "Fundamental of Statistics", Himalaya Publishing House, India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1	5	6
2	5	6
3	6	8
4	3	4
5	5	6
6	6	8
7	11	12
8	4	-
Total	**45**	**50**

* There may be minor deviation in marks distribution.

SURVEYING II

COURSE CODE: CE442

Year: II
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	3	1	50	50	50	25	175	

Course Objective: The basic objective of the course is to introduce fundamental knowledge of land measurement and modern survey application. After completing this course student will be able to prepare contour map by plane tabling and tacheometry and also be able to lay curves for road.

1. Tacheometry (6 hours)
   - 1.1. Introduction: Definition and uses of tacheometery
   - 1.2. Principle of optical distance measurements
   - 1.3. Basic systems of tachometric measurements (stadia system, non-stadia system)
   - 1.4. Booking and plotting of details
   - 1.5. Sources of errors and precision of tacheometric survey

2. Trigonometric Leveling (4 hours)
   - 2.1. Problems of heights and distances
   - 2.2. Reciprocal trigonometrical leveling
   - 2.3. It's significance and error ratio
   - 2.4. Determination of heights and distances o inaccessible objects

3. Contouring (5 hours)
   - 3.1. Introduction
   - 3.2. Contours and contour lines
   - 3.3. Establishment of controls
   - 3.4. Contour interval and factors for deciding contour intervals
   - 3.5. Characteristics of contour
   - 3.6. Methods of locating contours
   - 3.7. Interpolation of contours
   - 3.8. Contour gradient
   - 3.9. Uses of contour maps

4. Intersection and Resection (4 hours)
   - 4.1. Introduction
   - 4.2. Analytical intersection and resection
   - 4.3. Two points and three-point resection and their significance
   - 4.4. Instruction on field application

5. Horizontal and Vertical Curves (8 hours)
   - 5.1. Simple circular curves and their elements
   - 5.2. Calculation and setting out of simple circular curve by ordinate from long chord, offsets from tangent and deflection angle methods
   - 5.3. Geometry of transition curves and their elements
   - 5.4. Elements of composite curves and setting out techniques
   - 5.5. Equation of vertical curves and computation of reduced levels of points on curve

6. Construction Surveying (5 hours)
   - 6.1. Introduction
   - 6.2. Horizontal and vertical controls
   - 6.3. Positioning of a structure
   - 6.4. Setting out of building, culvert and bridge

7. Photogrammetry and Remote Sensing (5 hours)
   - 7.1. Introduction of photogrammetric as a branch of surveying and its importance
   - 7.2. Principle of photogrammetry and its limitations
   - 7.3. Scale of vertical photograph
   - 7.4. Relief displacement
   - 7.5. Necessity, importance and types of remote sensing
   - 7.6. Electromagnetic radiation (EMR)
   - 7.7. Interaction of EMR with earth surface features

8. Modern System in Surveying and Mapping (8 hours)
   - 8.1. Electronic and laser theodolite
   - 8.2. Global positioning system (introduction, components, working principles and uses of GPS)
   - 8.3. Total station (introduction, features, characteristics, field procedures for total station in topographical surveying), Robotic Total Station
   - 8.4. Digital terrain model (DTM)
   - 8.5. Geographic information system (introduction, application of GIS to civil engineering projects)
   - 8.6. Introduction to DGPS and Drone Survey

Practical /Field Works:

1. Traverse survey, computation and plotting using theodolite.
2. Application of tacheometry to measure distance and elevation by using stadia system including detailing, computation and plotting
3. Intersection and resection using theodolite
4. Trigonometric leveling
5. Contouring – Indirect leveling
6. Setting out of simple circular curve, transition and vertical curve
7. Demonstration and application of Total Station
8. Demonstration and application of GPS, GIS, Photogrammetry lab visit

Reference books:

1. A.M. Chandra, "Plane Surveying", New Age International Publishers, New Delhi.
2. A.M. Chandra, "Higher Surveying", New Age International Publishers, New Delhi.
3. B.C. Punmia, "Surveying Volume 1", Standard Book House, New Delhi.
4. B.C. Punmia, "Surveying Volume 2", Standard Book House, New Delhi.
5. B.C. Punmia, "Surveying Volume 3", Standard Book House, New Delhi
6. N. Basnet, and M. Basnet, "Basic Surveying- II", Benchmark Education Support Pvt. Ltd., Kathmandu.
7. N.B. Basak, "Surveying and Leveling", Tata Mc Graw Hill Publishing Company Limited, New Delhi.
8. R. Agor, "A text book of surveying and Levelling", Khanna Publishers, New Delhi.
9. S.K. Duggal, "Surveying", Tata McGraw Hill Education Private Limited New Delhi.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1	6	8
2	4	5
3	5	6
4	4	5
5	8	10
6	5	5
7	5	5
8	8	6
Total	**45**	**50**

*There may be minor variation in marks distribution

HYDRAULICS

COURSE CODE: CE443

Year: II
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
4	1	2	50	-	50	25	125	

Course Objective: The basic objective of the course is to provide the fundamental knowledge of hydraulics which aims to impart the concept of water resources engineering and their application in the field of civil engineering. The knowledge of hydraulics is essential to the design of various hydraulic structures.

1. Pipe Flow (10 hours)
   - 1.1. Introduction to pipe flow and uses of continuity equation
   - 1.2. Distinguish between pipe and open channel flow
   - 1.3. Reynolds experiment
   - 1.4. Difference between laminar and turbulent flow
   - 1.5. Laminar flow through pipes (Hagen Poisseuille's equation)
   - 1.6. Laminar flow between parallel plates
   - 1.7. Derivation of Darcy-Weisbach formula, Colebrook-White equation and its development, and use of Moody's chart
   - 1.8. Shear stress and their distribution in uniform flow
   - 1.9. Types of pipe flow problems and their solutions.
     - 1.9.1. Three types of simple pipe flow problems and their solution
     - 1.9.2. Pipe in series, Dupuit equation. concept of equivalent pipe length
     - 1.9.3. Pipe in parallel; Different kind of problems and their solution
     - 1.9.4. Siphons and its application

2. Pipe Networks (5 hours)
   - 2.1. Introduction to pipe network problems and application
   - 2.2. Hardy-Cross method of solving of pipe networks problems
   - 2.3. Solution procedure by Hardy-Cross method for single and double loops of pipe networks with examples
   - 2.4. Economic and equivalent diameter of pipes
   - 2.5. Three reservoir problems and its solution

3. Unsteady Flow in Pipes (5 hours)
   - 3.1. Basic equations for unsteady flow: celerity, Euler's equation and continuity equation.
   - 3.2. water hammer and its effects in pipes and pen stock
   - 3.3. Variation of pressures due to sudden closure of valve for the cases of rigid and elastic pipes
   - 3.4. Propagation of elastic wave in rigid and elastic pipe
   - 3.5. Relief devices against water hammer (different types of surge tanks)

4. Open Channel Flow (4 hours)
   - 4.1. Introduction to open channel flow and its practical application
   - 4.2. Shape of open channel
   - 4.3. Classification of open channel by time, space, and hydraulic regime
   - 4.4. Geometric properties including area of flow, wetted perimeter and hydraulic radius
   - 4.5. Economic channel section on plain and hilly regions

5. Uniform flow in Open Channel (6 hours)
   - 5.1. Condition of uniform flow,
   - 5.2. Shear stress and velocity distribution
   - 5.3. Flow resistance equations: Darcy-Weisbach, Chezy and Manning equations and their relationship.
   - 5.4. Determination and factors affecting manning's roughness coefficient
   - 5.5. Types of uniform flow problems and solutions
   - 5.6. Hydraulically- Efficient channel section

6. Energy and Momentum Principles in Open Channel Flow (5 hours)
   - 6.1. Energy principle, specific energy, specific energy curve, criteria for critical flow
   - 6.2. Critical depth computations for all kind of channel sections (prismatic as well as non-prismatic) and criteria for critical state of flow.
   - 6.3. Application of energy principle and concepts of critical depth concepts (channel width reduction, rise in channel bed, venture flume and broad crested weir)
   - 6.4. Momentum principle, specific force, specific force curve, criteria for critical state of flow, conjugate depth.

7. Gradually Varied Flow (6 hours)
   7.1. Gradually varied flow, basic assumptions, governing equation and its physical meaning
   7.2. Differential equation of gradually varied flow
   7.3. Characteristics bed slopes
   7.4. Characteristics and analysis of flow profiles
   7.5. Computation of gradually varied flow
   7.6. Solution of gradually varied flow equations by graphical and numerical methods

8. Hydraulic Jump (6 hours)
   8.1. The momentum equation for the jump
   8.2. Classification of jumps
   8.3. Flow condition for jump
   8.4. Hydraulic jump as an energy dissipater
   8.5. Hydraulic jump in a horizontal rectangular channel; Relationship between hydraulic jump variables (conjugate depth, height of the jump, efficiency jump, length of the jump)
   8.6. Energy loss in jump
   8.7. Classification of the jump based on the tail water level and Froude number
   8.8. Practical application of jump at spillway toe, falls etc.

9. Flow in Mobile Boundary Channel (3 hours)
   9.1. Introduction: Rigid and mobile boundary channel
   9.2. Difference between rigid boundary channel and alluvial channel
   9.3. Shear stress distribution on the channel boundary.

10. Similitude and Physical Modeling (3hours)
   10.1. Definition and types of similarities
   10.2. Definition and types of models
   10.3. Modeling criteria
   10.4. Introduction to distorted and undistorted models

Laboratory/Practical:

1. Head loss in pipe line
2. Reynolds' experiment
3. Flow through broad-crested weir
4. Flow through open sluice gate
5. Flow through venturimeter
6. Hydraulic jump on open channel

Reference books:

1. K. Subramanya, "Flow in open channels", TATA McGraw-Hill Publishing Company Ltd.
2. K. G. Ranga Raju, "Flow through open channel", Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria and Sons.
4. K. L. Kumar, "Engineering Fluid Mechanics", Eurasia Publishing house (P) Ltd. Ram Nagar New Delhi.
5. S. Ramamrutham, "Hydraulics fluid mechanics and fluid machines", Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
6. V. T. Chow, "Open channel hydraulics", McGraw-Hill Book Company Ltd.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1	10	10
2	6	5
3	6	5
4	6	5
5	6	5
6	5	4
7	6	5
8	6	5
9	3	2
10	6	4
Total	**60**	**50**

* There may be minor deviation in marks distribution.

SOIL MECHANICS

COURSE CODE: CE444

Year: II
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	2	50	-	50	25	125	

Course Objective: The basic objective of the course is to provide the students the concepts of soil engineering, including the science and technology of soils and their application to problems in civil engineering. The course emphasizes the fundamentals and relevant principles of soil mechanics, gives an overall picture of the behavior of soils and describes the nature of some of the soil problems encountered in civil engineering.

1. Introduction (1 hour)
   - 1.1. Definition of soil engineering and geotechnical engineering
   - 1.2. Historical development of soil mechanics
   - 1.3. Soil formation and soil type.
   - 1.4. General approach of solving soil mechanics problems

2. Physical and Index Properties of Soils (4 hours)
   - 2.1. Phase diagram
   - 2.2. Simple definitions and their relationships
   - 2.3. Index properties of soils
   - 2.4. Determinations of various index properties

3. Soil Identifications and Classification (4 hours)
   - 3.1. Introduction
   - 3.2. Field Identification of soil
   - 3.3. Soil classification-Textural, ISSCS, MIT, BSCS, USCS and AASHTO soil classification system
   - 3.4. General characteristics of soils of different groups
   - 3.5. Application of soil classification system

4. Clay Mineralogy and Soil Structure (2 hours)
   - 4.1. Introduction
   - 4.2. Basic structural units of clay minerals
   - 4.3. Clay particle interaction
   - 4.4. Soil structure and fabrics

5. Compaction of Soils (3 hours)
   - 5.1. Introduction
   - 5.2. Laboratory tests (standard proctor test, modified proctor test)
   - 5.3. Factors affecting compaction
   - 5.4. Compaction specification and field control
   - 5.5. Effect of compaction on properties of soils

6. Effective Stress Principle, Capillarity and Permeability (5 hours)
   - 6.1. Introduction
   - 6.2. Principle of effective stress
   - 6.3. Physical meaning of effective stresses
   - 6.4. Capillarity in soils
   - 6.5. Permeability of soils
   - 6.6. Factors affecting permeability of soils
   - 6.7. Determinations of coefficient of permeability: Laboratory and field methods.
   - 6.8. Types of head and seepage forces
   - 6.9. Quick sand conditions and remedial measures
   - 6.10. Failures of hydraulic structures by piping and its prevention measures

7. Seepage Through Soils (4 hours)
   - 7.1. Introduction
   - 7.2. Two dimensional flow (Laplace's equation)
   - 7.3. Flow nets and its characteristics
   - 7.4. Unconfined flow
   - 7.5. Seepage in anisotropic soil condition
   - 7.6. Seepage through an earth dam on an impervious base
   - 7.7. Flow through non–homogeneous sections
   - 7.8. Prevention of erosion- protective filters

8. Stress Due to Applied Loads (5 hours)
   - 8.1. Introduction
   - 8.2. Vertical, horizontal and shear stresses due concentrated loads
   - 8.3. Boussinesq equation and Westergaard's equation
   - 8.4. Vertical stress distribution diagrams
   - 8.5. Vertical stress beneath loaded areas
   - 8.6. Influence diagram
   - 8.7. New marks influence chart
   - 8.8. Limitations of elastic theory

9. Consolidation of Soils (6 hours)
   - 9.1. Fundamentals of consolidation
   - 9.2. Contact pressure and settlement profile.
   - 9.3. Consolidation test
   - 9.4. Void ratio – pressure plots
   - 9.5. Normally consolidated and over consolidated clay
   - 9.6. Terzaghi's theory of consolidation
   - 9.7. Effect of disturbance on void ratio–pressure relationship
   - 9.8. Compression index and swell index
   - 9.9. Secondary consolidation settlement
   - 9.10. Time rate of consolidation
   - 9.11. Determination of coefficient of consolidation
   - 9.12. Calculation of consolidation settlement under a foundation

10. Shear Strength of Soil (6 hours)
   - 10.1. Concept of shear strength
   - 10.2. Principal planes and principal stresses
   - 10.3. Mohr-Coulomb theory
   - 10.4. Mohr's stress circle and failure envelop
   - 10.5. Inclination of the plane of failure caused by shear.
   - 10.6. Laboratory tests
   - 10.7. Direct shear test
   - 10.8. Triaxial shear test-general
   - 10.9. Consolidated drained triaxial test
   - 10.10. Consolidated undrained triaxial test
   - 10.11. Unconsolidated undrained triaxial Test
   - 10.12. Unconfined compression test on saturated clay.
   - 10.13. Stress path
   - 10.14. Vane shear test
   - 10.15. Empirical relations between undrained cohesion and effective overburden pressure.
   - 10.16. Shear strength of saturated and unsaturated clays
   - 10.17. Shear strength of sands.

11. Stability of Slopes (5 Hours)
   - 11.1. Introduction
   - 11.2. Cause of slope moment and failures
   - 11.3. Types of slopes and slope failures
   - 11.4. Definition of factor of safety and critical surfaces
   - 11.5. Finite slopes- forms of slip surface
   - 11.6. Total stress analysis
   - 11.7. Method of slices
   - 11.8. Location of the most critical circles
   - 11.9. Friction circle method
   - 11.10. Taylors stability number
   - 11.11. Bishops method of stability analysis
   - 11.12. Use of stability coefficients

Laboratory/Practical:

1. Sieve analysis of coarse and fine grained soils.
2. Determination of Atterberg limit of soils
3. Determination of In-situ density by Sand replacement method and Core Cutter Method.
4. Determination of OMC and maximum dry density
5. Unconfined compression test
6. Direct shear test
7. Constant head permeability test
8. UU Triaxial test

Reference books:

1. B. M. Das, “Principles of Geotechnical Engineering”, PWS-KENT Publishing Co., Boston.
2. B. M. Das, “Introduction to Soil Mechanics”, Galgotia Publication, New Delhi.
3. G. Ranjan, and A.S.R. Rao, “Basic and Applied Soil Mechanics”, New Age International Publishers, New Delhi.
4. J.E. Bowles, “Physical and Geological Properties of Soils”, McGraw Hill Co. Ltd., New York.
5. K. Terzagji, “Soil Mechanics in Engineering Practice”, John Wiley & Sons, New York.
6. K. R. Arora, “Soil Mechanics and Foundation Engineering”, Standard Publisher Distribution, India.
7. S.R. Kaniraj, “Design Aids in Soil Mechanics and Foundation Engineering “, Tata McGraw Hill Education Limited, New Delhi.
8. V.N.S. Murthy, “A Text Book of Soil Mechanics and Foundation Engineering in SI units“, UBS Publishers Distributors Ltd., India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	1	2
2	4	5
3	4	5
4	2	2
5	3	4
6	5	6
7	4	5
8	5	5
9	6	6
10	6	6
11	5	4
Total	**45**	**50**

*There may be minor deviation in marks distribution.

CONCRETE TECHNOLOGY AND MASONRY STRUCTURES

COURSE CODE: CE445

Year: II
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Objective: The basic objective of the course is to provide the students the concepts of concrete ingredients and will be able to design concrete mix of different grades using commonly used methodologies. The course also familiarized with masonry structures, its behavior and construction technologies.

1. Introduction to Concrete and Concrete Materials (4 hours)
   - 1.1. Types and use of concrete
   - 1.2. Concrete materials(cement, aggregate, water and admixture)
   - 1.3. Properties of fresh concrete and their significance

2. Structure and Strength of Concrete (3 hours)
   - 2.1. Concrete as three phase system and structures of three different phases
   - 2.2. Various types of strength of concrete and their inter relationship
   - 2.3. Effect of time and temperature on concrete strength
   - 2.4. Effect of cyclic and dynamic loads on strength
   - 2.5. Importance of curing

3. Mix Design of Concrete (6 hours)
   - 3.1. Purpose and objectives of mix design
   - 3.2. Factors affecting the choice mix proportion
   - 3.3. Workability and its test
   - 3.4. W/C ratio in concrete
   - 3.5. Introduction to nominal mix
   - 3.6. Methods of concrete mix design by DOE, ACI and IS Method
   - 3.7. Some aspects of probabilistic approach in strength
   - 3.8. Concrete mix design by segregation and bleeding
   - 3.9. Quality control in site: Mixing, handling, placing, compaction and curing
   - 3.10. Concrete in extreme temperatures
   - 3.11. Use of admixtures

4. Properties of Hardened Concrete (3 hours)
   - 4.1. Deformation of hardened concrete, moduli of elasticity
   - 4.2. Shrinkage and creep
   - 4.3. Fatigue, impact and dynamic loading
   - 4.4. Effect of porosity, water-cement ratio and aggregate size
   - 4.5. Effect of gel/space ratio
   - 4.6. Factors affecting the strength of concrete

5. Testing of Concrete and Quality Control (6 hours)
   - 5.1. Various strength of concrete
   - 5.2. Compressive strength test
   - 5.3. Tensile strength test
   - 5.4. Relationship between tensile and compressive strength
   - 5.5. Factors causing variations in the quality of concrete
   - 5.6. Advantage of quality control
   - 5.7. Sampling of concrete
   - 5.8. Variability of concrete strength and acceptance criteria

6. Durability and Permeability (3 hours)
   - 6.1. Effect of water and permeability on concrete durability
   - 6.2. Physical and chemical causes of concrete deterioration
   - 6.3. Carbonation
   - 6.4. Corrosion of steel in concrete: Reasons and preventive measures

7. Introduction to Masonry Structures (4 hours)
   - 7.1. Specific features of stone structures in Nepal
   - 7.2. Materials tools and equipments for the construction of stone masonry structures
   - 7.3. Use of masonry structures

7.4. Construction technology - English bond, Flemish bond, Rat-trap bond
7.5. Masonry as infill walls
7.6. Reinforced and un-reinforced masonry

8. Design of Masonry System (8 hours)
   8.1. Introduction to codal provisions
   8.2. Design of building wall as a rigid and elastic system
   8.3. Design of building wall as frame
   8.4. Design of engineering structures (column, water tank and retaining wall)

9. Masonry Structures under Lateral Loads (5 hours)
   9.1. Performance of masonry structures in lateral loads
   9.2. Failure behavior of masonry structures in lateral loads
   9.3. In-plane and out-of-plane behavior of masonry structures
   9.4. Ductile behavior of reinforced and unreinforced masonry structures
   9.5. Calculation of stresses for lateral loads
   9.6. Elements of lateral load resisting masonry system

10. Testing of Masonry Structures (3 hours)
   10.1. Determination of mortar strengths
   10.2. Determination of brick strengths
   10.3. Determination of stone strengths

Laboratory/Practical:

Concrete Technology
1. Gradation/Propertiesof aggregates
2. Concrete Mix design: Nominal mix, DoE, ACI and IS Method
3. Test of concrete cubes, cylinders, prisms

Masonry Structures
1. Testof bricks on compression
2. Test of wall on compression

Reference books:

1. A.M. Neville, and J.J. Brook, “Concrete Technology”, International Students Edition.
2. B.L. Gupta, and A. Gupta, “Concrete Technology”, Standard Publishers Distributors, New Delhi.
3. M. S. Shetty, “Concrete Technology: Theory and Practice”, S. Chand, New Delhi.
4. P.K. Mehta, and P. J.M. Monteiro, “Concrete, Microstructure, Properties and Materials”, University of California, Berkley (Indian Edition)
5. A.S. Arya, “Masonry and Timber Structures including earthquake resistant Design”, Nem Chandra and Bros, Roorkee.
6. A.W. handry, B.P. Sinha, and S.R. Davies, “An Introduction to Load Bearing Brick Design”, University of Edinburgh.
7. P. Dayaratnam, “Brick and Reifnorced Brick Structures”, Oxford and IBH Publishing Co. Pvt. Ltd., USA.
8. Nepal National Building Code (NBC) 109.

Evaluation scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks distribution*
1	4	4
2	3	3
3	6	6
4	3	4
5	6	8
6	3	4
7	4	4
8	8	8
9	5	5
10	3	4
Total	**45**	**50**

* There may be minor variation in marks distribution

NUMERICAL METHODS

COURSE CODE: CO441

Year: II
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	2	1	50	-	50	50	150	

Course Objective: The basic objective of the course emphasizes algorithm development and programming, and its application to realistic engineering problems.

1. Introduction to Numerical Methods (4hours)
   - 1.1. Introduction, importance of numerical methods
   - 1.2. Approximation and errors in computation
   - 1.3. Taylor's series
   - 1.4. Newton's finite differences (forward , backward, central difference, divided difference)
   - 1.5. Difference operators, shift operators, differential operators
   - 1.6. Uses and importance of computer programming in numerical methods.

2. Solutions of Nonlinear Equations (7 hours)
   - 2.1. Newton Raphson method (two equation solution)
   - 2.2. Regula-Falsi method, Secant method
   - 2.3. Bisection method
   - 2.4. Fixed point iteration method
   - 2.5. Rate of convergence and comparisons of these methods
   - 2.6. Evaluation of polynomials using Horner's rule

3. Linear Algebraic Equations (7 hours)
   - 3.1. Gauss elimination method with pivoting strategies
   - 3.2. Gauss-Jordan method
   - 3.3. LU decomposition method
   - 3.4. Matrix inversion method
   - 3.5. Iterative methods (Jacobi method, Gauss-Seidel method)
   - 3.6. Eigen value and Eigen vector using Power method

4. Interpolation (10 hours)
   - 4.1. Linear interpolation
   - 4.2. Newton's interpolation
   - 4.3. Central difference interpolation: Stirling's formula, Bessel's formula
   - 4.4. Lagrange interpolation
   - 4.5. Least square method of fitting linear and nonlinear curve for discrete data and continuous function
   - 4.6. Cubic spline interpolation

5. Differentiation and Integration (6 hours)
   - 5.1. Numerical differentiation formulae
   - 5.2. Newton-Cote general quadrature formula
   - 5.3. Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Boole's rule
   - 5.4. Romberg integration
   - 5.5. Gaussian integration

6. Solution of Ordinary Differential Equations (7 hours)
   - 6.1. Euler's and Modified Euler's method
   - 6.2. Runge Kutta methods for $1^{st}$and 2^{nd}order ordinary differential equations
   - 6.3. Higher order differential equations
   - 6.4. Boundary value problems

7. Numerical Solution of Partial Differential Equation (4 hours)
   - 7.1. Elliptic equations (Laplace equation,Poisson equation)
   - 7.2. Parabolic equations
   - 7.3. Hyperbolic equations

Laboratory/Practical:

Algorithm and program development in C programming language of following:

1. Review of properties of programming language
2. Bisection method
3. Newton Raphson method
4. Secant method
5. Gauss elimination method
6. Gauss-Jordan method
7. Gauss-Seidal method
8. Matrix inversion method
9. Trapezoidal rule
10. Simpson's 1/3 rule
11. Simpson's 3/8 rule
12. Lagrange interpolation, Curve fitting by least square method.
13. Solution of 1^{st}& 2^{nd}order differential equation using Runge-Kutta method
14. Partial differential equation (Laplace equation)

Reference books:

1. B.S.Grewal, "Numerical Methods in Engineering and Science ", Khanna Publication, India.
2. C.F. Gerald, and P.O. Wheatley, “Applied Numerical Analysis”, Addison Wesley Publishing Co., New York.
3. S.Yakwitz, and F. Szidarovszky,”An introduction to Numerical computations”, Macmillan publishing Co., New York.
4. V. Rajaraman, “Computer oriented numerical methods”, Prentice Hall of India Private Limited, New Delhi.
5. W. Cdhency, and D. Kincaid, “Numerical Mathematics and Computing “, Brooks/Cole Publishing Co.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1	4	5
2	7	8
3	7	8
4	10	10
5	6	8
6	7	6
7	4	5
Total	**45**	**50**

* There may be minor deviation in marks distribution

B.E. (CIVIL) THIRD YEAR DETAIL SYLLABUS

(FIRST SEMESTER)

THEORY OF STRUCTURES II

COURSE CODE: CE451

Year: III
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
4	1	2	50	-	50	25	125	

Course Objective: The objective of the course emphasizes the basic concepts and theorems on static (equilibrium), geometrical (compatibility) and physical (force, stiffness and displacements) conditions in the context of indeterminate systems.

1. Introduction (2 hours)
   - 1.1. Definition and types of indeterminate structures
   - 1.2. Indeterminacy of structural systems its physical meanings and its types
   - 1.3. Degree of static indeterminacy and kinematic indeterminacy of a system, and its determination

2. Theorem on Displacements (4 hours)
   - 2.1. Maxwell's theorem
   - 2.2. Castigliano's theorem
   - 2.3. Betti's law

3. Force Method (14 hours)
   - 3.1. Definitions and explanations
   - 3.2. Equilibrium conditions and compatibility equations
   - 3.3. Flexibility matrix: generations and calculations
   - 3.4. Analysis of statically indeterminate beams and frames by force method
   - 3.5. Analysis of statically indeterminate beams and frames including yielding of support
   - 3.6. Analysis of statically Indeterminate trusses including temperature effects
   - 3.7. Analysis of two-hinged Parabolic arches including yield of support and temperature effect

4. Slope-Deflection Method (8 hours)
   - 4.1. Introduction
   - 4.2. Derivation of the slope-deflection equations
   - 4.3. Analysis of statically indeterminate beams including support settlement and rotation of joints
   - 4.4. Analysis of statically indeterminate rigid frames without and with unknown joint translation
   - 4.5. Analysis of statically indeterminate rigid frames due to yielding of support

5. Moment Distribution Method (8 hours)
   - 5.1. Introduction
   - 5.2. Stiffness
   - 5.3. Carry-over factors and distribution factors
   - 5.4. Cases of symmetry and anti-symmetry
   - 5.5. Analysis of statically indeterminate beams and frames

6. Influence Line (IL) for Indeterminate Structures (8 hours)
   - 6.1. Introduction
   - 6.2. Influence lines for statically indeterminate beams
   - 6.3. Mueller Breslau principle its physical meaning and its use
   - 6.4. Drawing of ILD by Mueller Breslau principle
   - 6.5. IL diagrams for reaction, bending moment and shear force in various sections of continuous beams (two to three spans only)
   - 6.6. Influence lines for statically indeterminate trusses

7. Matrix Method (10 hours)
   - 7.1. Introduction (Flexibility and stiffness)
   - 7.2. Flexibility and stiffness matrix
   - 7.3. Relationship between flexibility and stiffness matrix
   - 7.4. Analysis of statically indeterminate beams, frames and trusses by matrix method

8. Introduction to Plastic Analysis (6 hours)
   - 8.1. Definitions and explanations
   - 8.2. Plastic analysis of bending members
   - 8.3. Plastic bending
   - 8.4. Plastic hinge and its length

8.5. Load factor and shape factor
8.6. Collapse loads
8.7. Collapse with tied loads for simple cases of statically indeterminate beams and frames

Laboratories/Practical:

1. Continuous beams (propped cantilever, two spanned beams with various end conditions)
2. Two hinged arch
3. Symmetrical portal frame
4. Unsymmetrical portal frame

Reference books:

1. A. Ghali, and A.M. Neville, "Structural Analysis, A Unified Classical and Matrix Approach", Chapman and Hall, New York.
2. C.H. Norris, J.B. Wilbur, and S. Utku, "Elementary Structural Analysis", McGraw-Hill International Editions, Civil Engineering Series, India
3. G.S. Pandit, and S.P. Gupta, "Structural Analysis, A Matrix Approach", Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. C.S. Reddy, "Basic Structural Analysis", Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. C.K. Wang, "Intermediate Structural Analysis", McGraw-Hill International Editions, Civil Engineering Series, India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus as far as practicable. The approximate mark allocation to the questions is proposed to be as indicated in the table below:

Chapters	Hours	Mark distribution*
1	2	4
2	4	5
3	14	10
4	8	5
5	8	6
6	8	5
7	10	10
8	6	5
Total	**60**	**50**

* There may be minor variation in marks distribution

SURVEY CAMP

COURSE CODE: CE452

Year: III

Semester: I **(Field work: 10 days)**

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
-	-	-	-	50	-	50	100	

Course Objective: The basic objective of the course to give the students an ample opportunity to consolidate and update their practical and theoretical knowledge in surveying, in the actual field conditions and with practical problems.

A) Horizontal Control Practices for Large Area (Major and Minor Traverse):
For this purpose at least 1.4 km periphery area shall be enclosed by forming the closed traverse and coordinates of those traverse points shall be controlled with reference to national grid system. X and Y coordinates shall be controlled by Theodolite/Total Station. Detailed topographic survey shall be conducted within the perimeter of the semi built up area around 4.0 to 6.0 hectares of land (about 5-7 control points).
Time Allocated: 4 Days (including reconnaissance, stations selection and pegging of major traverse, minor traverse, major traverse angles, distances measurement, etc.)

B) Vertical Control for Major and Minor Traverse:
Coordinates (Z) of these traverses shall be controlled by using Auto level. Link traverse exercise must be compulsory.
Time Allocated: 2 Days
- 1 Day for fly leveling and RL transfer
- 1 Days for computation and plotting of traverse

Vertical control for control points shall be done by fly leveling and detailing shall be done by using Total Station and Theodolite. Data saving in data logger (Electronics field book) and manual booking both should be practices in detailing.

C) Bridge Site Survey:
Detailed topographic survey of suitable bridge site area (180 m *110 m) shall be conducted by which Topographic map, L- section, X section etc shall be prepared at standard scale.
Time Allocated: 2 Days
Detailing shall be done by using total station. Vertical control for control points shall be done by auto level.

D) Road Alignment Survey:
At least 800m road alignment survey shall be done from where plan, L section, X section etc. shall be drawn at standard scale including selection of grades and formation levels etc.
Time Allocated: 2 Days

Requirements:

The number of students for each group should not be more than 6 (six) and modern surveying equipment are to be used as far as possible.

Evaluation Criteria:

Internal Evaluation: Regular evaluation throughout the 10 days as well as viva for computation and plotting of major traverse, minor traverse, viva for road and bridge site survey and traverse orientation check should be taken.

External Evaluation: Standard Reports shall be prepared group wise. During compilation of the report, data shall be submitted content wise and all the reference sketches and standard drawings shall be compiled in A3 size and all the original data and drawings shall be presented during final viva.

WATER SUPPLY AND SANITATION ENGINEERING

COURSE CODE: CE453

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Objective: The basic objective of the course is to provide a sound knowledge in functions of various components of water supply system, water treatment technology and construction of water mains and distribution.

1. Introduction (2 hours)
   - 1.1. Objectives of water supply system, immediate and long-term impact
   - 1.2. Importance of water
   - 1.3. Definition
     - 1.3.1. Pure and impure water
     - 1.3.2. Potable and wholesome water
     - 1.3.3. Polluted and contaminated water
   - 1.4. Schematic diagram of typical water supply system
   - 1.5. Components of water supply system and their functions
   - 1.6. Development of water supply system in Nepal

2. Water Sources (4 hours)
   - 2.1. Classification of sources of water
     - 2.1.1. Surface water sources: Rivers, streams, lakes, ponds, and impounded reservoir
     - 2.1.2. Ground sources: Confined and unconfined aquifers, springs wells, infiltration galleries and wells
   - 2.2. Selection of water sources

3. Quantity of Water (5 hours)
   - 3.1. Per capita demand of water
   - 3.2. Design and base periods
   - 3.3. Types of water demand: Domestic, livestock, commercial, public/municipal, industrial, firefighting, loss and wastage
   - 3.4. Variation in demand of water
   - 3.5. Factors affecting demand of water
   - 3.6. Population forecasting - necessity and methods
     - 3.6.1. Arithmetical increase method
     - 3.6.2. Geometrical increase method
     - 3.6.3. Incremental increase method
     - 3.6.4. Decrease rate of growth method

4. Quality of Water (5 hours)
   - 4.1. Impurities in water, their classification and effects
   - 4.2. Hardness of water, types of hardness, and alkalinity in water
   - 4.3. Living organisms in water
   - 4.4. Water borne diseases and their control
   - 4.5. Examination of water
     - 4.5.1. Physical examination of water (tests for temperature, color and turbidity)
     - 4.5.2. Chemical examination of water (tests for pH, suspended, dissolved and total solids)
     - 4.5.3. Biological examination of water (multiple tube and membrane fermentation method), most probable number
   - 4.6. Water quality standard for drinking purpose (WHO Standard)

5. Intakes (3 hours)
   - 5.1. Definition
   - 5.2. Factors governing the site selection of an intake
   - 5.3. Classification of intake
   - 5.4. Characteristics of intake: River intakes, reservoir intake, and spring intake

6. Treatment of Water (14 hours)
   - 6.1. Impurities in water, their classification and effects
   - 6.2. Objectives of water treatment
   - 6.3. Screening: Purpose, types (coarse, medium and fine screens)
   - 6.4. Plain sedimentation
     - 6.4.1. Purpose
     - 6.4.2. Theory of settlement
     - 6.4.3. Effect of temperature on settlement
     - 6.4.4. Ideal sedimentation tank
     - 6.4.5. Types of sedimentation tank
     - 6.4.6. Design of sedimentation tank
   - 6.5. Sedimentation with coagulation
     - 6.5.1. Purpose
     - 6.5.2. Coagulants (types and their chemical reactions)
     - 6.5.3. Dose of coagulants (optimum dose of coagulant)
     - 6.5.4. Mixing devices (purpose and types)
     - 6.5.5. Flocculation and clarifier
   - 6.6. Filtration
     - 6.6.1. Purpose
     - 6.6.2. Theory of filtration
     - 6.6.3. Classification of filters
     - 6.6.4. Operation, construction and maintenance of filters
   - 6.7. Disinfection
     - 6.7.1. Purpose
     - 6.7.2. Methods of disinfection
     - 6.7.3. Chlorination (theory, chlorine demand, chlorine dose, residual chlorine, contact time
     - 6.7.4. Types of chlorine
     - 6.7.5. Forms of chlorination (plain chlorination, pre-chlorination, post chlorination, double chlorination, multiple chlorination, breakpoint chlorination, super chlorination, dechlorination)
     - 6.7.6. Factors affecting efficiency of chlorination
     - 6.7.7. Ozone treatment
   - 6.8. Softening
     - 6.8.1. Purpose
     - 6.8.2. Removal of temporary hardness by boiling method and lime treatment method
     - 6.8.3. Removal of permanent hardness by lime soda method, zeolite method and ionization method
   - 6.9. Miscellaneous Treatments
     - 6.9.1. Aeration: Purpose and methods of aeration
     - 6.9.2. Removal of iron and manganese
     - 6.9.3. Removal of color, odor and taste

7. Reservoirs and Distribution System (6 hours)
   - 7.1. System of supply
   - 7.2. Different types of water reservoirs: Clear water reservoirs, service reservoirs, balancing reservoir
   - 7.3. Layout of distribution system: Tree system, grid iron system, ring system and radial system
   - 7.4. Design of distribution system
   - 7.5. Appurtenances in distribution system

8. Conveyance of Water (3 hours)
   - 8.1. Pipe materials: Types and requirements of good material
   - 8.2. Pipe joints: Purpose and types
   - 8.3. Laying of pipes

9. Valves and Fittings (3 hours)
   - 9.1. Valves: Purpose and types
   - 9.2. Fittings: Purpose and types
   - 9.3. Break pressure tank: Purpose and construction
   - 9.4. Public stand post: Purpose, location and construction
   - 9.5. Maintenance of water supply system

Laboratory/Practical:

1. Determination of temperature, color, turbidity and pH
2. Determination of suspended, dissolved and total solids
3. Determination dissolved oxygen by winkler method
4. Determination of optimum dose of coagulant by jar test apparatus

Reference books:

1. B.C. Punmia, A. K. Jain, and A. Jain, "Water Supply Engineering", Laxmi Publications (P) Ltd., New Delhi.
2. B.S.N. Raju, “Water Supply and Wastewater Engineering”, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. G.S. Birdie, and J.S. Birdie, "Water Supply and Sanitary Engineering", Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
4. K.N. Duggal, "Elements of Environmental Engineering", S. Chand and company Ltd.., New Delhi.
5. P.N. Modi, "Water Supply engineering", Standard Book House, Delhi.
6. S.K. Garg, “Water Supply Engineering”, Khanna Publishers, Delhi.

Field Trip: Field visit of a water supply treatment plant, group presentation and submission of individual report (1 day)

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks Distribution*
1	2	2
2	4	4
3	5	5
4	5	5
5	3	6
6	14	14
7	6	10
8	3	2
9	3	2
Total	**45**	**50**

* There may be minor variation in marks distribution

ENGINEERING ECONOMICS

COURSE CODE: MS451

Year: III
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	1	50	-	50	-	100	

Course Objective: The objective of the course is to make students able to conduct simple economic studies. They will also be able to make evaluation of engineering projects and make decisions related to investment.

1. Introduction to Engineering Economics (3 hours)
   - 1.1. Origin of engineering economy
   - 1.2. Principles of engineering economy
   - 1.3. Role of engineers in decision making
   - 1.4. Notation and cash flow diagram.

2. Cost Classification and Analysis (3 hours)
   - 2.1. The elements of cost
   - 2.2. Classification of cost: overhead cost, prime cost
   - 2.3. Cost variance analysis
   - 2.4. Job and process costing

3. Interest and Money-Time Relationships (6 hours)
   - 3.1. Introduction
   - 3.2. Simple interest
   - 3.3. Compound interest (nominal interest rate, effective interest rate and continuous compounding)
   - 3.4. Economic equivalence
   - 3.5. Development of interest formulas

4. Methods of Engineering Economic Analysis (8 hours)
   - 4.1. Determining minimum attractive rate of return (MARR).
   - 4.2. Payback period method
   - 4.3. Equivalent worth methods (present worth method, future worth method and annual worth method)
   - 4.4. Rate of return methods (internal rate of return method and external rate of return method)
   - 4.5. Benefit cost ratio method
   - 4.6. Financial and economic analysis

5. Analysis of Alternatives (6 hours)
   - 5.1. Comparison of mutually exclusive alternatives having same useful life (payback period method and equivalent worth method, rate of return methods and benefit cost ratio method)
   - 5.2. Comparison of mutually exclusive alternatives having different useful lives (repeatability assumption, co-terminated assumption and capitalized worth method)
   - 5.3. Comparing mutually exclusive, contingent and independent projects in combination.

6. Cost/Benefit Analysis (3 hours)
   - 6.1. Conventional cost/benefit ratio
   - 6.2. Modified cost/benefit ratio
   - 6.3. Break-even analysis

7. Risk Analysis (6 hours)
   - 7.1. Introduction
   - 7.2. Methods of describing project risks.
     - 7.2.1. Sensitivity analysis
     - 7.2.2. Scenario analysis
   - 7.3. Projects operating under conditions of certainty and uncertainty
   - 7.4. Decision tree and sequential investment decisions

8. Depreciation and Income Taxes (6 hours)
   - 8.1. Depreciation concept and terminology
   - 8.2. Methods of depreciation (straight line method, declining balance method, sinking fund method, sum of the year digit method and modified accelerated cost recovery system (MACRS))
   - 8.3. Introduction to income tax.
   - 8.4. The effective corporate income tax rate.
   - 8.5. General procedure for making after tax economic analysis.

9. Inflation and Its Impact (4 hours)
   9.1. Concept of inflation.
   9.2. Measuring inflation
   9.3. Equivalence calculation under inflation
   9.4. Impact of inflation on economic evaluation

Reference books:

1. Chan S. Park, "Contemporary Engineering Economics", Prentice Hall Inc, India.
2. J. L. Riggs, D. D. Bedworth, and S.U. Randhawa, "Engineering Economics",Tata MCGraw Hill Education Private Limited, India.
3. W.G. Sullivan, J. A. Bontadelli, and E.M.Wicks, "Engineering Economy", Pearson Education Asia, India.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution*
1	3	2
2	3	2
3	6	6
4	8	10
5	6	8
6	3	2
7	6	8
8	6	8
9	4	4
Total	**45**	**50**

* There may be minor variation in marks distribution

FOUNDATION ENGINEERING

COURSE CODE: CE454

Year: III
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
4	1	2	50	-	50	-	100	

Course Objective: The basic objective of the course is to provide the student with the basic concepts and tools that can be used to determine the structure/ foundation/ soil interactions. The courses include a review of soil mechanics principles and deal with a variety of foundations and retaining walls. The course also emphasized the site exploration, the classic theories of earth pressure, and design of foundations.

1. Introductions (2 hours)
   - 1.1. Foundation engineering, importance and classification
   - 1.2. General requirement
   - 1.3. Factors influencing the choice of a foundation
   - 1.4. Selection of the type

2. Soil Investigation (8 hours)
   - 2.1. Introduction
   - 2.2. Purpose, methods of exploration
   - 2.3. Planning the sub-surface exploration
   - 2.4. Borings for exploration
   - 2.5. Soil sampling and soil samplers
   - 2.6. Preservation, transportation and storage of samples
   - 2.7. Penetration test (Standard penetration test, Static cone penetration test, Dynamic cone penetration test)
   - 2.8. Pressure meter tests, dialatometer test and in-situ vane shear test.
   - 2.9. Observations of ground water table
   - 2.10. Borehole logs
   - 2.11. Site investigation reports

3. Lateral Earth Pressure Theories (10 hours)
   - 3.1. Introduction
   - 3.2. Types of earth pressure
   - 3.3. Effect of wall movement on earth pressure
   - 3.4. Earth pressure at rest
   - 3.5. Classical earth pressure theories
   - 3.6. Rankine's theory
   - 3.7. Coulomb's theory
   - 3.8. Yielding of wall of limited height
   - 3.9. Graphical solution for coulomb's earth pressure
   - 3.10. Trial wedge method for earth pressure

4. Braced Cuts and Coffer Dams (6 hours)
   - 4.1. Introduction
   - 4.2. Typing of sheeting and bracing system
   - 4.3. Braced excavations
   - 4.4. Earth pressure against bracings in cuts
   - 4.5. Deep cuts in sand
   - 4.6. Deep cut in saturated, soft to medium clays
   - 4.7. Types of coffer dams and their uses
   - 4.8. Design of braced coffer dams

5. Retaining Structures and Sheet Piles (4 hours)
   - 5.1. Introduction
   - 5.2. Proportioning of retaining walls
   - 5.3. Stability of retaining walls
   - 5.4. Common types of sheet piles and their uses
   - 5.5. Design of cantilever and anchored sheet pile wall

6. Bearing Capacity of Shallow Foundations (6 hours)
   - 6.1. Introduction
   - 6.2. Principle modes of soil failure
   - 6.3. Bearing capacity by classical earth pressure theory of Rankine

6.4. Pauker and Bell‘s bearing capacity theory of failure
6.5. Prandtl’s theory of failure
6.6. Terzaghi’s method of determining bearing capacity of soil
6.7. Effect of water table on bearing capacity
6.8. Extension of Terzaghis bearing capacity theory
6.9. Introduction to recent bearing capacity theories
6.10. Bearing capacity from In-situ tests
6.11. Types of settlement and their relationships.
6.12. Limitations of the methods for predicting settlements
6.13. Allowable settlement and allowable bearing pressure
6.14. Steps involved in the proportion of footings

7. Design of Spread Foundation (4 hours)
7.1. Common types of spread footing and their use
7.2. Depth of footing
7.3. Foundation loading
7.4. Principle of design of footing
7.5. Design of spread footing

8. Mat Foundations (4 hours)
8.1. Introduction
8.2. Types of mat foundation and their uses
8.3. Bearing capacity and settlement of mat foundations
8.4. Design of mat foundation in sand and clay

9. Pile Foundations (6 hours)
9.1. Introduction
9.2. Necessity of pile foundation
9.3. Types and uses of piles, advantages and disadvantages
9.4. Selection of pile type
9.5. Pile driving formula
9.6. Static pile load formulae
9.7. Load test on piles
9.8. Dynamics pile formulae
9.9. Pile capacity from in-situ tests.
9.10. Group action of piles
9.11. Negative skin friction
9.12. Laterally load piles
9.13. Piles subjected to uplift loads
9.14. Damage alignment and effect of pile driving

10. Well or Caissons Foundations (6 hours)
10.1. Introduction
10.2. Types of wells or caissons
10.3. Components of a well foundation
10.4. Shapes of wells
10.5. Depth of a well foundation
10.6. Forces acting on well foundation
10.7. Lateral stability of well foundation
10.8. Sinking of a well
10.9. Design of caissons

11. Foundation Soil Improvements (4 hours)
11.1. Introduction
11.2. Mechanical compaction.
11.3. Dynamic compaction.
11.4. Preloading
11.5. Sand compaction piles and stone columns
11.6. Soil stabilization by use of admixtures
11.7. Soil stabilization by injection of suitable grouts

Laboratory/Practical:

One day observation tour of a site investigation projects and each student should prepare a brief report.

Reference books:

1. J. E. Bowels, "Foundation Analysis and Design", McGraw-Hill International Editions, New York.
2. G. Ranjan, and A.S.R. Rao, "Basic and Applied soil mechanics", New Age International Publishers, New Delhi.
3. K. R. Arora, "Soil Mechanics and Foundation Engineering", Standard Publisher Distribution, New Delhi.
4. V.N. S. Murthy, "A Text Book of Soil Mechanics and Foundation Engineering in SI units", UBS Publishers Distributors Ltd., India
5. H.G. Poulos, and E.H. Davis, "Pile Foundation Analysis and Design", John Wiley and Sons, New York.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Mark Distribution*
1	2	2
2	8	6
3	10	8
4	6	5
5	4	4
6	6	5
7	4	4
8	4	4
9	6	5
10	6	5
11	4	2
Total	**60**	**50**

* There may be minor deviation in marks distribution.

TRANSPORTATION ENGINEERING I

COURSE CODE: CE455

Year: III
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Objective: The basic objective of the course is to provide knowledge about plan, survey and design the road as well as road development and its planning based on Nepalese context.

1. Introduction to Transportation Planning (4 hours)
   - 1.1. Introduction
   - 1.2. Modes of transportation
   - 1.3. Comparison between various modes of transportation
   - 1.4. Historical development of roads and road construction in Nepal
   - 1.5. Transport planning including objective of road planning, national network planning, urban road network planning and ring roads
   - 1.6. Classification of roads (Nepal road standard)

2. Engineering Survey and Highway Alignment (4 hours)
   - 2.1. Engineering survey and its stages (map study, reconnaissance, preliminary and detailed surveys)
   - 2.2. Highway alignment
     - 2.2.1. Introduction
     - 2.2.2. Requirements of highway alignment
     - 2.2.3. Factors controlling highway alignment

3. Geometric Design of Highway (18 hours)
   - 3.1. Introduction
   - 3.2. Scope of geometric design
   - 3.3. Basic design controls and criteria for design
   - 3.4. Elements of cross-section
   - 3.5. Elements of horizontal alignments
     - 3.5.1. Definition and types of horizontal curve
     - 3.5.2. Design of horizontal curves including night visibility consideration
     - 3.5.3. Sight distance: Stopping sight distance, overtaking sight distance, set-back from obstructions
     - 3.5.4. Super elevation
     - 3.5.5. Extra widening
     - 3.5.6. Transition curves: Definition and types of transition curve, design of transition curve
   - 3.6. Elements of Vertical Alignment
     - 3.6.1. Definition and types of gradient
     - 3.6.2. Momentum grade
     - 3.6.3. Grade compensation
     - 3.6.4. Definition and types of vertical curve
     - 3.6.5. Design of vertical summit curve
     - 3.6.6. Design of vertical valley curve
     - 3.6.7. Lowest and highest point of vertical curve

4. Hill Roads (5 hours)
   - 4.1. Introduction
   - 4.2. Special consideration in hill road design (general consideration, route location in hills, gradient, different types of hill road cross sections, design and types of hair pin bends)
   - 4.3. Special structures in hill road (retaining structures and its type, river training structures, land slide stabilization structures and gully control structures)

5. Highway Drainage (4 hours)
   - 5.1. Introduction
   - 5.2. Importance of highway drainage system
   - 5.3. Causes of moisture variation in sub-grade soil
   - 5.4. Surface drainage system
     - 5.4.1. Road side drain and its type
     - 5.4.2. Cross drainage structures (culverts and others)
     - 5.4.3. Energy dissipating structure and its type
   - 5.5. Subsurface drainage system
     - 5.5.1. Drainage of infiltrated water

5.5.2. Control of seepage flow
5.5.3. Lowering of water table
5.5.4. Control of capillary rise

6. Road Construction Materials (10 hours)
   6.1. Introduction and classification of road materials
   6.2. Sub-grade Soil (characteristics and properties)
   6.3. Road aggregate
      6.3.1. Definition and classification of road aggregates
      6.3.2. Desirable properties of road aggregates
      6.3.3. Tests on road aggregates and their significance
   6.4. Bituminous road binders
      6.4.1. Definition and classification of road binders
      6.4.2. Liquid bitumen (cut-back bitumen and bitumen emulsion)
      6.4.3. Tests on bituminous binders
   6.5. Bituminous mixes
      6.5.1. Definition and classification
      6.5.2. Marshal method of bitumen mix design

Laboratory/Practical:

1. Penetration value; Viscosity; softening point and ductility of bitumen
2. Los angeles abrasion value and crushing value of aggregates
3. Marshall stability test and asphalt mix design
4. Skid resistance test on road surface

Reference books:

1. S.K. Khanna, and C.E.G. Justo, "Highway Engineering", Nem Chand & Bros Roorkee (U.P.), India.
2. S.B. Sehgal, and K.I. Bhanot ,"A Text-book on Highway Engineering and Airports", S. Chand and Co. Publishers Ltd., New Delhi
3. S.K. Sharma, "Principles, Practice and Design of Highway Engineering", S. Chand and Co. Publishers Ltd., New Delhi
4. V.N. Vazirani, and S.P. Chandola, "Transportation Engineering", Khanna Publishers, India.

Evaluation Scheme:

The question will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks Distribution*
1	4	5
2	4	5
3	18	20
4	5	5
5	4	5
6	10	10
Total	**45**	**50**

* There may be minor variation in marks distribution

ENGINEERING HYDROLOGY

COURSE CODE: CE456

Year: III
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Objective: The main objective of the course is to provide the student the basic knowledge of surface and ground water hydrology.

1. Introduction (2 hours)
   - 1.1. Definition, scope and importance of engineering hydrology
   - 1.2. Hydrological cycle and hydrological system model
   - 1.3. Earth water and water budget
   - 1.4. Development of hydro-meteorological study in Nepal

2. Hydrological Processes (15 hours)
   - 2.1. Causes, forms and types of precipitation
   - 2.2. Measurement of rainfall (types and adequacy of rain gauges)
   - 2.3. Snow fall and its measurements
   - 2.4. Estimation of missing rainfall data
   - 2.5. Double mass curve method for adjustment
   - 2.6. Presentation of rainfall data
   - 2.7. Estimation of mean rainfall over an area
   - 2.8. Development of intensity - duration - frequency (IDF) curve and equation
   - 2.9. Depth-area-duration (DAD) curve
   - 2.10. Initial hydrological losses
   - 2.11. Evaporation process
     - 2.11.1. Meteorological parameters (radiation, temperature, vapor pressure, humidity, wind)
     - 2.11.2. Energy budget methods and mass transfer approach (Dalton's law)
     - 2.11.3. Evaporimeters
   - 2.12. Evapotranspiration
     - 2.12.1. Actual evapotranspiration and lysimeters
     - 2.12.2. Potential evapotranspiration (Penman's equation)
   - 2.13. Infiltration
     - 2.13.1. Horton's equation
     - 2.13.2. Infiltration indices (Φ and W)
     - 2.13.3. Infiltrometers
     - 2.13.4. Factors affecting infiltration rates and capacity

3. Surface Runoff (8 hours)
   - 3.1. Drainage basins and its quantitative characteristics
   - 3.2. Runoff cycle
   - 3.3. Factors affecting runoff from a catchment
   - 3.4. Rainfall - runoff relationship
   - 3.5. Stream gauging (selection of sites, types of gauges and measurement)
   - 3.6. Stream flow measurement by velocity area method (current meters, floats and velocity rods)
   - 3.7. Slope area method of computing discharge
   - 3.8. Development of rating curve and its uses
   - 3.9. Estimation of monthly flows from rainfall

4. Hydrograph Analysis (8 hours)
   - 4.1. Components of a hydrograph
   - 4.2. Separation of base flow
   - 4.3. Unit hydrographs, their uses and limitations
   - 4.4. Derivation of unit hydrographs from isolated and complex storms
   - 4.5. Peak flow estimation using empirical methods
   - 4.6. The rational method and its limitation

5. Hydrology of Floods (8 hours)
   - 5.1. Definition and causes of floods
   - 5.2. Design flood and its frequency
   - 5.3. Statistical methods of flood prediction
     - 5.3.1. Continuous probability distribution

5.3.2. Return period, frequency and risk
5.3.3. Plotting positions, frequency factors
5.3.4. Log pearson III method
5.3.5. Gumbel's extreme value type I method

5.4. Flood prediction by rational and empirical methods
5.5. Hydro-geomorphological characteristics of rivers
5.6. Methods of mitigating floods
5.7. Flood routing: Linear reservoir routing, time area method, clark unit hydrograph

6. Ground Water (4 hours)

6.1. Occurrence and distribution of ground water aquifers
6.2. Wells and their types
6.3. Device for testing of wells
6.4. Role of ground water for irrigation development
6.5. Recharge of ground water

Practical:

1. Rainfall – runoff Simulation
2. Stream flow measurement by velocity area method (current meter and float method)
3. Stream flow measurement by dilution techniques.

Field Visit: Field visit at hydrological and meteorological station (1 day)

Reference books:

1. K. Subramanya, "Engineering Hydrology", Tata-McGraw Hill Publishing Co., New Delhi.
2. R.S. Varshney, "Engineering Hydrology", Nem Chand & Bros., Roorkee.
3. B.L. Gupta, "Engineering Hydrology", Standard Publishers and Distributors, New Delhi.
4. K.N. Dulal, and S. Baral, "Engineering Hydrology", Apex Educational Academy, Kathmandu.
5. V.T. Chow, D.R. Midment, and L.W. Mays, "Applied Hydrology", McGraw Hill International, New York.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below

Chapter	Hours	Marks Distribution*
1	2	2
2	15	15
3	8	8
4	8	10
5	8	10
6	4	5
Total	**45**	**50**

* There may be minor variation in marks distribution

B.E. (CIVIL) THIRD YEAR DETAIL SYLLABUS

(SECOND SEMESTER)

DESIGN OF STEEL AND TIMBER STRUCTURES

COURSE CODE: CE461

Year: III

Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
4	-	2	50	-	50	-	100	

Course Objective: The main objective of the course is to provide basic concepts for the design of simple structural members of steel and timber. After completing of this course, the students will be able to design various joints, compression members, columns, beams and roof trusses. These course emphases limit state design for steel and timber structures.

1. Introduction to Steel Structures (2 hours)
   - 1.1. Introduction and types of structural steels
   - 1.2. Structural steel and classification of steel sections
   - 1.3. Method of analysis and design
   - 1.4. Design process and basis for design
   - 1.5. Advantages and disadvantages of steel structures

2. Working Stress Design Method (3 hours)
   - 2.1. Basic assumptions in working stress design
   - 2.2. Service load and permissible stresses
   - 2.3. Design in tension, compression, bending and shear (simple example)

3. Limit State Design Method (2 hours)
   - 3.1. Safety and service ability requirements of structure
   - 3.2. Different limit states for steel design
   - 3.3. Design strength of materials and design loads
   - 3.4. Limit state of strength
   - 3.5. Limit state of serviceability

4. Types of Connections and Design (8 hours)
   - 4.1. Types of connections
   - 4.2. Welded connections
     - 4.2.1. Welds and welding
     - 4.2.2. Design of simple welded connections
     - 4.2.3. Design of eccentric welded connections
   - 4.3. Bolted connections
     - 4.3.1. Bolts and bolting
     - 4.3.2. Design of simple bolted connections
     - 4.3.3. Design of eccentric bolted connections
   - 4.4. Introduction to riveted connection
   - 4.5. Failure of a riveted connection

5. Design of Tension Members (4 hours)
   - 5.1. Introduction
   - 5.2. Types of tension members
   - 5.3. Net sectional area of tension member
   - 5.4. Design of axially loaded tension member
   - 5.5. Design of angle, tee, and tubular sections.
   - 5.6. Tension splice

6. Compression Members (8 hours)
   - 6.1. Introduction and types of compression member
   - 6.2. Effective length
   - 6.3. Design of column of simple and built-up section
   - 6.4. Design of lateral bracing of compression member
   - 6.5. Design of eccentrically loaded column
   - 6.6. Design of column bases
   - 6.7. Axially loaded column bases
   - 6.8. Eccentrically loaded column bases
   - 6.9. Design of column splices

7. Design of Simple, Composite and Built-up Beams (10 hours)
   - 7.1. Introduction and types of beams
   - 7.2. Beams under transverse and axial loading
   - 7.3. Different stresses and deflection limitations
   - 7.4. Design of simple beam
   - 7.5. Design of built-up beam
   - 7.6. Design of laterally supported and unsupported beams
   - 7.7. Design for bending, shear, deflection and lateral stability
   - 7.8. Design of bearing plate and cover plate
   - 7.9. Design of web and flange splice
   - 7.10. Design of rivets/ bolts connecting cover plates with flanges

8. Design of Plate Girders (5 hours)
   - 8.1. Elements of plate girder
   - 8.2. Economic depth and self-weight of plate girder
   - 8.3. Design of web and flanges
   - 8.4. Curtailment of flanges plates
   - 8.5. Design of web stiffeners, web splice and flange splice
   - 8.6. Design of riveted connections

9. Design of Roof Trusses (4 hours)
   - 9.1. Types of roof truss and components of roof truss
   - 9.2. Loads on roof truss
   - 9.3. Calculation of gravity and wind loads as per code and distribution to joints
   - 9.4. Design of roof components

10. Timber Structures and Design Methods (6 hours)
   - 10.1. Introduction to timber structures
   - 10.2. Advantages and disadvantages of timber structures
   - 10.3. Structural timber and factors affecting the strength of timber
   - 10.4. Design methods and basis for design

11. Design of Timber Structures (6 hours)
   - 11.1. Design of compression members
   - 11.2. Design of flexure member

12. Joints in Timber Structures (2 hours)
   - 12.1. Types of joints
   - 12.2. Design of bolted joints
   - 12.3. Design of nailed joints

Reference books:

1. S.K. Duggal, “Limit State Design of Steel Structures”, Tata McGraw-Hill Publishing Com., India
2. K.S. Sai Ram, “Design of Steel Structures”, PEARSON Education, India
3. L.S. Negi, “Design of Steel Structures”, Tata McGraw-Hill Publishing Com., India
4. R. Chandra, “Design of Steel Structures”, Standard Book House, India
5. V.N. Vazirani, and M.M. Ratwani, “Steel Structures”, Khanna Publishers, New Delhi.

Evaluation scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1	2	2
2	3	2
3	2	3
4	8	6
5	4	4

6	8	6
7	10	8
8	5	4
9	4	4
10	6	4
11	6	5
12	2	2
Total	**60**	**50**

* There may be minor variation in marks distribution

TRANSPORTATION ENGINEERING II

COURSE CODE: CE462

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	25	125	

Course Objective: The basic objective of the course is to provide the knowledge about design, construct, supervise, repair and maintain the roads as well as familiar with traffic design, control and operation.

1. Introduction to Traffic Engineering and its Scope (3 hours)
   - 1.1. Introduction to traffic engineering and its scope interrelationships between human/machinery/environmental elements
   - 1.2. Impact of human and vehicular characteristics on traffic planning
   - 1.3. Traffic operations and regulations covering driver control and vehicle control
   - 1.4. Traffic control devices: Signs, signals, road making and traffic islands

2. Traffic Studies (4 hours)
   - 2.1. Traffic volume and speed studies
   - 2.2. Traffic flow characteristics studies
   - 2.3. Origin and destination studies
   - 2.4. Traffic flow and capacity studies
   - 2.5. Parking studies and design of parking facilities
   - 2.6. Accident study and analysis

3. Road Intersections (6 hours)
   - 3.1. Basic requirements of intersections
   - 3.2. Types of intersections and their configuration
   - 3.3. Channelized and un-channelized intersections
   - 3.4. Choice of traffic control devices for intersection
   - 3.5. Design of intersection approaches for one-way and two-way streets
   - 3.6. Design of intersections for rural roads

4. Road Lighting (2 hours)
   - 4.1. Importance of road lighting
   - 4.2. Factors influencing night visibility
   - 4.3. Requirements of level of illumination in roads
   - 4.4. Design of the lighting system (selection of height of lamps, spacing between light poles, height and overhang of light poles, lateral placement and Light layouts.)

5. Road Pavement (10 hours)
   - 5.1. Definition and types of pavements
   - 5.2. Differences between flexible and rigid pavement structures
   - 5.3. Loads and other factors controlling pavement
   - 5.4. Design methods for flexible pavements
   - 5.5. Details of the asphalt institute method of design of flexible pavements
   - 5.6. Design methods for rigid pavements and Westergaard's theory
   - 5.7. Stresses due to load, temperature differential and subgrade friction
   - 5.8. Details of the IRC method of design of rigid pavements for highways

6. Road Construction Technology (8 hours)
   - 6.1. Activities and techniques used in road construction
   - 6.2. Tools, equipment and plants used in road construction
   - 6.3. Preparation of road bed (excavation, fill, compaction, soil stabilization, etc.)
   - 6.4. Construction of asphalt concrete layers, including prime coats, tack coats and seal coats
   - 6.5. Construction procedure of grouted or penetration macadam
   - 6.6. Construction procedure of bituminous bound macadam
   - 6.7. Construction procedure of plain concrete pavements
   - 6.8. Construction of surface dressing

7. Highway Maintenance, Repair and Rehabilitation (6 hours)
   - 7.1. Classification of maintenance activities for road pavement and road facilities
   - 7.2. Inspection, prioritization and planning of maintenance operations
   - 7.3. Evaluation of pavement distress and pavement condition

7.4. Types of road failure and its causes
7.5. Types and methods of pavement repair
7.6. Types of overlays and strengthening of existing pavements

8. Introduction to Bridge and Tunnel Engineering (6 hours)
8.1. Choice of location of bridge site
8.2. Classification of bridges and component parts of a bridge
8.3. Hydraulic analysis of bridges
8.4. River bank and protection structures
8.5. Types of roads and railway tunnels
8.6. Component parts of tunnels and tunnel cross-section
8.7. Survey for tunnel alignment
8.8. Drainage, lighting and ventilation requirements for tunnels
8.9. Methods of tunnelling in firm, soft and rock soils
8.10. Tunnel lining

Laboratory/Practical:

1. Determination of CBR in the laboratory
2. Measurement of spot speed and data analysis.
3. Measurement of deflection of pavement surface.

Reference books:

1. S.K. Khanna, and C.E.G.Justo, "Highway Engineering", Nem Chand & Bros Roorkee (U.P.), India.
2. S.B.Sehgal, and K.I. Bhanot ,"A Text-book on Highway Engineering and Airports", S. Chand and Co. Publishers Ltd., New Delhi
3. S.K. Sharma, "Principles, Practice and Design of Highway Engineering", S. Chand and Co. Publishers Ltd., New Delhi
4. V.N. Vazirani, and S.P. Chandola, "Transportation Engineering", Khanna Publishers, India.

Evaluation Scheme:

The question will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks Distribution*
1	3	5
2	4	5
3	6	6
4	2	4
5	10	10
6	8	8
7	6	6
8	6	6
Total	**45**	**50**

* There may be minor variation in marks distribution

IRRIGATION ENGINEERING

COURSE CODE: CE463

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	2	50	-	50	-	125	

Course objective: This course is aimed at training the students specific engineering design consideration for canal irrigation, their operation, maintenance and management with environmental balance and farmer participation in the hills of Nepal. After the completion of the course the student will confidently design the canal and micro irrigation project in the remote Hilly and Terai areas of Nepal.

1. Introduction (4 hours)

1.1 Definition advantages and disadvantages of irrigation
1.2 Status and need of irrigation development in Nepal
1.3 Characteristics of Hill irrigation system
1.4 Need potentiality and types of irrigation development in the hills of Nepal.
1.5 Crops their seasons and Periods (Cropping pattern and their intensity)
1.6 Commanded area and Irrigation Intensity
1.7 Method of field irrigation and their suitability
1.8 Planning of irrigation Projects

2. Irrigation Water Requirements (4 hours)

2.1 Relation between Duty, Delta and Crop Period
2.2 Crop Water Requirements (Penman's method)
2.3 Operation water requirements
2.4 Water losses due to seepage and irrigation
2.5 Effective rainfall
2.6 Irrigation water requirements
2.7 Soil moisture Irrigation relationship
2.8 Depth and Frequency of Irrigation
2.9 Irrigation efficiencies
2.10 Design discharges for canal

3. Canal Irrigation system (4 hours)

3.1 Classification of canals
3.2 Components of canal irrigation system
3.3 Alignments of canals
3.4 Alluvial and Non-alluvial canal
3.5 Canal standard and balancing canal depths
3.6 Canal distribution system

4. Design of canals (6 hours)

4.1 Design capacity of canals
4.2 Sediment transport in canals
4.3 Tractive force approach for canal design
4.4 Design of stable canals
4.5 Design of alluvial canal and lined canal (Kennedy theory and lacey theory)

5. Diversion Headwork (8 hours)

5.1. Components parts of weir /barrage detailed drawing
5.2. Bligh lane and Khosla theory
5.3. Design of sloping glacis weir bay (crest length and thickness of impervious floor)
5.4. Design of under sluice and silt excluder
5.5. Design of silt ejector
5.6. Design of head regulator (crest length and thickness of impervious floor)

6. Regulating structure (5 hours)

6.1 Alignment of the off taking channels
6.2 Function of Head regulator, cross regulator, outlet, drop and canal escapes
6.3 Design of regulators and escapes (crest length and thickness of impervious floor)
6.4 Types of outlets, design of pipe outlets
6.5 Types of drops, design of vertical drops (crest length and thickness of impervious floor)

7. Water logging and drainage (5 hours)

7.1 Cause effects and preventive measures of water logging
7.2 Water logging and drainage of irrigated land

7.3 Surface drainage system and their design
7.4 Subsurface drainage system and their design

8. **Sprinkler irrigation** **(3 hours)**
   8.1. Advantage and suitability of sprinkler for hill irrigation
   8.2. Limitation and disadvantages of sprinkler irrigation
   8.3. Types and components of sprinkler system
   8.4. Design approach and selection of sprinklers
   8.5. Operation and maintenance of sprinkler system

9. **Drip or trickle irrigation** **(3 hours)**
   9.1. Advantage and suitability of drip for hill irrigation
   9.2. Limitation and disadvantage of drip irrigation
   9.3. Types and components of drip system
   9.4. Design approach and selection of drips
   9.5. Design of a portable drip system
   9.6. Operation and maintenance of drip system

10. **Planning and Management of Irrigation system** **(3 hours)**
   10.1.General irrigation system planning
   10.2.Organization and irrigation management
   10.3.Operation and maintenance of irrigation systems
   10.4.Institutional aspects of irrigation system management
   10.5.Introduction to water resource act and customary act

Field visit and practical

1. Field visit of an irrigation system, group presentation and submission of individual report to the respective teacher
2. Individual assignment on irrigation water requirement using Cropwat software

Reference book:

1. BC Punmia, and BBL Pande “irrigation and water power engineering” standard publisher distributors, New Delhi
2. PC Pokhrel "Simple design of hill irrigation project in Nepal"
3. RS varshney, SC gupta, and RL gupta, theory and design of hydraulic structure volume I and volume II
4. SK garg “Irrigation engineering and Hydraulic structure” Khanna Publisher, New Delhi
5. Design manual for irrigation project in Nepal,PDSP manual,M9 Drainage manual
6. Nonconventional irrigation technology project “Manual of drip irrigation technology”, Government of Nepal
7. Nonconventional irrigation technology project “Manual of Sprinkler irrigation technology “Government of Nepal

Evaluation scheme

The question will cover all the subject of the syllabus. The evaluation scheme will be indicated as shown in table below

Marks distribution

Chapters	Hours	Marks Distribution
1	4	4
2	4	5
3	4	5
4	6	8
5	8	8
6	5	8
7	5	3
8	3	3
9	3	3
10	3	3
Total	45	50 marks

***There may be minor variation in marks distribution.**

SANITATION ENGINEERING

COURSE CODE: CE464

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	-	100	

Course Objective: The basic objective of the course is to provide the knowledge of the sewerage system, sludge treatment and its disposal.

1. Introduction (2 hours)
   - 1.1. Sanitation engineering definition
   - 1.2. Principles of sanitation
   - 1.3. Importance of wastewater managements
   - 1.4. Wastewater management methods; Collection, conveyance, treatment and disposal
   - 1.5. Objectives of sewage disposal
   - 1.6. Sanitation systems: Conservancy system and water carriage system with merits and demerits
   - 1.7. Types of sewerage system: Separate, combined and partially separate systems
   - 1.8. Development of wastewater treatment system in Nepal

2. Quantity of Wastewater (4 hours)
   - 2.1. Dry weather flow and wet weather flow
   - 2.2. Variation in rate of sewage
   - 2.3. Sources of sanitary sewage
   - 2.4. Factors affecting quantity of sanitary sewage
   - 2.5. Determination of quantity of sanitary sewage
   - 2.6. Determination of quantity of storm water (rational method and its limitation)

3. Design and Construction of Sewers (4 hours)
   - 3.1. Design criteria of sewers
   - 3.2. Shapes of sewers: Circular and non-circular sections with merits and demerits
   - 3.3. Sewer Materials: Requirements, types of sewer materials
   - 3.4. Design of the sewers for separate and combined systems
   - 3.5. Construction of sewers: Planning, setting out, alignment and gradient, excavation of trench, timbering of trench, dewatering of trench, laying and jointing, testing of sewer, and backfilling of trench

4. Sewer Appurtenances (3 hours)
   - 4.1. Necessity of sewer appurtenances
   - 4.2. Construction of sewer appurtenances
     - 4.2.1. Manhole
     - 4.2.2. Drop manhole
     - 4.2.3. Lamphole
     - 4.2.4. Street inlets
     - 4.2.5. Catch basin
     - 4.2.6. Flushing device
     - 4.2.7. Sand, grease and oil traps
     - 4.2.8. Inverted siphon
     - 4.2.9. Sewer outlet
     - 4.2.10. Ventilating shaft

5. Quality of Sewage (5 hours)
   - 5.1. Constituents of sewage
   - 5.2. Properties of sewage: Physical, chemical and biological properties
   - 5.3. Cycle of decomposition
   - 5.4. Characteristics of wastewater: Physical characteristics, chemical characteristics, biological characteristics
   - 5.5. Sampling of wastewater: Grab and composite samples
   - 5.6. Preservation and storing
   - 5.7. Biochemical oxygen demand (BOD) and Chemical oxygen demand (COD)
   - 5.8. Examination of wastewater (volatile, fixed and total solids, settleable and non-settleable solids, DO, pH-value, COD)
   - 5.9. Necessity of wastewater examination

6. Wastewater Disposal (6 hours)
   - 6.1. Necessity and objectives of wastewater disposal

6.2. Wastewater disposal methods; Dilution and land treatment
6.3. Self-purification of rivers/streams
6.4. Factors affecting self-purification
6.5. Oxygen sag curve
6.6. Streeter Phelp's equation (derivation not required)
6.7. Wastewater disposal by land treatment
    6.7.1. Suitability of land treatment
    6.7.2. Methods of land treatment
    6.7.3. Broad irrigation and sewage farming
    6.7.4. Methods of application of sewage on land
    6.7.5. Sewage sickness and its prevention

7. Wastewater Treatment (12 hours)
7.1. Objectives of wastewater treatment
7.2. Treatment process types and impurity removal
7.3. Primary treatment process: Racks and screens, skimming tank, grit chamber, sedimentation, chemical precipitation
7.4. Biological (secondary) treatment processes and types
7.5. Principles of biological treatment: Attached and suspended growth processes
7.6. Sewage filtration: filter types (intermittent sand filter, contact bed, trickling)
7.7. Activated sludge process: Theory, design, aeration methods
7.8. Oxidation ponds: Functions, theory and design

8. Sludge Treatment and Disposal (4 hours)
8.1. Sources of sludge and necessity of sludge treatment
8.2. Characteristics of sludge
8.3. Sludge thickening and concentration
8.4. Sludge treatment methods: Grinding and blending, thickening, digestion, dewatering, drying, composting/ incineration/ final disposal
8.5. Method of sludge disposal

9. Disposal of Sewage from Isolated Buildings (3 hours)
9.1. On site sanitation; Definition and types
9.2. Privies: Pit privy, ventilated improved pit (VIP) latrine and pour flush latrine
9.3. Septic tank; Purpose, construction, design criteria, working and maintenance
9.4. Disposal of septic tank effluent: Drain field, soak pit, evapotranspiration mound, leaching cesspool

10. Solid Waste Disposal (2 hours)
10.1. Characteristic of solid waste
10.2. Quantity of solid waste
10.3. Collection and transportation of solid waste
10.4. Solid waste disposal methods
    10.4.1. Dumping
    10.4.2. Sanitary landfill
    10.4.3. Incineration
    10.4.4. Composting

Reference books:

1. B. C. Punmia, and A. Jain, "Wastewater Engineering", Laxmi Publications (P) Ltd., New Delhi.
2. B.S.N. Raju, “Water Supply and Wastewater Engineering”, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. G.S. Birdie, and J.S. Birdie, "Water Supply and Sanitary Engineering", Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
4. K.N. Duggal, "Elements of Environmental Engineering", S. Chand and Company Ltd., New Delhi.
5. P.N. Modi, "Sewage Treatment & Disposal and Wastewater Engineering", Standard Book House, Delhi.

Field Trip: Field visit of a wastewater treatment plant, group presentation and submission of individual report

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below

Chapters	Hours	Marks Distribution*
1	2	2
2	4	2
3	4	5
4	3	3
5	5	5
6	6	5
7	12	16
8	4	5
9	3	5
10	2	2
Total	**45**	**50**

* There may be minor variation in marks distribution

PROJECT MANAGEMENT

COURSE CODE: MS461

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	1	50	-	50	-	100	

Course Objective: The objective of the course is to provide the students with fundamental concepts of initiating, planning, scheduling, implementation, and controlling projects.

1. Introduction (4 hours)
   - 1.1. Project definition
   - 1.2. Setting project objectives and goals
   - 1.3. Project phases, project life cycle

2. Project Appraisal and Formulation (5 hours)
   - 2.1. Concept of project appraisal
   - 2.2. Types and preparation of project proposal (financial and technical)
   - 2.3. Project formulation techniques (feasibility, cost benefit , input and environmental analysis)

3. Project Planning and Scheduling (15 hours)
   - 3.1. Project planning process
   - 3.2. Work break down structure
   - 3.3. Project scheduling with bar chart, CPM, PERT
   - 3.4. Project scheduling with limited resource
   - 3.5. Introduction to planning software (MS Project)

4. Project Monitoring and Control (8 hours)
   - 4.1. Introduction to monitoring, evaluation and controlling
   - 4.2. Project control cycle
   - 4.3. Elements of project control
   - 4.4. Feedback control systems
   - 4.5. Cost control
   - 4.6. Project quality control
   - 4.7. Introduction to project management information systems

5. Capital Planning and Budgeting (6 hours)
   - 5.1. Capital planning procedures
   - 5.2. Preparation of operating budgets
   - 5.3. Fixed and flexible budgets
   - 5.4. Introduction to budgetary control

6. Project Risk Analysis and Management (7 hours)
   - 6.1. Introduction to project risk and its types
   - 6.2. Analysis of major sources of risks
   - 6.3. Impact analysis (social, environmental and economic)
   - 6.4. Effective management of project risk
   - 6.5. Management and identification of risk
   - 6.6. Risk monitoring and controlling

Reference books:

1. A. M. Ruskin,and W. E.Estes, "Project Management", Marcel Dekker Publishers.
2. J. J. Moder, and C. R. Phillips, “Project Management with CPM and PERT", Van Nostrand Reinhold Publishers.
3. A. Bhattacharyya, and S.K. Sorkhel, "Management by Network Analysis", The Institution of Engineers, India.
4. P. Chandra, "Projects: Preparation, Appraisal, Implementation", Tata McGraw-Hill Publishing Company Ltd., New Delhi.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution
1	4	4
2	5	6
3	15	16
4	8	10
5	6	6
6	7	8
Total	**45**	**50**

* There may be minor variation in marks distribution

ELECTIVE I

COURSE CODE: CE46*

Year: III

Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	-	100	

Selection of Electives I:

The main purpose of elective courses is to equip undergraduate students with specialized knowledge and skill on anyone of the main streams of civil engineering:

i. Structural Engineering (CE466)
ii. Environmental Impact Assessment (CE467)
iii. Low Volume Road Engineering (CE468)
iv. Advanced Structural Analysis (CE469)

The detail of course content, accepted by the subject committee will be presented to the students before the commencement of the course.

ENGINEERING PROFESSIONAL PRACTICES

COURSE CODE: CE465

Year: III
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
2	-	-	25	-	25	-	50	

Course Objective: The objective of the course is to introduce the ethical and legal environmental in which engineering is practiced and their role in the society.

1. Background Perspective (4 hours)
   - 1.1. Man technology and society
   - 1.2. Impacts and consequences of technology on society: effects of major technological development such as printing, gunpowder, mechanization, computers, organic chemistry, communication satellites
   - 1.3. Cultural motivations and limitations,
   - 1.4. Eastern vs western philosophy of change and development
   - 1.5. Political and social limitations
   - 1.6. Individual freedoms vs societal goals
   - 1.7. Engineering practices in Nepal

2. Ethics and Professionalism (3 hours)
   - 2.1. Perspective on morals, ethics and professionalism
   - 2.2. Codes of ethics and guidelines for professional engineering practice
   - 2.3. Moral dilemma and ethical decision making
   - 2.4. Relationship of the engineering profession to basic science and technology; relationship to other professions
   - 2.5. Duties of an engineer
   - 2.6. Liability and Negligence

3. Engineering Professional Practice Sectors in Nepal (4 hours)
   - 3.1. Public sectors practice
   - 3.2. Private sector practice
   - 3.3. General job descriptions of engineers working in public and private sectors

4. Professional Associations and Regulatory Environments (4 hour)
   - 4.1. Introduction to Nepal Engineering Council and Nepal Engineering Association
   - 4.2. Nepal Engineering Council Act
   - 4.3. Labor law
   - 4.4. Intellectual property right
   - 4.5. Building codes and bylaws
   - 4.6. Company registrations

5. Contract Management (5 hours)
   - 5.1. Types of contracts
   - 5.2. Tendering procedure
   - 5.3. Contract documents/ Agreements

6. Issues in Engineering (2 hours)
   - 6.1. Globalization and cross cultural issues
   - 6.2. Public private partnership
   - 6.3. Safety, risk and benefit analysis
   - 6.4. Conflict and dispute management

7. The Roles and Practice of Professional Engineering in Other Countries (2 hours)
   - 7.1. Asian countries
   - 7.2. The USSR and Eastern Europe
   - 7.3. Western Europe
   - 7.4. North America

8. Case Studies Based on Engineering Practice (6 hours)

Reference books:

1. C. Morrison, and P. Hughes, “Professional Engineering Practice-Ethical Aspects”, McGraw-Hill Ryerson Ltd., Toranto.
2. R. Adhikari, “Engineering Professional Practice- Nepalese and International Prospectives”, Pashupati Publishing House, Kathmandu.
3. Nepal Engineering Council Act
4. Contract Act
5. Labor Act
6. Company Act
7. Public Procurement Act
8. Building By-Laws

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution
1	4	4
2	3	2
3& 4	8	5
5	5	5
6 & 7	4	3
8	6	6
Total	**30**	**25**

* There may be minor variation in marks distribution

B.E. (CIVIL) FOURTH YEAR DETAIL SYLLABUS

(FIRST SEMESTER)

CIVIL ENGINEERING PROJECT I

COURSE CODE: CE 471

Year: IV
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
0	4	0		50	-	50	-	

Course Objective: The objective of the project work is to equip the students with skills required to synthesize comprehensively the knowledge gained during the course of study for a practical application of civil engineering discipline in real life. Under the supervision and guidance of member/members of faculty each student is required to carry out an individual or group project which provides opportunities for tackling problem to civil engineering and is required to submit a project report.

The choice of project will depend upon the interest of student/students, faculty and the facilities available in the campus.
A project may involve:

1. Preparation of a design for an expensive Civil Engineering project
2. Preparation of a Dissertation involving a literature survey, and a correlation of existing knowledge
3. An experimental investigation

The project work is defined into two parts, viz. Project I and Project II. In Project I students are required to complete following works for aforementioned categories of project works:

1. Design type project
   - 1.1. Background
   - 1.2. Project Description
   - 1.3. Study Area
   - 1.4. Literature Review/Guidelines etc.
   - 1.5. Methodology
   - 1.6. Field data collection and plotting

2. Dissertation type project
   - 2.1. Background
   - 2.2. Need of the Research
   - 2.3. Objectives and scope of the work
   - 2.4. Literature Review
   - 2.5. Area of Study
   - 2.6. Methodology
   - 2.7. Data Collection and Compilation

3. Experimental type project
   - 3.1. Background
   - 3.2. Objectives and Scope of the Work
   - 3.3. Literature Review
   - 3.4. Current State of Technology and Need of the Research
   - 3.5. Experimental Setup
   - 3.6. Methodology
   - 3.7. Data Collection and Compilation

At the initial phase, the faculty may conduct a number of lectures and discussions as to the approach of the project. In the later phase, the student will be left on his/their won to pursue his/their work and to consult the faculty whenever any problem crops up. The student/s should then submit a draft report, prior to the final report, so that the supervisor can review the work, and correct the mistakes, if necessary. The final draft of the report of the report shall be submitted to the Head of Department in duplicate.

HYDROPOWER ENGINEERING

COURSE CODE: CE472

Year: IV
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	2	50	-	50	25	125	

Course Objective: The basic objective of the course is to make students able to design independently various components of hydropower system with proper use of hydraulic.

1. Introduction (3 hours)
   - 1.1. Definition, advantage and disadvantage of hydropower
   - 1.2. Power situation in Nepal and world (historical background, thermal, water and electrical power, and their development)
   - 1.3. Sources of hydropower potential(surface flow, ground water and oceans, technical and economical potentials)
   - 1.4. Hydropower potential of Nepal
   - 1.5. Hydropower plants (types and classification based on energy, storage capacity and head)

2. Planning of Hydropower Projects (4 hours)
   - 2.1. Stages of hydropower development
   - 2.2. Requirements for hydropower (flow duration curves, mass curves of flow and their uses, energy flow diagram, gross and net head, power estimation, its demand and prediction
   - 2.3. Reservoir regulation: peak and normal flow discharges, distribution of sediments and their control, life of reservoirs
   - 2.4. Layout of hydropower projects

3. Power Regulation (6 hours)
   - 3.1. Primary and secondary power
   - 3.2. Plant and installed capacity
   - 3.3. Mean and peak load,
   - 3.4. Load curve, load capacity, utilization and diversity factors
   - 3.5. Power variation(daily, weekly, monthly and annual variations or power)
   - 3.6. Power grid and its components

4. Dam Engineering (8 hours)
   - 4.1. Dams classification based on function and head
   - 4.2. Materials use for dams
   - 4.3. Site selection for dams.
   - 4.4. Foundation treatment (types of grouting and their necessity; remedies against piping and exit gradient)
   - 4.5. Design of concrete gravity and earthen dam

5. Regulating Structures (10 hours)
   - 5.1. Intake (importance, location, types and its design)
   - 5.2. Hydraulic tunnels (rock pressure, hardness coefficient of rocks, pressure and non-pressure tunnels, their types and design, design of tunnel lining)
   - 5.3. Settling basin (settling velocity, horizontal velocity, lifting velocity, types of settling basin and its location, components of basin and their designs)
   - 5.4. Forebay and surge tanks (importance, location, condition of their application, and design of forebay)
   - 5.5. Water hammer
   - 5.6. Penstock and its classification
   - 5.7. Sizing of penstock (thickness, diameter and economic diameter)

6. Spillways and Energy Dissipaters (6 hours)
   - 6.1. Spillway and its types
   - 6.2. Design of spillway
   - 6.3. Cavitation and erosions due to cavitation
   - 6.4. Energy dissipaters and its types
   - 6.5. Design of stilling basin

7. Hydro-Electrical Machines (6 hours)
   - 7.1. Hydro-mechanical installation in powerhouse
   - 7.2. Types of turbines and their performance characteristics
   - 7.3. Selection of turbines and their specific speed
   - 7.4. Draft tube, scroll case, tailrace canal and their importance.
   - 7.5. Design of turbines (Francis and Pelton)

7.6. Pumps (Centrifugal, reciprocating and their performance characteristics, selection and starting speed)
7.7. Generators and their types
7.8. Purpose and working principle of governors

8. Powerhouse (2 hours)
8.1. Classification of powerhouse
8.2. General arrangement
8.3. Dimensions of powerhouse

Laboratory/Practical:

1. Performance characteristics of a Pelton turbine
2. Performance characteristics of a Francis turbine
3. Characteristics of Kaplan turbine
4. Characteristics of centrifugal pump
5. Characteristics of pressure channel flume

Reference books:

1. S. Baral, “Fundamental of Hydropower Engineering”, Engineering and Education Service Pvt.Ltd. Kathmandu.
2. M.M. Dandekar and K.N. Sharma, "Water Power Engineering", Vikash Pubkication House Pvt.Ltd, India
3. M.M. Grishin, "Hydraulic Structures", Mir Publishers, Moscow.
4. R.S. Varshney, "Hydropower Structures", Nem Chand and Bros., India.
5. G.I. Krivchenko, "Hydraulic Machines", Mir Publishers, Moscow.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below

Chapters	Lecture Hours	Marks Distribution*
1	3	4
2	4	5
3	6	6
4	8	10
5	10	10
6	6	6
7	6	6
8	2	3
Total	**45**	**50**

* There may be minor variation in marks distribution

CONSTRUCTION MANAGEMENT

COURSE CODE: MS471

Year: IV
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	1	50	-	50	-	100	

Course Objective: The objective of the course is to provide students the knowledge on the management and execution of the construction and maintenance works.

1. Introduction (2 hours)
   - 1.1. Scope and necessity of construction management
   - 1.2. Construction project characteristics
   - 1.3. Construction project management
   - 1.4. Construction execution methods

2. Specifications (4 hours)
   - 2.1. Purpose of specifications
   - 2.2. Types of specifications: general and detailed specifications
   - 2.3. Specification writing - techniques, use of international and local standards, code of practice
   - 2.4. Importance of specifications

3. Contractual Procedure (7 hours)
   - 3.1. Method of execution of work
   - 3.2. Types of contract
   - 3.3. Tender and tender notice
   - 3.4. Tender guarantee
   - 3.5. Preparation before inviting tender
   - 3.6. Contractor's pre-qualification
   - 3.7. Evaluation of tenders and selection of contractor
   - 3.8. Contract acceptance
   - 3.9. Conditions of contract
   - 3.10. Responsibility of site engineer
   - 3.11. Supervising work of a contractor
   - 3.12. Site order book
   - 3.13. Procedure to prepare bills
   - 3.14. Measurement book
   - 3.15. Muster roll
   - 3.16. Relation between owner, contractor and consultants

4. Construction Equipment (8 hours)
   - 4.1. Advantages and disadvantages of using equipments
   - 4.2. Equipment for excavation, fill, transportation and compaction
   - 4.3. Aggregate handling and concrete construction equipment
   - 4.4. Equipment for construction of pipes and cassions
   - 4.5. Cranes for lifting materials and parts
   - 4.6. Equipment for tunnel construction
   - 4.7. Equipment for hydraulic construction
   - 4.8. Equipment for highway and pavement construction
   - 4.9. Selection of appropriate equipment

5. Construction Planning (6 hours)
   - 5.1. Site surveying and preparation
   - 5.2. Arrangement of facilities and job layouts
   - 5.3. Selection of personnel
   - 5.4. Selection of construction plant and equipment
   - 5.5. Material handling system
   - 5.6. Construction scheduling: network techniques and barcharts
   - 5.7. Use of C.P.M. and PERT for planning, scheduling and controlling of construction works
   - 5.8. Procurement procedure for materials
   - 5.9. Finance management
   - 5.10. Cash flows and financial accounting
   - 5.11. Cost analysis and control
   - 5.12. Time-cost trade off

6. Regulatory Requirements (3 hours)
   - 6.1. Safety regulations
   - 6.2. Workman's compensation board
   - 6.3. Fire regulations and Insurance
   - 6.4. Environment concerns and protection of the environment
   - 6.5. Building codes and quality control

7. Construction Safety Management (3 hours)
   - 7.1. Modern safety concept
   - 7.2. Accidents/ causes of accidents
   - 7.3. Prevention of accidents
   - 7.4. Managing safety
   - 7.5. Contract condition on safety
   - 7.6. Cost of safety economy

8. Project Maintenance (4 hours)
   - 8.1. Importance of maintenance
   - 8.2. Maintenance types: routine, minor, major, schedules, non-schedules and diagnostic
   - 8.3. Planning and scheduling of maintenance
   - 8.4. Estimating maintenance cost
   - 8.5. Management of maintenance and its financing

9. Personnel Management (5 hours)
   - 9.1. Management principles: administration and organization principles
   - 9.2. Centralization and decentralization
   - 9.3. Supervisory and leadership styles
   - 9.4. Importance of communication
   - 9.5. Information systems for decisions
   - 9.6. Motivating and directing: human elements, evaluation and merit rating
   - 9.7. Personnel selection, testing and training
   - 9.8. Trade unions and relation with management

10. Record Keeping and Reporting (3 hours)
    - 10.1. Importance of record keeping for construction and maintenance
    - 10.2. Control of changes during construction or maintenance
    - 10.3. Importance of receipts in calculating taxes
    - 10.4. Accounting statements: balance sheets, profit and losses

Reference books:

1. B.L. Gupta, and A. Gupta, “Construction Management and Machinery”, Standard Publisher Distributors, New Delhi.
2. G.S. Birdie, “Estimating Valuation and Specification”, Dhanpat Rai & Sons, India.
3. K.K. Chitkara, “Construction Project Management”, McGraw Hill, New York.
4. R.L. Purifoy, “Construction Planning, Equipment and Methods”, McGraw Hill, New York.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution
1	2	2
2	4	5
3	7	6
4	8	8
5	6	6
6	3	4
7	3	4
8	4	5
9	5	5
10	3	5
Total	**45**	**50**

* There may be minor variation in marks distribution

ESTIMATING AND VALUATION

COURSE CODE: CE473

Year: IV
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objective: The basic objective of the course is to provide the students basic knowledge of estimating, costing and valuation of building and civil engineering works. After completing this course the students will be able to analyze the rates of various civil construction activities.

1. Introduction and Method of Estimating (6 hours)
   - 1.1. Purpose of estimating
   - 1.2. System of units
   - 1.3. Units of measurement and payments for items of work and materials
   - 1.4. Requirement of estimating
   - 1.5. Method of estimating
   - 1.6. Methods of measurements of building and civil engineering works
   - 1.7. Subheads of various items of work
   - 1.8. Various methods of taking out quantities: centre line method, long and short wall method, crossing method
   - 1.9. Abstracting bills of quantities
   - 1.10. Preparation of detail estimation: Cost of items, contingencies work, charged establishment

2. Types of Estimate (3 hours)
   - 2.1. Approximate estimates
   - 2.2. Detailed estimates
   - 2.3. Revised estimates
   - 2.4. Supplementary estimates
   - 2.5. Annual repair or annual maintenance estimates
   - 2.6. Extension and improvement estimates
   - 2.7. Complete estimates
   - 2.8. Split up of cost of building works

3. Analysis of Rates (10 hours)
   - 3.1. Introduction
   - 3.2. Purposes of rate analysis
   - 3.3. Importance of rate analysis
   - 3.4. Requirements of rate analysis
   - 3.5. Factors affecting the rate analysis
   - 3.6. Procedure of rate analysis: for building works, for sanitary and water supply works, for road work, for irrigation works, for suspension bridge works

4. Detailed Estimate (20 hours)
   - 4.1. Estimate for a single room building
   - 4.2. Estimate for a two room building
   - 4.3. Estimate of earth work in road construction in plain and hilly area
   - 4.4. Estimate of earth work in canal
   - 4.5. Estimate for construction of highways for 500 m length
   - 4.6. Estimate of an aqueduct
   - 4.7. Estimate of R.C.C. slab culvert
   - 4.8. Estimate of R.C.C. T-Beam decking
   - 4.9. Estimate of septic tank and soak pit
   - 4.10. Estimate of underground R.C.C water tank
   - 4.11. Estimate of well foundation
   - 4.12. Estimate of a residential toilet

5. Valuation (6 hours)
   - 5.1. Introduction
   - 5.2. Purpose of valuation
   - 5.3. Principles of valuation
   - 5.4. Terms used in valuation
   - 5.5. Methods of determining value of property
   - 5.6. Methods of valuation report writing

Tutorial:

1. Estimate for a single room building (Load bearing wall and frame structure)
2. Estimate for a double storey residential building (Load bearing wall and frame structure)
3. Estimate of earth work in road construction in plain and hilly area
4. Estimate of earth work in canal
5. Estimate for construction of highways for 500 m length
6. Estimate of an aqueduct
7. Estimate of R.C.C. slab culvert
8. Estimate of R.C.C. T-Beam decking
9. Estimate of septic tank and soak pit
10. Estimate of underground R.C.C water tank
11. Estimate of a residential toilet
12. A valuation report of a property

Reference books:

1. A. Aggrawal, “Civil Estimating Quantity Surveying and Valuation", Katson Publishing House, Ludhiana.
2. B.N. Dutta, “Estimating and Costing”, S. Dutta and Company, Lucknow.
3. M. Chakraborti, “Estimating, Costing, Specification and Valuation”, M. Chakraborti, India.
4. S. Berger, and J.B. Godel, "Estimating and Project Management for Small Construction Firms", Van Nostradn Reinhold Publishing Company, New York.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	**Hours**	**Marks Distribution**
1	6	6
2	3	4
3	10	12
4	20	20
5	6	8
Total	**45**	**50**

* There may be minor variation in marks distribution

ELECTIVE II/ ELECTIVE III

COURSE CODE: CE47*

Year: IV

Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	2	50	-	50	-	100	

Selection of Electives II/Elective III:

The main purpose of elective courses is to equip undergraduate students with specialized knowledge and skill on anyone of the five main streams of civil engineering:

i. Geographic Information System
ii. Airport and Railway Engineering
iii. Earthquake Engineering
iv. Solid Waste Management
v. Design of Reinforced Concrete Bridge

The detail of course content, accepted by the subject committee will be presented to the students before the commencement of the course.

DESIGN OF REINFORCED CEMENT CONCRETE STRUCTURES

COURSE CODE: CE474

Year: IV
Semester: I

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
4	1.5	2	50	-	50	25	125	

Course Objective: The basic objective of the course is to make students able to design simple reinforced concrete structures. These course emphases limit state design for beam, slab, column and footing.

1. Concrete Structures and Design Philosophies (3 hours)
   - 1.1. Limitations of use of plain concrete
   - 1.2. Steel reinforcement and the concept of reinforced concrete
   - 1.3. Characteristic strength and loads
   - 1.4. Design methods of reinforced concrete structures

2. Working Stress Method (8 hours)
   - 2.1. Basic assumption, working load and permissible stresses in concrete and steel
   - 2.2. Behavior of beam under loading
   - 2.3. Modular ratio
   - 2.4. Design of singly reinforced rectangular sections
   - 2.5. Balanced, over-reinforced and under reinforced Sections (introduction)

3. Limit State Method (25 hours)
   - 3.1. Strength and serviceability requirements
   - 3.2. Idealized stress-strain diagram of concrete and steel
   - 3.3. Characteristic strength of materials and safety factors
   - 3.4. Characteristic loads and their safety factors
   - 3.5. Limit state of collapse in compression, shear and torsion
   - 3.6. Limit state of serviceability in deflection and cracking
   - 3.7. Design of singly reinforced concrete beam
   - 3.8. Design of doubly reinforced concrete beam (rectangular and flanged)
   - 3.9. Design of slab (one-way and two-way)
   - 3.10. Design of axially and eccentrically loaded columns
   - 3.11. Design of isolated footing for columns
   - 3.12. Design of combined footings
   - 3.13. Design of raft and pile foundation
   - 3.14. Design of staircases

4. Reinforcement Detailing (5 hours)
   - 4.1. Codal provisions for reinforcement detailing
   - 4.2. Curtailment of reinforcement
   - 4.3. Spacing of reinforcement and concrete cover
   - 4.4. Reinforcement splices
   - 4.5. Anchorage
   - 4.6. Minimum and maximum reinforcement in beams, slabs, columns, etc.
   - 4.7. Minimum and maximum sizes of reinforcing bars
   - 4.8. Details of reinforcement in columns
   - 4.9. Bar bending schedule
   - 4.10. Details of beam/column connections

5. Introduction to Earthquake Resistance Design (9 hours)
   - 5.1. Introduction (earthquake records, plate tectonics, seismic waves, faults, earthquake magnitude and intensity)
   - 5.2. Introduction to earthquake resisting performance expectations including dashpot system
   - 5.3. Philosophy of design of structures in earthquake prone region
   - 5.4. Ductility requirement for beam, column and joints
   - 5.5. Liquefaction
   - 5.6. The importance and implications of structural regularity

6. Introduction to Prestressed Concrete (10 hours)
   - 6.1. Materials used and their properties
   - 6.2. Prestressing systems and anchorages
   - 6.3. Loss of prestressing stress due to tendon friction
   - 6.4. Analysis and design of section in flexure

6.5. Cable layouts, camber and deflections
6.6. Introduction to the load balancing concept

Laboratory/Practical:

1. Test a beam in pure bending failure.
2. Test a beam in shear failure.
3. Test a beam in combined bending and shear failure.
4. Investigate the behavior of a simply supported rectangular beam with single reinforcement. Record the deflection and strains for various loads and cracking patterns.
5. Investigate the behavior of rectangular beams with double reinforcement.
6. Investigate the behavior of reinforced concrete columns till failure.

Reference books:

1. A. K. Jain, "Reinforced Concrete Limit State Design", Nem Chand & Bros., Roorkee.
2. P. Dayaratnam, "Design of Reinforced Concrete Structures", Oxford & IBH Publishing Company.
3. S. Kumar, " Treasure of R.C.C Design", Standard Book House, Delhi
4. S. Ramamrutham, and R. Narayan, "Design of Reinforced Concrete Structures", Dhanpat Rai & Sons, New Delhi.

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below

Chapters	Lecture Hours	Marks Distribution*
1	3	2
2	8	8
3	25	20
4	5	4
5	9	8
6	10	8
Total	**60**	**50**

* There may be minor variation in marks distribution

B.E. (CIVIL) FOURTH YEAR DETAIL SYLLABUS

(SECOND SEMESTER)

CIVIL ENGINEERING PROJECT II

COURSE CODE: CE481

Year: IV
Semester: II

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
0	6	0	-	50	-	50	-	

Course Objective: Civil Engineering Project II is the continuation of Civil Engineering Project I. In Project II, students are required to complete following works in carry-over of the Project I falling under different categories of project works:

1. **Design type project**
   - 1.1. Design of the System and their Alternatives
   - 1.2. Detail Drawings
   - 1.3. Cost Estimation
   - 1.4. Economic and Financial Analysis
   - 1.5. References
2. **Dissertation type project**
   - 2.1. Model Formation
   - 2.2. Model Application
   - 2.3. Results and Discussions
   - 2.4. Larger Implications
   - 2.5. Conclusion and Recommendations
   - 2.6. References
3. **Experimental type project**
   - 3.1. Formulation of Hypothesis
   - 3.2. Analysis of Results and Model Application
   - 3.3. Results and Discussions
   - 3.4. Larger Implications
   - 3.5. Conclusion and Recommendations
   - 3.6. References

At the initial phase, the faculty may conduct a number of lectures and discussions as to the approach of the project. In the later phase, the student will be left on his/their won to pursue his/their work and to consult the faculty whenever any problem crops up. The student should then compile both the works of Civil Engineering Project I and II and submit a draft report, prior to the final report, so that the supervisor can review the work, and correct the mistakes, if necessary. The final draft of the report of the report shall be submitted to the Head of Department in duplicate.

INTERNSHIP IN CIVIL ENGINEERING

COURSE CODE: CE482

Year: IV
Semester: II

Duration	Examination Scheme				Total Marks	Remarks
	Final		Internal Assessments			
	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3 Months	-	50	-	50	150	

Course Objective: Internship in Civil Engineering is solely designed to provide students with the on-site working experience in various sectors of Civil Engineering. Each student is required to work a period of 3 months in an industry or an organization or in a research institute where he/she will have the opportunity to experience job training.

Before commencing the internship, the student should submit a formal proposal to the Head of Department. Internship should be accepted and the organization in the student wants to pursue his/her internship should be approved by the Department Head.

Students are to work in the direction, management, and guidance of the organization of their choice. Student progress and quality of work is determined and reported by the organization. University faculty will make at-least one random on-site visit of the organization to determine the quality of work and the level of service offered by the student.

Duration of Internship: The duration of the internship shall in no case be less than 3 months.

Evaluation Process:

i. Internal Evaluation is based on the observation made during the organization visit, where the faculty conducts a thorough study of the daily log book, professional discipline, professional growth, etc. of the student
ii. The final evaluation is based on the observation made by the organization during the course of internship and individual presentation after the internship.

APPENDIX
(ELECTIVES)

ENVIRONMENTAL IMPACT ASSESSMENT

COURSE CODE: CE467

Year: III

Semester: II (Elective-I)

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objective: This subject deals with the various impacts of infrastructure projects on the components of environment and method of assessing the impact and mitigating the same. The student is expected to know about the various impacts of development projects on environment and the mitigating measures.

1. Introduction (5 hours)
   - 1.1. Impact of development projects under civil engineering on environment
   - 1.2. Environmental impact assessment (EIA)
   - 1.3. Environmental impact statement (EIS)
   - 1.4. Objectives and types of EIA
   - 1.5. Current issues in EIA
   - 1.6. EIA capability and limitations
   - 1.7. History of EIA in Nepal
   - 1.8. Legal provisions on EIA in Nepal

2. Screening and Initial Environmental Examination (5 hours)
   - 2.1. Objectives of screening
   - 2.2. Screening criteria and procedure

2.3. Initial environmental examination (IEE)
2.4. Method of IEE

3. Scoping and Preparation of Terms of Reference (ToR) (5 hours)
   3.1. Objectives of scoping
   3.2. Scoping procedure
   3.3. Terms of reference and its main components

4. Establishing the Environmental Baseline and Impact Identification (7 hours)
   4.1. The environmental setting
   4.2. Purpose of baseline data
   4.3. Method of data collection
   4.4. Importance of baseline data
   4.5. Methods of impact identification

5. Impact Prediction, Evaluation and Mitigation (14 hours)
   5.1. Methods of impact prediction
   5.2. Impact evaluation techniques
   5.3. Types of mitigation measures
   5.4. Implementation of environmental protection measures

6. Management of EIA Processes (9 hours)
   6.1. Environmental management plan
   6.2. Environmental monitoring
   6.3. Environmental auditing
   6.4. EIA report review and decision making
   6.5. Stakeholder consultation and public participation

Tutorial:
1. Preparation of environmental management plan
2. Preparation of environmental monitoring plan
3. Preparation of environmental auditing plan
4. Review of EIA report
5. Involve in process of stakeholder consultation and public participation

Reference books:

1. B.K. Upreti, "Environmental Impact Assessment: Process and Practice", Published by Uttara Uprety, Koteshwor, Kathmandu.
2. J. Glasson, R. Therivel, and A. Chadwick, "Introduction to Environmental Impact Assessment", UCL Press Ltd., London.
3. L. W. Canter, "Environmental Impact Assessment", McGraw Hill, New York.
4. IUCN/ Nepal, "EIA: Training Manual for Professional and Managers", Published by IUCN/ Nepal.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution
1	5	6
2	5	6
3	5	8
4	7	10
5	14	10
6	9	10
Total	**45**	**50**

* There may be minor variation in marks distribution

LOW VOLUME ROAD ENGINEERING

COURSE CODE: CE468

Year: III

Semester: II (Elective-I)

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objectives: The objective of the course is to provide the student with the concept and the tools that can be used to incorporate in the field planning design, construction and maintenance of rural roads. The course includes the details of practical considerations based on the socioeconomic, technical and environmental aspect of low volume road in Nepal.

1. Introduction — 6 hours
   - 1.1. General Background
   - 1.2. Introduction to low volume Road
   - 1.3. Characteristics of low volume Road
   - 1.4. Objectives of low volume Road
   - 1.5. Low volume road in Context of Nepal
   - 1.6. Good and Bad Practices
   - 1.7. Road Planning
     - 1.7.1. Use of GIS in road planning
     - 1.7.2. Road width spacing
     - 1.7.3. District Transportation Planning
   - 1.8. Introduction to Nepal Road Standard
2. Design of Forest road — 12 hours
   - 2.1. Standard and Specification for road construction through forest
   - 2.2. Construction equipment
   - 2.3. Balancing material quantities in earth work (cut and fills)
   - 2.4. Estimating and costing of rural roads
   - 2.5. Installation of reinforced soil wall and bio-technology
   - 2.6. Drainage Design
     - 2.6.1. Hydrology
       - 2.6.1.1. Rational Formula, WCES Formula, MIP Formula
       - 2.6.1.2. Manning's Formula
     - 2.6.2. Use of geo-textiles in drainage
     - 2.6.3. Surface drainage and cross drainage for low volume roads
       - 2.6.3.1. Crowns, In slope and Outslope Road Cross-slopes
       - 2.6.3.2. Water Control in ditches and Inlets/Outlets to Structures
       - 2.6.3.3. Wetland and Swampy Area Crossings
     - 2.6.4. Subsurface Drainage, Underdrains
     - 2.6.5. Natural drainage crossing structures, culverts, fords, Bridges
     - 2.6.6. Design consideration
3. Design of simple bridge — 6 hours
   - 3.1. Site selection
   - 3.2. Hydrology and scouring
   - 3.3. Basic structural design of Beam and wooden logs
   - 3.4. Slab bridges
4. Stability of roadway cuts and fill — 8 hours
   - 4.1. Basic soil mechanics and soil strength factors
   - 4.2. Types and use of retaining wall

4.3. Gravity and reinforces soil wall
4.4. Basic design of gravity retaining structures
4.5. Method of soil stabilization
4.5.1. Physical and vegetative method
4.5.2. Bio-technical method
4.6. Gully stabilization method

5. Environmental Conservation 6 hours
5.1. Environmental Analysis of road
5.2. Process of Environmental Analysis
5.3. Minimization of Slope Cutting and Preservation
5.4. Mass Balancing
5.5. Reuse of Excavated Materials
5.6. Bio-engineering
5.7. Water Quality Protection
5.8. Fish (AOP) Passage, Wildlife Crossings and Issues.

6. Road Maintenance and Rehabilitation 4 hours
6.1. Environmentally sensitive road maintenance
6.2. Road maintenance issues
6.3. Mitigation Measures
6.4. Types of Maintenance
6.5. Sustainable Maintenance Funding
6.6. Rehabilitation and upgrading

7. Socio-Economic Aspect of road 3 hours
7.1. Introduction to socio-economic
7.2. Importance of socio-economic
7.3. Opportunities and Risks of Road Construction Activities
7.4. Social screening
7.5. Beneficial and adverse impacts
7.6. Context of Nepal

Tutorial: Three assignments that include the design of a rural road project, construction technology and maintenance arrangements

Field visit

Evaluation of Roadway Surface Drainage Issues
Evaluation of Bridge and Ford Sites
Discussion regarding Installation of Culverts
Installation of a Culvert considering the Drainage Channel and Watershed
Discussion regarding Stability of Cuts and Fills
Sites for Retaining Structures, Biotechnical Options
Maintenance Issues with Roads

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks Distribution*
1.	6	6
2.	14	16
3.	6	6
4.	8	10
5.	6	6
6.	5	6
Total	**45**	**50**

* There may be minor deviation in marks distribution.

ADVANCED STRUCTURAL ANALYSIS

Course Code: 469

Year: III
Semester: II (Elective-I)

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	-	100	

Course Objective: The objective of the course emphasizes the basic concepts and theorems on static (equilibrium), geometrical (compatibility) and physical (force, stiffness and displacements) conditions in the context of indeterminate systems.

1. **Indeterminacy:** **(4 Hours)**
   Determination of static and kinematic indeterminacies of two dimensional and three-dimensional portal frames, pin jointed trusses and hybrid frames coordinate systems, structural idealization.
2. **Introduction to matrix methods of analysis:** **(6 Hours)**
   Flexibility and stiffness matrices and Force displacement relationships for axial force, couple, torsional moments, stiffness method of analysis and flexibility method of analysis.
3. **Analysis of continuous beams:** **(6 Hours)**
   Stiffness method and flexibility method of analysis, continuous beams of two and three spans with different end conditions, internal hinges.
4. **Analysis of two-dimensional portal frames:** **(8 Hours)**
   Stiffness and flexibility method of analysis of 2D portal frames with different end conditions, plotting of bending moment diagrams.
5. **Analysis of two-dimensional portal frames:** **(6 Hours)**
   Stiffness and flexibility methods, computation of joint displacement and member forces.
6. **Transformation of co-ordinates:** **(9 Hours)**
   Local and Global co-ordinate systems, transformation of matrices from local to global coordinates of element stiffness matrix, direct stiffness method of analysis, assembly of global stiffness matrix from element stiffness matrices, static condensation, sub-structuring.
7. **Equation of solvers:** **(6 Hours)**
   Solution of system of linear algebraic equations, direct inversion method, gauss elimination method, Cholesky method, banded equation solvers frontal solution techniques.

Text/Reference books:

1. Cotes, R. C., Couties, M.G., and Kong, F.K., Structural Analysis, ELBS.
2. M. C. Guire, W., and Gallagher, R.H., Matrix Structural analysis, John Wiley and sons.
3. John L. Meek., Matrix Structural Analysis, McGraw Hill Book company.
4. Structural Analysis by Pundit & Gupta
5. Structural Analysis by C. S. Reddy.
6. Structural Analysis – R. C. Hibbeler
7. Intermediate Structural Analysis – C. K. Wang

Evaluation Scheme:

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below

Chapters	Lecture Hours	Marks Distribution*
1	4	4
2	6	6
3	6	8
4	8	10
5	6	6
6	9	10
7	6	6
Total	**45**	**50**

* There may be minor variation in marks distribution

GEOGRAPHICAL INFORMATION SYSTEM
COURSE CODE: CE475

Year: IV

Semester: I (ELECTIVE II/ELECTIVE III)

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	-	100	

Course Objective: The main objectives of this course are to provide the students with fundamental concepts of Geographic Information Systems (GIS) and familiarize with GIS software. Database development, manipulation and spatial analysis techniques for information generation will be taught.

1. Introduction (4 hours)
   - 1.1. Information systems
   - 1.2. The philosophy of GIS
   - 1.3. History of GIS
   - 1.4. Definition and need of GIS
   - 1.5. Components of GIS
   - 1.6. GIS and cartography
   - 1.7. Vector representation
   - 1.8. Different types of data
   - 1.9. Data processing steps
   - 1.10. Function of GIS and its applications

2. Spatial Data Model (6 hours)
   - 2.1. GIS spatial elements
   - 2.2. Concept of data model
   - 2.3. Raster data model
   - 2.4. Vector data model
   - 2.5. Topology
   - 2.6. Vector and 3-D

3. Data Capture and Automation (6 hours)
   - 3.1. Importance of data
   - 3.2. Source of data
   - 3.3. Capture from analog map by GEOCODING
   - 3.4. Field data collection
   - 3.5. Alternative data entry methods
   - 3.6. Attribute data
   - 3.7. Editing and validation
   - 3.8. Coordinate system
   - 3.9. Map projection
   - 3.10. Accuracy and precision

4. Database Concept and Design (6 hours)
   - 4.1. Databases concepts and components
   - 4.2. Database processing and management systems
   - 4.3. Database design
   - 4.4. Data dictionary

5. Spatial Analysis (6 hours)
   - 5.1. Spatial interpolation methods
   - 5.2. Raster methods including topological overlays
   - 5.3. Map calculations
   - 5.4. Statistics
   - 5.5. Integrated spatial analysis

6. Surface Model: DEM; Slope; Aspect; other Raster Functions (3 hours)

7. GPS (4 hours)
   - 7.1. Basic concept of GPS and its application

7.2. Working principles of GPS
7.3. Introduction of DGPS
7.4. Error in GPS

8. Remote Sensing (6 hours)
   8.1. Basic concept of remote sensing
   8.2. Electromagnetic spectrum and windows
   8.3. Spectral signature of different land use
   8.4. Introduction to different satellites
   8.5. Resolutions in remote sensing
   8.6. Application of remote sensing

9. Making Maps (4 hours)
   9.1. Map function in GIS
   9.2. Map design
   9.3. Map elements
   9.4. Choosing the map type
   9.5. Exporting map in different format printing a map

Tutorials:

1. Spatial database development
2. Linking non-spatial and spatial database
3. Projection
4. Database editing and uploading
5. GPS data and integration in GIS
6. Geo processing
7. Spatial analysis
8. River analysis
9. Map layout
10. Mini-project for GIS application

Reference books:

1. J. Star, and J. Estes, "Geographical Information Systems: An Introduction", Prentice Hall, Englewood Cliffs, N.J.
2. J. Lee, and D.W.S. Wong, "Statistical Analysis with Arc View GIS", John Wiley and Sons, Inc., New York
3. P.A. Burrough, and R.A. McDonnell, "Principles of Geographical Information Systems", Oxford University Press, USA.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution
1	4	4
2	6	6
3	6	6
4	6	8
5	6	8
6	3	2
7	4	5
8	6	6
9	4	5
Total	**45**	**50**

* There may be minor variation in marks distribution

AIRPORT AND RAILWAY ENGINEERING

COURSE CODE: CE476

Year: IV
Semester: I (ELECTIVE II/ELECTIVE III)

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	-	50	-	100	

Course Objective: The basic objective of this course is to understand the fundamental concepts of Airport & Railway Engineering, Characteristics of their components, their design and others.

1. Introduction to Airport & Railway Engineering (3 hours)
   - 1.1. History of Air Transport
   - 1.2. Role of Air Transport
   - 1.3. Air Transport in Nepal
   - 1.4. Some organizations related to Civil Aviation
   - 1.5. History of Railway
   - 1.6. Classification of Railway
   - 1.7. Advantages & Disadvantages

2. Component & Characteristics of Aircraft (4 hours)
   - 2.1. Engine & its type
   - 2.2. Control System
   - 2.3. Carriage
   - 2.4. Types of propulsion
   - 2.5. Size of Aircraft, speed ,capacity ,weight ,Noise, turning Radius, Jet blast, Fuel Spillage

3. Airport Site Selection (4 hours)
   - 3.1. Prediction of Air Travel
   - 3.2. Demand Forecast Based on Econometric models
   - 3.3. Selection Methods
   - 3.4. Runway Orientation
   - 3.5. Typical layout of Airport
   - 3.6. Geometric Standards for elements of Airport
   - 3.7. Terminal Facilities & Space
   - 3.8. Planning of Terminal Facilities

4. Design of Airfield pavement (8 hours)
   - 4.1. Wheel Load
   - 4.2. Sub- grade Characteristics
   - 4.3. Strength of Material
   - 4.4. Types of Pavement

5. Railway Track (5 hours)
   - 5.1. Rail Guage
   - 5.2. Rolling Stock of Railways
   - 5.3. Component part of Railway Track
   - 5.4. Functions of the track components
   - 5.5. Requirement of an ideal Railway Track
   - 5.6. Cross Dimensions and length

6. Design of Railway track Components (8 hours)
   - 6.1. Sleepers
   - 6.2. Ballast
   - 6.3. Track Fittings and fastening
   - 6.4. Material requirement per KM of Railway Track

7. Geometric Design of Railway Track (10 hours)
   - 7.1. Gradient
   - 7.2. Grade compensation on Curve
   - 7.3. Elements of Circular curve
   - 7.4. Super Elevation on Curves

7.5. Safe Speed on Curves, Max. Permissible speed on curves
7.6. Transition Curve & Vertical Curves
7.7. Cant deficiency
7.8. Points & Crossings

8. Requirements of Platform (3 hours)
   8.1. Passenger Requirements, Traffic Requirements, Locomotive Requirement , General
   8.2. Types of Platform, Yards
   8.3. Loops & Sidings
   8.4. Staff Quarters

Field Visit / Field Trip
Field Visit to the nearest Airport & Railway Station for actual Knowledge of the materials used in them.

Reference Books:

1. Airport Planning and Design, S. K. Khanna, M.G. Arora, S.S. Jain, Nem Chand and Bros. Roorkee, 2005
2. Principles of Railway Engineering, S.C. Rangwala, Charotar Publishing House Pvt. Ltd. India, 2010.

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution
1	3	3
2	4	5
3	4	5
4	8	8
5	5	5
6	8	8
7	10	12
8	3	4
Total	**45**	**50**

* There may be minor variation in marks distribution

EARTHQUAKE ENGINEERING

COURSE CODE: CE477

Year: IV

Semester: I (ELECTIVE II/ELECTIVE III)

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	125	

Course Objective: The basic objective of this course is to understand the fundamental concepts of Earthquake Engineering, behavior of structures during earthquake and earthquake resistance design.

1. Elements of Seismology (3 hours)
   - 1.1. Definition and introduction of earthquake
   - 1.2. General effects of an earthquake
   - 1.3. Causes of an earthquake
   - 1.4. Plate tectonic theory
   - 1.5. Seismic waves, magnitude and intensity,
   - 1.6. Methods of measurement

2. Characterization of Earthquake Input (4 hours)
   - 2.1. Attenuation relationships
   - 2.2. Ground motion parameters
   - 2.3. Local site effects
   - 2.4. Seismic hazard analysis

3. Fundamentals of Structural Dynamics (12 hours)
   - 3.1. Dynamic loads and dynamic analysis,
   - 3.2. Degrees of freedom
   - 3.3. Vibrating system
   - 3.4. Single degree of freedom systems
     - 3.4.1. Equation of motion
     - 3.4.2. Damped and undamped free vibration, natural frequency and time period
     - 3.4.3. Overdamped, underdamped and critically damped system
     - 3.4.4. Forced vibration
     - 3.4.5. Vibration isolation and force transmissibility
   - 3.5. Multi degree of freedom systems
     - 3.5.1. Equation of motion
     - 3.5.2. Free vibration response of MDOF system
     - 3.5.3. Eigen values, eigen vectors and mode shapes
     - 3.5.4. Modal superposition method

4. Response Spectrum Theory (4 hours)
   - 4.1. Response to general dynamic loading
   - 4.2. Duhamel's integral
   - 4.3. Earthquake response spectrum
   - 4.4. Construction of design response spectrum
   - 4.5. Effect of foundation and structural damping on design spectrum.

5. Structural Systems for Earthquake Resistance Design (6 hours)
   - 5.1. Moment resisting frames
   - 5.2. Building frame systems and bearing wall systems
   - 5.3. Dual systems
   - 5.4. Building configuration implications

6. Analysis Procedure for Earthquake Resistant Design (12 hours)
   - 6.1. Philosophy of earthquake resistant design
   - 6.2. Codal provisions
   - 6.3. Equivalent lateral load and dynamic analysis procedure
   - 6.4. Drift evaluation and verification
   - 6.5. Torsional response and diaphragm effect
   - 6.6. Computer aided analysis procedure

7. Behaviors of R.C. Structures in Earthquake (4 hours)
   - 7.1. Principles of inelastic design
   - 7.2. Capacity design concept

7.3. Flexural and shear strength
7.4. Ductile detailing of RCC members

Reference Books:

1. A.K. Chopra, “Dynamics of Structures” , Prentice hall of India.
2. M. Paz, “Structural Dynamics” CBS Publication, India.
3. P. Agrawal and M. Shrikande, “Earthquake Resistance Design of Structures”, Prentice hall of India
4. R. W. Clough and J. Penzian, “Dynamics of Structures”, McGraw Hill co, New Delhi

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution
1	3	4
2	4	5
3	12	12
4	4	5
5	6	6
6	12	12
7	4	6
Total	**45**	**50**

* There may be minor variation in marks distribution

SOLID WASTE MANAGEMENT

COURSE CODE: CE478

Year: IV

Semester: I (ELECTIVE II/ELECTIVE III)

Teaching Schedule Hours/ Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	-	2	50	-	50	-	100	

Course Objective:

- After successful completion of this course student will be able to describe main features and processes involved with technologies and process schemes available for treatment of solid wastes.
- Develop insight into the collection, transfer, and transport of municipal solid waste.
- Explain the design and operation of a municipal solid waste landfill.
- Examine the design and operation of a resource recovery facility.

1. Introduction (7 hours)
   - 1.1. Development and issues of solid waste management (SWM)
   - 1.2. Legislation provision of solid waste management in Nepal
   - 1.3. Introduction to integrated solid waste management
   - 1.4. Solid waste management in Nepal
   - 1.5. 3R principles of SWM

2. Source and Types of Solid Waste (8 hours)
   - 2.1. Sources of municipal solid waste
   - 2.2. Types of municipal waste
   - 2.3. Composition of solid waste
   - 2.4. Characteristics of solid waste
   - 2.5. Properties of solid waste (physical, chemical and biological)
   - 2.6. Waste generation, sampling and characteristics

3. Collection, Transfer and Transport (9 hours)
   - 3.1. Waste collection planning
   - 3.2. On-site management
   - 3.3. Handling, storage and processing
   - 3.4. Collection-service, analysis of collection system
   - 3.5. Transfer station, processing and transport

4. Disposal of Solid Waste (12 hours)
   - 4.1. Landfilling, sanitary landfills, land filling methods and operations
   - 4.2. Incineration
   - 4.3. Leachate collection and removal systems
   - 4.4. Final cover system for MSW landfills
   - 4.5. Gas generation and management
   - 4.6. Design and operation of landfills
   - 4.7. Ground water monitoring

5. Resource Recovery (9 hours)
   - 5.1. Introduction
   - 5.2. Material separation and processing techniques
   - 5.3. Materials recovery facilities
   - 5.4. Conversion technology for recovery
   - 5.5. Biological transformation: Composting, vermicomposting
   - 5.6. Recovery of thermal conversion products (incineration, types and design consideration)

Project Work:

- One day field observation visit to observe collection, transport and landfill operation of SWM of nearest municipalities.
- Overview and case study of waste management practices in municipality and VDC.

Reference books:

1. G. Tchobanoglous, H. Theisen, and S. Vigil, “Integrated Solid Waste Management”, McGraw-Hill Inc, New York.
2. H. S. Peavy, D. R. Rowe, and G. Tchobanoglous, “Environmental Engineering”, McGraw-Hill Inc Editions, New York.
3. G. M. Masters, “Introduction to Environmental Engineering and Sciences”, Pearson Education (Singapore) Pte. Ltd., India

Evaluation Scheme:

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below.

Chapters	Hours	Marks distribution*
1	7	6
2	8	10
3	9	10
4	12	14
5	9	10
Total	**45**	**50**

* There may be minor variation in marks distribution

DESIGN OF REINFORCED CONCRETE BRIDGE

Course Code 479

Year: IV

Semester: I (ELECTIVE II/ELECTIVE III)

Teaching Schedule Hours/Week			Examination Scheme				Total Marks	Remarks
			Final		Internal Assessments			
Lecture	Practical	Tutorial	Theory Marks	Practical Marks	Theory Marks	Practical Marks		
3	1	1	50	--	50	-	100	--

Course Objectives:

- Introduction to bridge structures and their types for selection appropriate bridge type
- Introduction to bridge loading and response calculation due to various types of live loads
- To make capable to analyze and design simple RCC bridges, bearings and substructure
- To make students familiar with methods of bridge construction and maintenance

1. Introduction to Fundamentals of Bridge Design (5 hours)

1.1 Bridge and its components
1.2 General design requirements of bridges
1.3 Types of bridges and their characteristics
1.4 Data required for bridge design and their acquisition
1.5 Selection of bridges type

2. Bridge Loading and Responses (2 hours)

2.1 Bridge loading
2.2 Bridge responses

3. Bridge Deck Analysis and Method of Lateral Load Distribution (6 hours)

3.1 Methods of bridge deck analysis
3.2 Effective width method
3.3 Courbon's method
3.4 Distribution coefficient method
3.5 Hendry Jaeger method
3.6 Longitudinal and lateral positioning of moving loads and response calculation

4. Design of Simple Reinforced Concrete Bridge (11 hours)

4.1 Design of RC slab bridge
4.2 Simply supported slab bridges
4.3 Slab Supported in all four sides
4.4 Design of RCT-Beam bridge
4.5 Design of deckslab
4.6 Design of longitudinal girder
4.7 Design of cross girder
4.8 Design of cantilever slab

5. Introduction to Prestressed Bridges (3 hours)

5.1 Introduction and methods of prestressing
5.2 Benefits of prestressing
5.3 Losses in prestressing

6. Design of Bridge Substructures (8 hours)

6.1 Design of piers
6.2 Design of abutments
6.3 Introduction to bridge foundation

7. Bridge Bearing and Expansion Joints **(6 hours)**

7.1 Bridge bearing
7.2 Types of bearings
Design of metallic bearing
Design of elastomeric bearing
7.3 Expansion joint
Requirements of expansion joints
Types of expansion joints

8. Bridge Construction and Maintenance **(4 hours)**

8.1 Introductions to methods of construction of bridges

8.2 Introduction to maintenance of bridges

Field Visit:

1. Each student is given a minor project work on design of RCC/ steel bridge and student has to defend the project at the end of the semester.
2. Two days field visit to observe existing types of bridges and their components and students have to submit field visit report.

Reference books:

1. N. Krishna Raju, "Design of Bridges", Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi
2. D. Johnson Victor, "Essentials of Bridge Engineering", Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi
3. Rangawala "Bridge Engineering" Charotar Publishing House Pvt. Ltd.;16 edition (2015)
4. T. R. Jagadeeh, M.A. Jayaram "Design of Bridge Structures" Prentice Hall India Learning Private Limited
5. Indian Standard Codes (IRC-6, IRC-21, IR-112, IRC-24, IRC-22I, RC-456)

Evaluation scheme:

The questions will cover all chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks Distribution
1	5	5
2	2	2
3	6	5
4	11	12
5	3	3
6	8	8
7	6	6
8	4	4
Total	**45**	**50**

*There may be small variation in marks distribution.