# Faculty of Science and Technology

Detailed Curriculum of
First and Second Semester

## BACHELOR IN SCIENCE
**(COMPUTER SCIENCE AND INFORMATION TECHNOLOGY)**

Mid Western University
Surkhet, Nepal

**August 2016**

# GENERAL POLICY ON
# BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND INFORMATION TECHNOLOGY PROGRAMS OF
# MID WESTERN UNIVERSITY

Mid Western University(MWU) is planning to offer various undergraduate (Bachelor level) programs in engineering (electronics and communication and computer), Bachelor in Information Management and Bachelor of Science in Computer Science and Information Technology. The following point list some basic information regarding the general policy of Mid Western Universityrelated to undergraduate electronics and communication engineering program. Mid Western Universityperiodically reviews and updates its policies to uplift the standard of education.

## 1. Title:

The title of the program is Bachelor of Science in Computer Science and Information Technology (B.Sc. in Computer Science and Information Technology)

## 2. Objective:

The objective of the Bachelor of Science in Computer Science and Information Technology program at Mid Western Universityis to produce high quality computer science and information technology manpower and researchers.

## 3. Duration of the Program:

The program of study for Bachelor of Science in Computer Science and Information Technology is over a period of eight semesters (four academic years). The academic year begins in the September of each year.

## 4. Medium of Instruction and Examination:

The medium of instruction and examination in the Bachelor of Science in Computer Science and Information Technology program shall be English.

## 5. Entry Requirement for New Students:

The entry requirement for students in Bachelor of Science in Computer Science and Information Technology 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 second division marks at their Intermediate level. Besides the basic academic requirement, an entrance examination will be held for all Nepalese applicants.

## 6. Admission Procedure:

The entrance test application form and the information brochure shall be provided on request at the Registrar's Office (MWU) or at the concerned college. The concerned college scrutinizes the applications. The eligible candidates fare 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 subjects and weightage for each subject of the Entrance test will be Physics: 20%; English: 20%; Mathematics: 40% and Chemistry: 20%.

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.

## 7. 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 per week is assigned one credit as a general rule.

## 8. Academic Schedule:

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

## 9. Student Evaluation:

The students' academic performance during a semester is evaluated using the system of continuous assessment (evaluation of sessional work plus the final examination). The college and the University conduct the sessional works and the final examinations, respectively.

Each course shall have sessional 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, no final examination will be conducted and the sessional marks shall be awarded on the basis of continual assessment. Normally, final examinations are not conducted in elective courses and in courses which are offered as intensive courses conducted by reputed international scholars.

To pass in a subject, a student must obtain a minimum of D grade in that subject in sessional work and the final examination, separately.

## Grading System:

The grade (marks) awarded to a student in a course is based on his/her consolidated performance in sessional 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:

| **Grade** | **A** | **A-** | **B** | **B-** | **C** | **C-** | **D** | **D-** | **F** |
|---|---|---|---|---|---|---|---|---|---|
| **Grade point** | **4.00** | **3.67** | **3.33** | **3.00** | **2.50** | **2.00** | **1.50** | **1.00** | **0.00** |

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

**10. 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 from the college for more than four weeks without notifying the principal, his/her name will be removed from the college roll.

**11. Normal and Maximum Duration of Stay at the College:**

The normal duration for completing the Bachelor of Science in Computer Science and Information Technology program at the university will be four years. The maximum duration for the completion of the requirements shall be the normal duration plus two years.

**12. 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 college. In case of illness or any exceptional circumstance during the registration period, he/she must inform the Principal of the same. Registration in absentia may be allowed only in rare cases, at the discretion of the Principal.

However, the student's nominee cannot register for courses but will only be allowed to complete other formalities.

**13. 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.

**14. Course Coding for Bachelor of Science in Computer Science and Information Technology:**

Each course is identified by three letters followed by a three numbers. The three letters stand for subject and three numberssignifies, first digit of each number indicates the total academic year,second digit indicate semester and last number indicate paper.For e.g. COM 411 means four years, First semester and First paper.

**15. Elective Courses:**

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

**16. Award of Degree:**

MWU awards Bachelor of Science in Computer Science and Information Technology degree upon completion of all requirements as prescribed in the curriculum. MWU awards grades as explained in the curriculum on the basis of individual student's relative performance. The minimum credit hours needed for Bachelor of Science in Computer Science and Information Technology degree is 120.

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

**17. Scrutinizing of Final Examination Paper:**

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

**18. Final Examination:**

MWU conducts final examination at the end of each semester. The procedure of final examination conduction will be as per the examination rules of the Mid Western University.

**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 or requirements contained in this document at any time, without pre-notification, within the students' term of residence.

**CURRICULUM FOR THE BACHELOR OF SCENCE IN COMPUTER SCIENCE AND INFORMATION (BSCCSIT)**

| Sr. No | Course Description | Course Code | Credit Hour |
|---|---|---|---|
| **1st Semester** | | | |
| 1. | Fundamentals of Computer | COM411 | 3 |
| 2. | Programming in C | COM412 | 3 |
| 3. | Physics | PHY413 | 3 |
| 4. | Basic Mathematics I | MAT414 | 3 |
| 5. | Digital logic | COM415 | 3 |
| **2nd Semester** | | | |
| 6. | Discrete structure | COM421 | 3 |
| 7. | Microprocessor and Assembly Language | COM422 | 3 |
| 8. | Object Oriented Programming | COM423 | 3 |
| 9. | Statistics | STA424 | 3 |
| 10. | Basic Mathematics II | MAT425 | 3 |

**Fumdamentals of Computer**

Course Code: COM411 Semester: I
Nature of the course: Theory + Practical Credit: 3

Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation:

| | Theory | Practical | Total |
|---|---|---|---|
| Internal | 50 | -50 | 100 |
| Final (External) | 50 | - | 50 |
| Total | 100 | - | 150 |

**Course Objectives**

This course introduces fundamental concepts of Information technology and computer science.

**Course Contents:**

**Unit 1. Introduction to Computer Systems** **10 hrs.**

Introduction to computers, Classification of digital computer systems, Anatomy of a digital Computer, Computer Architecture, Memory system, Memory Units, Auxiliary Storage devices, Inputs devices, Output Devices.

**Unit 2. Computer Software and Software Development** **6 hrs**.

Introduction to Computer Software, Operating Systems, Programming Languages, General Software Features and Trends.

**Unit 3. Database Management Systems** **6 hrs.**

Data processing, Introduction to Database Management systems, Database design

**Unit 4. Telecommunications** **8 hrs.**

Introduction to Telecommunications, Computer Networks, Communication Systems, Distributed systems

**Unit 5. Internet and New Technologies in Information Technology** **10 hrs.**

Internet, Multimedia tools and system, Intranets, Electronic Commerce, Hypermedia, Data Warehouses and Data Marts, Data Mining, Geographical Information System

**Unit 6. Applications of Information Technology** **5 hrs.**

Computers in Business and Industry, Computers in education, training, Computers in Entertainment, science, medicine and Engineering

**Laboratory works:**

The main objective is familiarizing students with operating system and desktop applications using current version of windows.

**References:**

Fundamentals of Information Technology, Alexis Leon, Mathews Leon, Leon TechWorld
Introduction to Computers, Peter Norton's, Tata McGraw-Hill
Foundations of IT, AtulKahate, Tata McGraw hill

**Programming in C**

Course Code: COM412 Semester: I
Nature of course: Theory + Practical Credit: 3

Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation:

| | Theory | Practical | Total |
|---|---|---|---|
| Internal | 50 | -50 | 100 |
| Final (External) | 50 | - | 50 |
| Total | 100 | - | 150 |

**Course Objective:**

The object of this course is to make the students familiar with the basic principles of programming and development of software systems. It encompasses the use of programming systems to achieve specified goals, identification of useful programming abstractions or paradigms, the development of formal models of programs, the formalization of programming language semantics, the specification of program, the verification of programs, etc. the thrust is to identify and clarify concepts that apply in many programming contexts:

**Course Contents:**

1. **Introduction** **4 hrs.**
   History of computing and computers, Text editing and file concepts, Traditional and structured programming concept, Problems analysis, flow chart and algorithm, Program Documentation

2. **Variables and data types** **3 hrs.**
   Constants and variables, Variable declaration, Variable Types, Simple input/output function, Operators

3. **Loops and Decisions** **5 hrs.**
   Introduction, For Loop, While Loop, Do while Loop, Nested Loop, Case, break and continue statements, The if, if else, else-if and switch statements.

4. **Functions** **6 hrs.**
   Introduction, Returning a value from a function, Sending a value to a function, Arguments, External variables, Preprocessor directives, C libraries, Macros, Header files and prototyping

5. **Arrays and Strings** **9 hrs.**
   Introduction to Arrays, Initializing Arrays, Multidimensional Arrays, String, Functions related to the strings, Function related to Graphics

**6. Pointers** **10 hrs.**

Pointers definition, Pointers and Arrays, Returning multiple values from functions, using pointers, Pointer Arithmetic, Pointer and Strings, Double Indirection, Pointer to Arrays

7. **Structure and Unions** **5 hrs.**

Definition of Structure, Nested type Structure, Arrays of Structure, Structure and Pointers, Unions

**8. Files and File Handling** **3 hrs.**

Operating a file in different modes (Real, Write, Append), Creating a file in different modes (Read, Write, Append)

**Laboratory:**

Laboratory work at an initial stage will emphasize on the verification of programming concepts learned in class and use of loops, functions, pointers, structures and unions. Final project of 10 credit hours will be assigned to the students which will help students to put together most of the programming concepts developed in earlier exercises.

**Textbooks:**

1. A book on C by A.Kely and Ira Pohl
2. The C Programming Language by Kerighan, Brain and Dennis Ritchie

**Physics**

Course Code: PHY413 Semester: I
Nature of the course: Theory + Practical Credit: 3

Class Load: 7 Hrs. per Week (Theory: **4**Hrs**,** Practical: 3 Hrs)
Evaluation:

| | Theory | Practical | Total |
|---|---|---|---|
| Internal | 50 | -50 | 100 |
| Final (External) | 50 | - | 50 |
| Total | 100 | - | 150 |

**Course Objective:**

The main objectives of this course is to make able:

1. To apply the theory of simple Harmonic motion in different elastic systems.
2. To apply theory of wave propagation and knowledge of resonance.
3. To apply and analyze the Optical properties in different optical systems.
4. To make use of fundamentals of electromagnetic equipment.
5. To use the knowledge of basic physics in different engineering fields.

**Course Contents:**

**1. Simple Harmonic Motion** **3 hrs.**

Equation of linear simple harmonic motion, Application of SHM in suspended spring mass system and simple pendulum, Angular simple harmonic motion and its application in Physical (Bar) pendulum, Energy consideration.

**2. Waves in Elastic Media** **5 hrs.**

Mechanical waves, Types of waves, Travelling waves, Wave speed, Power and intensity, Reflection, Refraction and interference, Standing waves, Resonance.

**3. Sound Waves** **6 hrs.**

Propagation and speed of sound wave, Displacement and pressure wave, Power and intensity, Reflection and refraction, velocity of sound from air column method, Beats, Doppler effect, Effect of high speed, Production and uses of ultrasound.

**4. Geometrical Optics** **5 hrs.**

Review of mirror and thin lens formula, Combination of lenses, Chromatic aberration, Cardinal points, Monochromatic aberration and its removal, Optical fibers.

**5. Physical Optics**

**Interference** **4 hrs.**

Coherent sources, double slits, thin films, Newton's rings

**Diffraction** **3 hrs.**

Fraunhoffer diffraction at single slit and double slit, diffraction grating.

**Polarization** **4 hrs.**

Breuester's law, Malus law, Double refraction, NIcol prism, Plane, elliptical and circular polarization, Half wave plate, Full wave plate, Optical activity and polarimeter.

**6. Electrostatics** **6 hrs.**

Electric field, Gauss's Law, Electrical potential, E and V of dipole, Capacitance, Dielectrics and energy, Three electric vectors.

**7. Electricity and Magnetism**

**Current Flow** **4 hrs.**

Current and current density, Resistance and resistivity, Ohm's law Energy, Combination of resistances, Kirchhoff's law network equation.

**Magnetism** **7 hrs.**

Magnetic field, Magnetic force on a current, Ampere's law, Force between parallel conductor, Biot& Savart's law, Faradays law of induction, Flux linkage, Lenz's law, Self induction, Inductance, LR circuit, Energy and Energy density in Magnetic field.

**Magnetic Properties of Matter** **2 hrs.**

Poles, Dipoles, Paramagnetism, Diamagnetism, Ferromagnetism, and three magnetic vectors.

**8. Electromagnetism** **11 hrs.**

LC oscillation, Analog to SHM, Electromagnetic oscillation, Resonance, Displacement current, Maxwell's equation. Electromagnetic waves, Waves on transmission line, Waveguide, Travelling waves, Waves in free space.

**Experiments:**

1. To find out the refractive index of the liquid using convex lens by parallax method.
2. To find the refractive index of the liquid using convex lens by parallax method.
3. To determine the value of the acceleration due to gravity (in the lab) and radius of gyration using bar pendulum.
4. To find the refractive index of the material (of given prism) using a spectrometer.
5. To determine the pole strength of bar magnet by neutral point method keeping the magnet vertical.
6. To find the wavelength of sodium light by measuring the diameters of Newton's rings.
7. To determine the frequency of A.C. mains and compare the mass per unit length of two given wires.
8. To determine the wavelength of sodium light using a plane diffraction grating.
9. To determine the Velocity of Sound in air at room temperature with the first resonance air column and two tuning forks.
10. To determine the specific rotation of sugar solution using half-shade polarimeter.
11. To find the (low) resistance using Carry Foster Bridge.

**Textbooks:**


1. David Halliday and Robert Resnik, Physics I &II , H.S. Poplai for Wiley Eastern Limited, New Delhi.
2. Subrahmanyam and BrijLal, *A Text Book of Optics,* S. Chand and Company Ltd., New Delhi.


**Reference Books:**


1. H.C. Verma, *Concepts of Physics,* BharatiBhawan (P&D)
2. J.M. Pradhan and S.K. Gupta, *Text Book of Physics,* Surya Publication, India.
3. D.N. Vasudeva, *Fundamental of Magnetism and Electricity*, S Chand and Company Ltd, New Delhi.
4. David J, Griffiths, *Introduction to Electrodynamics*, Prentice Hall of India Ltd., New Delhi.

**Basic Mathematics I**

Course Code: MAT414 Semester: I
Nature of the course: Theory + Practical Credit: 3

Class Load: 3 Hrs. per Week (Theory: 3 Hrs.)
Evaluation:

| | Theory | Practical | Total |
|---|---|---|---|
| Internal | 50 | - | 50 |
| Final (External) | 50 | - | 50 |
| Total | 100 | - | 100 |

**Course Objectives**

This module alms to provide the students with the basic mathematical skills required to IT and computing courses.

*Detailed Course*

Unit 1: Set Theory and Real Number System **5 hrs.**

Concept, notation and specification of sets, Types of sets, Relation between sets and their Venn diagrams, Operations on sets Laws of algebra of sets (without proof), Number of elements in a set and the problems relating up to three sets.Sets of numbers (Natural numbers, Integers, Rational lumbers, Irrational numbers, Real numbers), Representation of real numbers on the real line. Properties (addition multiplication, cancellation, distributive, order) of real numbers (without proof), Inequalities and their properties. Intervals, Modulus of a real number and its properties. *Numerical Exercises.*

**Unit 2: Complex Numbers** **4 hrs.**

Definition of a complex number, Integral powers of i, Algebra of complex numbers (sum. difference, multiplication, division), Properties of complex numbers, Conjugate of a complex number and its properties, Modulus of a complex number and Its properties, Representation of *a* complex number by a point in a plane (Argand's diagram), Polar representation of a complex number, Square roots of a complex number, DeMoivre's theorem (statement -only) and its application to find up to cube roots of a complex number. *Numerical* ***Exercises.***

Unit **3:** Functions, Limits and Continuity **5 hrs.**

Constant and variable. Concept of functions, Types of functions. Graphic representation of algebraic, logarithmic and exponential functions, Computation of functional values, Domain and range of a function. Application of functions to business and economics.

Idea of a limit, Limit of a function at a particular point and at infinity, Properties of limits (without proof) and use in evaluating limits involving algebraic functions.

Concept of continuity and discontinuity, Test of continuity and discontinuity for simple algebraic function *Numerical Exercises*

Unit 4: Differentiation and its Application **5 hrs.**

Average rate of change, Definition of derivative, Derivative and slope of tangent to the curve. Differentiation by (the first principle of algebraic, logarithmic and exponential functions, Methods of differentiation (power rule, sum rule, product rule. quotient rule chain rule), Differentiation of implicit and parametric functions. Higher order derivatives (up to 3' order)

Unit **5;** Integration and Its Application **6 hrs.**

Concept of integration, Techniques of integration (Standard forms. Substitution method, Integration by parts), Integration of algebraic, logarithmic and exponential functions Definite integral, Methods of evaluating definite Integrals, Area under a curve, Application of integration in business and economics (including consumer's surplus and producers surplus). *Numerical Exercises*

**Unit** 6: Differential Equations **5 hrs.**

Introduction Differential equation. Ordinary differential equation, Order and degree of a' differential equation, Solution of a differential equation, General and particular solutions.

Equations of the first order and first degree

a) variables separated from

b) homogeneous equations

c) linear equations

***Numerical Exercises*** *(without involving* ***trigonometric*** *functions)*

**Unit 7: Vectors** **5 hrs.**

Definition **of *a*** vector '.i a plane **and** space, Directed line segment, Magnitude of a vector, types of vectors, Multiplication of a vector by **a scalar.** Addition of vectors, Parallelogram law **of addition** of vectors, Collinear and coplanar vectors, **Linearity** dependent and independent **vectors. Scalar** product of two vectors, Orthogonal vectors. Vector product of two vectors, ***Numerical Exercises***

**Unit 8:** Matrices and **Determinants** **7 hrs.**

Introduction of matrices, Types of matrices, Equality of matrices, Algebra of matrices, Transpose of a matrix. Determinant of a matrix, Minors and cofactors of matrix, Properties of determinants (without proof) and some simple problems. Singular and non-singular matrix. Adjoint and inverse of matrices,

Solution of a system **of** non-homogeneous linear equations upto three variables (Cramer's rule, Inverse matrix method. Gaussian elimination method).

*References Mathematics for Economics,* Taro Yamane, Prentice-Hall of India. New Delhi, *2nd* Edition (An Elementary Survey)

*Calculus with Analytic Geometry,* George B. Thomas and Ross L Finney, Addison - Wesley, 9th Edition

Basic *Mathematics* - B-C Bajracharya. M K Publishers, 2nd Edition (A text book for BBA / BIM).

*Basic Mathematics* - K.K. Parajuli, SukundaPustakBhawan. 2nd Edition (for BBA/BIM)

*Basic Mathematics* - Sunil Amatya, BasantaDhakal, GovindTamang. Phan Bdr. K-C.

# Digital Logic

Course Code: COM 415 Semester: I
Nature of the course: Theory + Practical Credit: 3

Class Load: **6** Hrs. per Week (Theory: 3 HrsPractical: 3 Hrs)
Evaluation:

| | Theory | Practical | Total |
|---|---|---|---|
| Internal | 50 | -50 | 100 |
| Final (External) | 50 | - | 50 |
| Total | 100 | - | 150 |

**Course Objective:**

The objective of this subject is to acquaint students with basics of Boolean algebra and familiarize the students with the fundamental building blocks of the digital domain Students will be able to design simple digital devices and implement them Laboratory work is essential in this module

*Detailed Course*

**Unit** 1: Number system **5hrs**.

a. Decimal system
b. Binary system
c. Hexadecimal system
d. Octal system
e. Conversion from one number system to another
f. Basic operations on the above bases
g. BCD codes, gray codes and alphanumeric codes

**Unit 2:** Introduction to **digital techniques** **5hrs.**

a. Analog and digital signals and systems
b. Advantages of digital electronics techniques
c. Application of digital signals
d. Conversion of analog signal to digital signal

**Unit** 3: Digital Design fundamentals **7hrs**.

a- logic gates, symbols, truth tables
b. Realization of logic gates using universal gates
G- Boolean algebra and their properties
d- Minimization techniques using Boolean algebra
S. Canonical forms

f. K-Maps and don't cares (K-Maps up to 4 variables only)
g. Reduction using K-Maps (SOP and POS)

Unit 4; Combinational circuit **4hrs**.

a. Designing a combinational logic for *a* specified behavior
b. Adders and subtractors
c. Multiplexers and de multiplexer
d. Encoders and Decoders
e. Seven segment decoders
f. Code generators

Unit 5: Sequential circuits **4hrs**.

a. Difference between combinational and sequential circuits
b. Concept of clock and frequency
c. Latches as a 1- bit memory
d. Flip-flops, R-S flip-flops, J-K flip-flops, D flip-flops and T flip flops
e. Basic Flip-Flop applications

**Unit 6:** Counters **4hrs**.

a. Introduction to counters
b. Asynchronous counters
c. Synchronous counters
d. Up and down counters
e. Modulo counters
f. Using cascaded counters for counting larger modulus
g. Counter applications

**Unit 7: Shift registers** **4hrs.**

a. Introduction to shift registers
b. Serial and parallel shift registers
c. Loading and shifting
d. Left shift and right shift registers
**e.** Bidirectional shift registers
f. Rotating data in either direction
g. Shift register applications
h. Ring counters and Johnson counters

**Unit 8: Sequential machine design** **4hrs.**

*a.* Introduction
b. The use of clock in sequential machine design

c. Synchronous versus asynchronous design

d. State diagrams

e. Transition tables and redundant stales

f. Implementation using flip-flops with simple examples

Unit **9: Memories** **3hrs**

a. Classification of memories

b. General storage method

c. Types of memories

i. RAM and ROM (no circuit details)

**Unit 10: General programmable logic devices** **3 hrs.**

a. Introduction lo *various* programmable devices

i. PLA

ii. PAL

iii. CPLD

iv. FPGA

**Unit 11: Logic families** **3hrs.**

a. Overview of semiconductor technologies used for IC fabrication

b Basic idea of TTL, ECL, $I^2L$. PMOS.NMOS, CMOS and then comparison

c. Level of integration (SSI. MSI, LSI, VLSI, ULSI)

**Unit 12: Miscellaneous topics** **3hrs.**

a. Various digital displays

b. Clocks used in IC chips

c. Simple digital clock working principle

*References*

Floyd T. L and Jain R, P, *Digital Fundamentals,* eighth edition

Mano M.M, *Digital Design,* third edition

Mano M. M, Kime C, R ,*Logic and computer design fundamentals,* second edition

**Discrete Structure**

Course Code: COM 421 Semester: II
Nature of the curse: Theory + Practical Credit: 3

Class Load: **3** Hrs. per Week (Theory: 3 Hrs)
Evaluation:

| | Theory | Practical | Total |
|---|---|---|---|
| Internal | 50 | - | 50 |
| Final (External) | 50 | - | 50 |
| Total | 100 | - | 100 |

**Course Objective:**

This module aims to expose students to rigorous mathematical proof techniques of discrete mathematics.

Detailed Course **8 hrs**.

Unit 1. Relations and order Relations

1.1 Product sets, Binary relations, Domain and Range of binary relation.

1.2 Types of relation-Inverse relation, Identity relation, universe relations, void relation, complementary relation, ternary relation and n-ary relation.

1.3 Representation of relations-Table of relation, Arrow diagrams of relation, Graph of relation,Matix of relation, Directed graph of a relation on a set A.

1.4 Boolean Matrix.

1.5 Properties of relations- reflexive, irreflexive, symmetric, asymmetric, anti-symmetric and transitive raltions. Equivalence relation, Equivalence relation and partition, Equivalence classes and quotient set.

1.6 Composition of two relations, matrix of composition relations properties-

1.7 Partial order relation, Partial ordered set, Dual partial ordered set.

Unit 2. Function (Mapping) **7 hrs**.

2.1 Concept of function, Domain and Range, image and pre-image, Graph of a function f: A→B, Equality of functions, Real valued function, constant function and Identity function.

2.2 Types of functions – onto function, one-to-one function, One-to-one correspondence between A and B, Inverse function.

2.3 The composition of two functions, Properties

2.4 Special functions-Floor function, ceiling functions, Exponential and Logarithmic functions, Integer valued function, Absolute value function, Remainder functions(mod. M functions), factorial function, characteristic function.

2.5 Sequence, finite sequence and infinite sequence length of finite sequence, string and bit string.

2.6 Cardinality – Cardinal set, Denumerable set, countable and uncountable set.
Induction and recursion, Examples of proofs by mathematical induction, Recursive definition and Recursively defined function.

Unit 3 Counting and Combinatory **8 hrs.**

3.1 Basic counting principle. The sum rule and the product rule.

3.2 Permutation of n different objects. The number of r- permutations of n distinct objects when (a) repetition of objects are not allowed (b) repetition of objects are allowed.
Permutations of n objects when the things are not distinct, circular permutations.
Restricted permutations – The number of r-permutations of n different objects are always present.
Combination :- r-combinations of n different objects Restricted combinations, combinations with repetitions:

3.4 Binomial Theorem, Binomial coefficients and Pascal triangle Pascal's identity.

3.5 The pigeonhole principle and Inclusion and Exclusion principle.

Unit 4: Basic Concepts of Graphs **8 hrs.**

4.1 Simple graph, multiple graph and pseudo graph, order of a graph and size of a graph.

4.2 Adjacent vertices, Adjacent edge, degree of a vertex, Isolated vertex and Pendant vertex. Degree sequence of a graph.
Properties (with proofs):
a) The sum of the degree of the vertices of a graph is equal to twice the number of edges.
b) The number of odd vertices in a graph is always even.

4.3 Special types of graph- Isolated graph, complete graph, Regular graph, Path graph, Cycle graph, Wheel graph, Bipartite graph and complete bipartite graph, Graphs of regular Platonic Solids.

4.4 Connectivity – walk, trail and circuit, Path and Cycle, Connected graph, Cut-sets and Cut-vertices. Edges connectivity an vertex connectivity. Theorems (with proofs): a) Let G be a graph. Then every walk from any two verticals U n V contains a path from these vertices b)

4.5 Subgraphs – Subgraphs of a graph, Spanning subgraph, Induced subgraph, Subgraphs deleting a vertex of G(V,E), Subgraph deleting an edge of G(V,E), Connected graph and connected components, Components of a graph.

4.6 Representations of graph – Adjacency list, Adjacency matix, and Incidence matrix.

4.7 Isomorphism of Graphs, Isomorphic graphs, Isomorphic classes, Self Complementary.

Unit 5 Traversability **4 hrs**.

5.1 Eulerian trail, Eulerain circuit, Eulerian graph, Konigsberg Bridge problem. Theorems (without proofs):-
a) A connected graph G is Eulerian if and only if each vertex has even degree.
b) A connected graph G has Eulerian trail if and only if it has exactly two odd vertices.

5.2 Hamitonian path, Hamiltonian cycle and Hamiltonian graph. Theorems (without proofs)

Unit 6. Trees **5 hrs.**

6.1 Label tree and non Label tree. Non isomorphic trees. Leaf and branch node, Forest. Between any two vertices of G.

6.2 Properties of tree (with proofs).

6.3 Spanning tree, A theorem with proof – A graph G has a spanning tree if and only if G is connected, Methods of constructing a spanning tree from a graph by

a) Breadth – first search and
b) Depth – first search (Backtracking), Determination of all spanning tree in a simple connected graph, using 'Matrix tree theorem's (Kirchhoff's Theorem).

6.4 Minimum spanning tree- a) Kruskal algorithm b) Prim's algorithm. Edge constrained spanning tree.

Unit 7. Directed Graphs **5 hrs.**

7.1 Digraph, Simple digraph, Reflexive, Symmetric and Transitive digraph, Loop and Parallel arc (edge), Adjacent vertices and degree of vertices, Source vertex and Sink vertex. Theorem (with proof) – In a digraph, the sum of the in-degrees of vertices, the sum of the out-degrees of vertices and the number of edges are equal are equal to each other.

7.2 Connectivity of digraphs – underlying graph, directed walk, closed walk, directed path, directed cycle, spanning path. Weakly connected, Unilaterally connected and strongly connected theorems (without proofs)

7.3 Representation of diagraph – Adjacency list, Adjacency matrix and Incidence matrix.

7.4 Rooted tree, Pictorial representation of rooted tree. Definitions of some terms related to Parent and child sibling, Ancestors, Descendants.

7.5 Subtrees of a rooted tree – the subtree at a vertex v, the subtree of vertex v, ordered rooted tree, universal address system for the vertices of an ordered rooted trees, Lexicographical order.

7.6 Binary tree and m-any tree, properties of binary tree with proofs:

References

Kolma, Busby, Roos; ***Discrete Mathematical Structure***, Prentice-Hall of India.
Kenth Rosen; ***Discrete Mathematical and its application***, McGraw-Hill
R.Joshnsonbaugh; ***Discrete Mathematical***, Pearson Education Asia.
Seymour Lipschutz and Marc Lipson; ***Discrete Mathematics***,(Schaum's Outline).
S.M Maskey: ***First course in Graph Theory***, Published by RatnaPustakBhandar.

## Microprocessor and Assembly Programming

Course Code: COM 422 Semester: II
Nature of the course: Theory + Practical Credit: 3

Class Load: 7 Hrs. per Week (Theory: 3 Hrs**,** Tutorial 1 hr,Practical: 3 Hrs)
Evaluation:

| | Theory | Practical | Total |
|---|---|---|---|
| Internal | 50 | -50 | 100 |
| Final (External) | 50 | - | 50 |
| Total | 100 | - | 150 |

**Course Objective:** To be familiar with the operation, programming and application of 8 and 16 bit microprocessor.

**1. Introduction** **6 hrs.**

1.1 History of microprocessor
1.2 Calculator and stored program computer
1.3 Von Neumann and Harvard architecture
1.4 Simple stored program computer architecture
1.5 Microprocessor Architecture (8 and 16 bit)
1.6 Applications

**2. Microprocessor Instructions (8bit Microprocessor)** **8 hrs.**

2.1 Resister transfer language (RTL)
2.2 Instruction and machine cycle
2.3 Addressing modes: Direct, indirect, immediate, absolute, relative, indexed, register, stack and implied
2.4 RTL description of data transfer, arithmetic, logical, branch, miscellaneous instructions
2.5 Fetch and execution cycle, fetch execution overlap
2.6 Timing diagram for register move, indirect read, indirect write and out instructions

**3. Assembly Language Programming (16 bit Microprocessor)** **10 hrs.**

3.1 Assembler instructions format: Opcodes, memonics and operands
3.2 Assembler operations: Sample assembly language program and code generation, one pass and two pass assembly
3.3 Macro assemblers, linking assemblers and assembler directives

**4. Bus Structure and Memory Devices** **4 hrs.**

4.1 Bus Structure, synchronous and asynchronous data bus, address bus, bus timing
4.2 Static and Dynamic RAM, ROM
4.3 PROM, UVEPROM, EEPROM, PROM programmer and erasure
4.4 Address decoding, memory interface (8, 16, 32, 64 bit)

**5. Input/Output Interfaces** **7 hrs.**

5.1 Serial Communication
- 5.1.1 Asynchronous interface: ASCII code, baud rate, start bit, stop bit, parity bit
- 5.1.2 Synchronous interface
- 5.1.3 8255 Programmable Peripheral Interface (Block diagram and Modes only)
- 5.1.4 8251 Programmable Communication Interface (Block diagram and Modes only)

5.2 Parallel Communication
5.3 Data transfer wait interface
5.4 RS-232 and IEEE 488-1978 general purpose interface standard
5.5 8279 Keyboard and display controller (Block diagram and Modes only)

**6. Interrupt (8, 16-bit) 5 hrs.**

6.1 Introduction
6.2 Interrupt vector and descriptor table
6.3 Interrupt service routine requirements
6.4 Interrupt priority: Maskable and non-maskable interrupts, software interrupts, trap and execution (8 and 16 bit)
6.5 Vectored, chained and polled interrupt structures
6.6 Interrupts in parallel and serial interfaces
6.7 8259 Interrupt controller (Block diagram and Modes only)

**7. DMA 3hrs.**

7.1 Introduction
7.2 Basic DMA operations
7.3 8237 DMA controller (Block diagram and Modes only)

**8. Introduction to Advance Microprocessor Architecture 2 hrs.**

Based on register size and Bus width from 8085 to Recent Microprocessor

**Laboratory:**

12 laboratory exercise using microprocessor trainer kit and assembler.

**Reference:**


1 Ghosh, P. K., Sridhar P. R.,"*0000 to 8085: Introduction to Microprocessors for Engineers and Scientists*", Second Edition, Prentice Hall of India Private Limited, 1997.
2 Barry B. Berry,"*The Intel Microprocessors 8086,8088,80186, 80286, 80386, and 80486 (Architecture, Programming and Interface* ,", Prentice Hall of India Private Limited, 1997.
3 "Lance, A. Leventhal., "*Introduction to Microprocessors: Software, Hardware, and Programming*", Eastern Economy Edition, Prentice Hall of India Private Limited, 1995.
4 Yu Cheng Liu and Glenn A. Gibson, "*Microprocessors Systems: The 8086/8088 Family* ,", Prentice Hall of India Private Limited, 1998.
5 Douglas V. Hall, "*Microprocessors and Interfacing* ,", Prentice Hall of India Private Limited, 1997.

# Object Oriented Programming

Course Code: COM 423 Semester: II
Nature of the course: Theory + Practical Credit: 3

Class Load: 7 Hrs. per Week (Theory: 3 Hrs**,** Tutorial 1 hr,Practical: 3 Hrs)
Evaluation:

| | Theory | Practical | Total |
|---|---|---|---|
| Internal | 50 | -50 | 100 |
| Final (External) | 50 | - | 50 |
| Total | 100 | - | 150 |

**Course Objectives:**

Object-oriented programming is an approach to thinking about computation and problem solving in Object Oriented Paradigms. This course lays out the principles of object-oriented programming in C++ Programming Language. The Course helps the target audience to discover the basic concepts of object-oriented programming in C++. The basic objective behind this course is:

- To introduce the fundamentals of C++ programming
- To present the defensive programming style required by the C/C++ programming language
- To explore the facilities offered by C++ for object-oriented programming.

**Course Contents:**

1. **Introduction to Object Oriented Paradigm** **12 hrs.**
   Object-Oriented Programming as a New Paradigm, A Way of Viewing the World-Agents, Computation as Simulation, Coping with Complexity: The Nonlinear Behavior of Complexity: Abstraction Mechanisms, reusable Software. Object-Oriented Design: Responsibility Implies Noninterference, Programming in the Small and Programming in the Large, Role of Behavior in OOP, Case Study: Responsibility-Driven Design, CRC Cards, Components and Behavior, Software Components, Formalize the Interface, Design the Representation for Components, Implementing Components, Integration of Components, Maintenance and Evolution

2. **Classes, Methods and Messages** **13 hrs.**
   Encapsulation, Varieties of Classes, Interface and Implementation, Classes and Methods in C++, Message-Passing Formalism, Message Passing Syntax in C++, Issues in Creation and Initialization; Stack Versus Heap Storage Allocation, Memory recovery, Pointers; Mechanisms for Creation and Initialization in C++, Case Study: The Eight Queen Puzzle in C++.

**3. Inheritance and Software Reusability** **10 hrs.**

Introduction to Inheritance, Subclass, Subtype, and Substitutability; Forms of Inheritance, Inheritance in C++, Inheritance- Its merit and demerits, Inheritance and Substitutability, The*is-a* rule and the *has-a* rule, Composition and Inheritance, Software reusability

**4. Polymorphism** **10 hrs.**

Polymorphism in Programming languages, Varieties of Polymorphism, Polymorphic Variables, Overloading, Overriding, Deferred Methods, Pure Polymorphism, Generic and Templates, Polymorphism in C++ and, Case Study: Container Classes and The Standard Template Library

**Laboratory Work**

There shall be 20 exercises in minimum, as decided by the faculty. The exercises shall encompass a broad spectrum of real-life and scientific problems, development of small program to the development of fairly complex subroutines, programs for engineering applications and problem solving situations. Laboratory assignments will be offered in groups of two to four for evaluation purpose. In general, the Laboratory Work must cover assignments and exercises from the following areas:

1. Data types – control structures, functions and scoping rules.
2. Composite data types, C++ strings, use of " Constant " keyword, pointers and references
3. Classes and data abstraction
4. Inheritance, abstract classes and multiple inheritance
5. Friend functions, friend classes and operator overloading.
6. Static class members
7. Polymorphism, early binding and late binding
8. C++ type conversion
9. Exception handling
10. Function templates, class templates and container classes.

**Reference:**


1. R. Lafore, *Object Oriented Programming in Turbo C++*, Galgotia Publications Ltd. India, 1999
2. Budd, T., *An Introduction to Object Oriented Programming*, Second Edition, Addison-Wesley, Pearson Education Asia, ISBN: 81-7808-228-4.
3. Savitch, W, *Problem Solving with C++ - The Object of Programming*, 2nd Edition, Addison – Wesley, Pearson Education Asia (LPE), 2001, ISBN: 81-7808-173-3
4. Lippman, S.B., Lajoie. J., *C++ Primer*, 3rd Ed., Addison Wesley, 1998
5. Eckel, B., *Thinking in C++*, 2nd Edition, Prentice Hall, 2000

## Statistics

Course Code: STA424 Semester: II
Nature of the course: Theory + Practical Credit: 3

Class Load: **3** Hrs. per Week (Theory: 3 Hrs)
Evaluation:

| | Theory | Practical | Total |
|---|---|---|---|
| Internal | 50 | - | 50 |
| Final (External) | 50 | - | 50 |
| Total | 100 | - | 100 |

**Course Objective:**

This module aims to introduce students to the tools and techniques of statistics that can be used for managerial decision making.

*Detailed Course*

Unit 1: Introduction **2 hrs.**

Definition, scope, and limitations of statistics. Use of statistics in management.

Unit*2:* **Data Collection andClassification** **2 hrs.**

Objective of data collection. Types of data. Methods of collecting primary data. Method of collecting secondary data. Precaution in using secondary data. Problems of collecting primary and secondary data. Sampling - concepts and method.

**Unit 3:** Classification and Presentation **4 hrs.**

Need and meaning of classification. Types of classification Frequency distribution (including bivariate frequency). Graphic and diagrammatic presentation: Histogram, Frequency, polygon and 0 give curves, Percentage bar diagram and Pie diagram.

**Note:** Unit 1, 2, and 3 Revision only,

Unit 4: **Measures** of Central **Tendency** **6 hrs.**

Types of average (AM, GM, HM, Median, Mode), Choice of average

**Unit** 5: Measures of Dispersion **3 hrs.**

Objectives of relative and absolute measures of dispersion. Types ol measuring dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Loren; Curve. Coefficient of variation and its application

Unit 6: Measures of Skewness and Kurtosis **4 hrs.**

Objective of measuring Skewness Karl Pearson's and Bowley's coefficient of skewness. Obji'c.live of measures of Kurtosis. Measures of skewness and Kurtosis based on moments,

Unit 7: Correlation and Regression **5 hrs.**

Correlation and *its* type Karl Pearsons correlation coefficient (including bivariate frequency distribution) Spearman's rank correlation coefficient Regression analysis and its application (simple and Including bivariate frequency distribution). Properties of correlation and regression coefficient.

Unit 8: Analysis of Time Series **8 hrs.**

Need and definition of time series. Components of time series. Methods of measuring trend - (a) Method of semi average (b) Method of moving average (c) Least square method Measurement of seasonal variation - Simple average method and Ratio to moving average using additive and multiplicative model.

**Unit** 9: Index Number **7 hrs.**

Definition and uses of index number. Types of index number Problems in constructing index number. Simple aggregative and simple averages of price relatives. Laspeyre's, Paasche's and Fisher's index numbers. Weighted average of price relatives (using A.M. and G M). Time reversal test and factor reversal test. Consumer's price index number Aggregative expenditure method. Family budget method. Base shifting and deflating.

Unit 10: Probability **4 hrs.**

Concept of objective and subjective probability. Permutations and combinations. Counting and random variable Marginal and joint probability. Addition and multiplication rule Conditional probability and Baye's theorem.

References

Statistics *for Management,* by Levin.
Gupla SC., *Fundamentals of Statistics,* Himalayan Publishing House, India.

# Basic Mathematics II

Course Code: MAT425 Semester: II
Nature of the course: Theory + Practical Credit: 3

Class Load: 3 Hrs. per Week (Theory: 3 Hrs.)
Evaluation:

| | Theory | Practical | Total |
|---|---|---|---|
| Internal | 50 | - | 50 |
| Final (External) | 50 | - | 50 |
| Total | 100 | - | 100 |

**Course Objectives**

This course provides students with the knowledge of fundamental of linear algebra and the theory of matrices. On completion of this course the student will master the basic concepts and acquires skills in solving problems in linear algebra.

**Course Contents:**

**Unit 1: Linear equations in linear Algebra** **10 hrs.**

1.1 Systems of linear equations
1.2 Row reduction and Echelon Forms
1.3 Vector equations
1.4 The matrix equations Ax = b
1.5 Solution sets of linear systems
1.6 Linear independence
1.7 Introduction Linear Transformations
1.8 The matrix of a Linear Transformations

**Unit 2: Matrix Algebra** **8 hrs.**

2.1 Matrix operations
2.2 The inverse of a matrix
2.3 Characterization of invertible matrices
2.4 Partitioned Matrices
2.5 The Leontief Input-output model
2.6 Application to Computer graphics

**Unit 3: Determinants** **4 hrs.**

3.1 Introduction to determinants
3.2 Properties of determinants
3.3 Cramer's rule value and linear transformations

**Unit 4: Vector Spaces** **8 hrs.**

4.1 Vector spaces and sub polar
4.2 Null spaces, Column spaces and linear transformations
4.3 Linearly Independent Sets; Bases
4.4 Coordinate systems
4.5 The dimension of a vector space
4.6 Rank
4.7 Change of basis

**Unit 5: Eigen values and Eigen vectors** **7 hrs.**

5.1 Eigen vectors and Eigen values
5.2 The characteristics equations
5.3 Diagonalization
5.4 Eigen vectors and Linear Transformations
5.5 Complex Eigen values
5.6 Discrete Dynamical System

**Unit 6: Orthogonality and Least Squares** **8 hrs.**

6.1 Linear product, length and Orthogonality
6.2 Orthogonal sets
6.3 Orthogonal Projections
6.4 The Gram- Schmidt process
6.5 Least square problems
6.6 Applications to Linear models

**References:**


1. David C. lay: Linear Algebra and its applications, 3rd edition, Pearson Education.
2. Kolman, Bernard; Introductory Linear Algebra with Application.7th edition. Pearson.
3. Gilbert Strang; Linear Algebra and its Application.3rd edition.
4. Kreszig, E. " Advanced Engineering Mathematics." 5th edition. Wiley

# Mid-Western University
# Surkhet

# Detailed Curriculum

## BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND INFORMATION TECHNOLOGY
(B. Sc. CSIT)

**March, 2017**

# GENERAL POLICY ON
# BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND INFORMATION TECHNOLOGY PROGRAMS OF MID-WESTERN UNIVERSITY

Mid-Western University (MWU) is offering undergraduate (Bachelor level) programs in Bachelor of Science in Computer Science and Information Technology and other applied science program under the Faculty of Science and Technology (FoST). The following point list some basic information regarding the general policy of Mid Western University related to undergraduate B. Sc. in computer science and information technology. Mid Western University periodically reviews and updates its policies to uplift the standard of education.

## 1. Title:

The title of the program is Bachelor of Science in Computer Science and Information Technology (B.Sc. in Computer Science and Information Technology)

## 2. Objective:

The objective of the Bachelor of Science in Computer Science and Information Technology program at Mid Western University is to produce high quality computer science and information technology manpower and researchers.

## 3. Duration of the Program:

The program of study for Bachelor of Science in Computer Science and Information Technology is over a period of eight semesters (four academic years). The academic year begins in the September of each year.

## 4. Medium of Instruction and Examination:

The medium of instruction and examination in the Bachelor of Science in Computer Science and Information Technology program shall be English.

## 5. Entry Requirement for New Students:

The entry requirement for students in Bachelor of Science in Computer Science and Information Technology 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 second division marks at their Intermediate level. Besides the basic academic requirement, an entrance examination will be held for all Nepalese applicants.

## 6. Admission Procedure:

The entrance test application form and the information brochure shall be provided on request at the Registrar's Office (MWU) or at the concerned campus. The concerned campus scrutinizes the applications. The eligible candidates fare informed to appear in the entrance test. The exact date for the entrance test is communicated to the applicants by the campus. The candidates shall be admitted on merit basis. The subjects and weightage for each subject of the Entrance test will be

Physics: 20%; English: 20%; Mathematics: 40% and Chemistry: 20%.

The campus 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 campus.

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 cancelled.

## 7. 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 per week is assigned one credit as a general rule.

## 8. Academic Schedule:

The academic session of the University consists of two semesters per year. The Fall semester starts in September. For the Bachelor's program in science and technology, student admission may commence in the Fall semester, approved by the University. Mid Western University publishes its yearly academic calendar. The campus is required to follow the calendar.

## 9. Student Evaluation:

The students' academic performance during a semester is evaluated using the system of continuous assessment (evaluation of sessional work plus the final examination). The campus and the University conduct the sessional works and the final examinations, respectively.

Each course shall have sessional marks of 40% evaluated by the assigned teacher. Generally, each course will have a written semester examination of 60% marks at the end of each semester. In the Practical courses, no final examination will be

conducted and the sessional marks shall be awarded on the basis of continual assessment. Normally, final examinations are not conducted in elective courses and in courses which are offered as intensive courses conducted by reputed international scholars.

To pass in a subject, a student must obtain a minimum of $D^-$ grade in that subject in sessional work and the final examination, separately.

**Grading System:**

The grade (marks) awarded to a student in a course is based on his/her consolidated performance in Internal 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:

| **Grade** | **A** | **$A^-$** | **B** | **$B^-$** | **C** | **$C^-$** | **D** | **$D^-$** | **F** |
|---|---|---|---|---|---|---|---|---|---|
| **Grade point** | **4.00** | **3.67** | **3.33** | **3.00** | **2.50** | **2.00** | **1.50** | **1.00** | **0.00** |

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

**10. 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 from the campus for more than four weeks without notifying the chief, his/her name will be removed from the campus roll.

## 11. Normal and Maximum Duration of Stay at the Campus:

The normal duration for completing the Bachelor of Science in Computer Science and Information Technology program at the university will be four years. The maximum duration for the completion of the requirements shall be the normal duration plus three years.

## 12. 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 chief.

## 13. 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 Campus or University, which he/she attended previously.

## 14. Course Coding for Bachelor of Science in Computer Science and Information Technology:

Each course is identified by three letters followed by a three-digit number. The three letters indicate the subject area (e.g., COM for computer, PHY for physics, etc). The first digit of each number indicates the level or academic year the course is normally taken (1 for first year, 2 for second year, 3 for third year and so on). The second and the third digits indicate departmental sequence, and the fourth digit, which is preceded by a decimal, indicates the number of semester hour credit awarded for the course (e.g., COM 411 is a four year and first semester and course serial).

In the course description, figures in parenthesis following the course number, for example, (3-2-0), indicate the hours per week devoted to lecture, tutorial, and practical, respectively.

**15. Elective Courses:**

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

**16. Award of Degree:**

MWU awards Bachelor of Science in Computer Science and Information Technology degree upon completion of all requirements as prescribed in the curriculum. MWU awards grades as explained in the curriculum on the basis of individual student's relative performance. The minimum credit hours needed for Bachelor of Science in Computer Science and Information Technology degree is 120.

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

**17. Scrutinizing of Final Examination Paper:**

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

**18. Final Examination:**

MWU conducts final examination at the end of each semester. The procedure of final examination conduction will be as per the examination rules of the Mid Western University.

**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 or requirements contained in this document at any time, without pre-notification, within the students' term of residence.

**CURRICULUM FOR THE BACHELOR OF SCENCE IN COMPUTER SCIENCE AND INFORMATION (B.Sc.CSIT)**

| S. N | Course Description | Course Code | Credit Hour |
|---|---|---|---|
| **3rd Semester** | | | |
| 11. | Data Sstructure and Algorithm | COM431 | 3 |
| 12. | Computer Organization and Architecture | COM432 | 3 |
| 13. | Numerical Methods | COM433 | 3 |
| 14. | Principle of Management | MAN434 | 3 |
| 15. | Computer Networks | COM435 | 3 |
| **4th Semester** | | | |
| 16. | Operating Systems | COM441 | 3 |
| 17. | Database Management System | COM442 | 3 |
| 18. | Technical Writing | ENG443 | 3 |
| 19. | Computer Graphics | COM444 | 3 |
| 20. | Theory of Computation | COM445 | 3 |
| **5th Semester** | | | |
| 21. | Artificial Intelligence | COM451 | 3 |
| 22. | Systems Analysis and Design | COM452 | 3 |
| 23. | Design and Analysis of Algorithms | COM453 | 3 |
| 24. | Compiler Design | COM454 | 3 |
| 25. | Elective (Any One) | | |
| | Management Information System | COM 455A | 3 |
| | Neural Network | COM455B | 3 |
| | | | |

| | | | |
|---|---|---|---|
| **6th Semester** | | | |
| 26. | Simulation and Modeling | COM461 | 3 |
| 27. | Software Engineering | COM462 | 3 |
| 28. | Web Technology | COM463 | 3 |
| 29. | Cryptography | COM464 | 3 |
| 30. | Elective(Any One) | | |
| | Information Retrieval | COM465A | 3 |
| | Database Administration | COM465B | 3 |
| **7th Semester** | | | |
| 31. | Advanced Java | COM471 | 3 |
| 32. | Real Time Systems | COM472 | 3 |
| 33. | Data Warehousing and Data Mining | COM473 | 3 |
| 34. | Project Work | COM474 | 3 |
| 35. | Elective(Any One) | | |
| | Software Project Management | COM475A | 3 |
| | Network Security | COM475B | 3 |
| | System Administration | COM475C | 3 |
| **8th Semester** | | | |
| 36. | Image Processing | COM481 | 3 |
| 37. | Cloud Computing | COM482 | 3 |
| 38. | Internship | COM483 | 6 |
| 39. | Elective(Any One) | | |
| | Geographical Information System | COM484A | 3 |
| | Mobile Application Development | COM484B | 3 |

| | | | |
|---|---|---|---|
| | E-governance | COM484C | 3 |
| | Bio-Informatics | COM485D | 3 |
| **Total Credit Hours(From 3rd to 8th)** | | | **90** |

Course Title: **Data Structure and Algorithms**
Course Code: **COM431**
Semester: **III**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**

1. To provide fundamental knowledge on Data Structure and its implementation.
2. To provide the knowledge of various algorithms used in computer science.
3. To introduce time complexity analysis of problems.
4. To study the representation, implementation & applications of data structures.
5. To compare alternative implementations of data structures.
6. To choose the appropriate data structure for modeling a given problem.

**Course Contents:**

**1.0 Introduction to data structure ( 2 hrs)**
Concept of data structure, Abstract Data Type, Implementation of Data structure

**2.0 The Stack ( 3 hrs)**
Definition, Stack as an ADT, POP and PUSH operation, Stack application: Evaluation of Infix, Postfix, and Prefix expressions

**3.0 Queue ( 3 hrs)**
Definition, Queue as an ADT, Primitive operations in queue, Linear and circular queue and their application, Enqueue and Dequeue, Priority queue

**4.0 List ( 2 hrs)**
Definition, Static and dynamic list structure, Array implementation of lists, Queues as list

**5.0 Linked Lists ( 5 hrs)**
Definition and link list as an ADT, Dynamic implementation, Basic operations in linked list: node insertion, deletion, insertion and deletion after and before nodes, Linked stacks and Queues, Doubly linked lists and its advantages

**6.0 Recursion ( 4 hrs)**
Principle of recursion, Comparison between recursion and iteration, Recursion example: TOH and Fibonacci sequence, Applications of recursion, Search tree

**7.0 Trees ( 5 hrs)**
Concept and definitions, Basic operation in Binary tree, Tree search and insertion/deletions, Binary tree traversals (pre-order, post-order and in-order), Tree

height, level, and depth, Balanced trees: AVL balanced trees, Balancing algorithm, The Huffman algorithm, Game tree, B-Tree

**8.0 Sorting ( 5 hrs)**

Internal and external sort, Insertion and selection sort, Exchange sort, Bubble and quick sort, Merge and Radix sort, Shell sort , Binary sort, Heap sort as priority queue, Efficiency of sorting, Big 'O' notation

**9.0 Searching ( 5 hrs)**

Search technique; essential of search, Sequential search, Binary search, Tree search, General search tree, Hashing: Hash function and hash tables, Collision resolution technique, Efficiency comparisons of different search technique

**10.0 Graphs ( 6 hrs)**

Representation and applications, Graphs as an ADT, Transitive closure, Warshall's algorithm, Graphs types, Graph traversal and Spanning forests, Kruskal's and Round-Robin algorithms, Shortest-path algorithm, Greedy algorithm, Dijkstra's Algorithm

**11.0 Algorithms ( 5 hrs)**

Deterministic and no-deterministic algorithm, Divide and conquer algorithm, Series and parallel algorithm, Heuristic and Approximate algorithms

**Laboratory Works:**

There shall be 10 lab exercises based on C or C++

1. Implementations of stack
2. Implementations of linear and circular queues
3. Solutions of TOH and Finbonacci Recursion
4. Implementations of linked list: singly and doubly linked
5. Implementation of trees: AVL trees, Balancing of AVL
6. Implementation of Merge sort
7. Implementation of search: sequential, Tree and Binary
8. Implementation of Graphs: Graph traversals
9. Implementation of Hashing
10. Implementations of Heap

**Text Book:**

- Y. Langsam, M. J. Augenstein and A. M. Tenenbaum, "*Data Structures using C and C++*", PHI

**References:**

- G. W. Rowe, "*Introduction to Data Structure and Algorithms with C and C++*", PHI
- The Design and Analysis of Algorithm, Nitin Upadhyay, SK Kataria & Sons.

Course Title: **Computer Organization and Architecture**
Course Code: **COM432**
Semester: **III**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Tutorial: **3** Hr**s**)
Evaluation: External (60) +Internal (20+20)

**Course Objectives:**
Under going this course will help a student to build up a sound background in understanding the fundamentals of organization of the Computer System and the associated components. This course exposes a student to the modem trends and technology behind computer organization in a practical perspective with examples taken from real world.

**Course Contents:**

1. **Instruction Set Architecture** **(5 hrs)**
   Levels of Programming Language, Language Category, Compiling and Assembling Programs. Assembly Language Instructions, Instruction Type, Data Types, Addressing Modes, Instruction Formats. Instruction Set Architecture, Study of Intel 8085 Instruction, Writing Simple Programs for Intel 8085.

2. **Computer Organization** **(5 hrs)**
   Basic Computer Organization, System Buses, Instruction Cycles. CPU Organization, Memory Sub-system Organization and Interfacing, I/O Sub-system Organization and interfacing, Intel 8085 Based computer as a Real World Example.

3. **RTL and HDL** **(5 hrs)**
   Micro-Operations and RTL, Using RTL to specify a Digital System, Specification of Digital Component, Specification and Implementation of Simple System. Introduction to VIIDL: Syntax, Levels of Abstraction in Design, Advance Capabilities of VHDL.

4. **CPU Design** **(5 hrs)**
   Specification of a CPU, Design and Implementation of a Very Simple and Relatively Simple CPU: Instruction Execution, Fetch, Decode, Data Path, Hardwired Control Unit, Design Verification. Features of Simple CPU: Internal Registers and Cache, Internal Architecture of Intel 8085 Microprocessor as a Real World Example.

5. **Control Unit Design** **(4 hrs)**
   Basic Micro-sequencer (Control Unit) Design and Operations, Micro-instruction Formats, Design and Implementation of a Very Simple and Relatively Simple Control Unit: Layout, Control Sequence Generation, Generation of Micro-Operations, Control Signal Generation, Reducing tile Number of Micro-Instructions. Micro-programmed vs. Hardwired Control Unit. Intel Pentium Processor as a Real World Example of a Microcoded CPU.

**6. Arithmetic Unit (5 hrs)**

Representations of Binary Number and Arithmetic in Unsigned Notation, Signed Notation, and Binary Coded Decimal (BCD) . Specialized Arithmetic Hardware: Pipelining, Lookup Table, Intel Pentium Co-processor as a Real World Example. Real Number representation: Format, Characteristics and Arithmetic on Floating Point Numbers. IEFIE-754 Floating Point Standard as a Real World Example.

**7. Memory Organization (5 hrs)**

Hierarchical Memory System, Cache Memory: Associative Memory: Cache memory with Associative, Direct and Set-Assoclative Mapping- Mapping Strategies in current CPUs. Virtual Memory: Paging, Segmentation, and Memory Protection. Example: Cache Hierarchy in Intel's Itanium Processor, Memory Management in Intel Pentium Processor as a Real World Example.

**8. Input /Output Organization (5 hrs)**

Asynchronous Data Transfer, Modes of Asynchronous Data Transfer, Programmed I/0, Interrupts, Interrupts Driven Data Transfer. Interrupts Processing, Interrupts Hardware and Priority, Implementation of Interrupt Hardware. Direct Memory Access (DMA), DMA Transfer Modes, I/O Processors. An Intel's Processor with Built-in DMA as a Real World example. Serial Communication, Universal Asynchronous Receiver/Transmitters (UART), Real World Example: RS-232-C as Serial Communication Standard and RS-422 as Standard For USB (Universal Serial Bus).

**9. Introduction to RISC (4 hrs)**

RISC Fundamentals, RISC Instruction Set. Instruction Pipeline, Register Windows and Renaming, Real World Example. Conflicts in Instruction Pipeline: Data Conflicts, Branch Conflicts, RISC vs. CISC, Intel Itanium Processor as Real World Example.

**10. Introduction to Parallel Processing (2 hrs)**

Parallelism in Uni-Processor System, Organization of Multi-Processor System. Communication in Multi-Processor Systern, Memory Organization in Multi-processor System, Multi-Processor Operating System and Software.

**Text Book:**


- M. Morris Mano, "*Computer System Architecture*", Prentice-Hall of India, Pvt. Ltd., Third edition, 2007


**References:**


- Carpineili, John D., *Computer System Organization and Architecture*, Addison Wesley. Pearson Education Asia (LPE.), 2010.
- Hayes, John P., McGraw-Hill, Third Edition, 2009
- W.Stalling, and Architecture, Prentice Hall India Limited. New Delhi.
- Tanenbaum, A.S., *Structured Computer Organization*, Prentice Hall India Limited, New Delhi, Fourth Edition.

Course Title: **Numerical Methods**
Course Code: **COM433**
Semester: **III**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20 +20)

**Course Objectives:**
To be familiar with the theory of numerical analysis for solving algebraic and transcendental equations, solution of ordinary and partial differential equations related to engineering problems, numerical differentiation and integration.

**Course Contents:**

1. **Solution of Nonlinear Equations (10 hrs)**
   Review of calculus and Taylor's theorem, Errors in numerical calculations, Trial and error method, Bisection method, Newton's method, Secant method and their convergence, Fixed point iteration and convergence.

2. **Interpolation and Approximation (8 hrs)**
   Lagrange's polynomials, Newton's interpolation using difference and divided differences. Cubic spline interpolation, Least squares method for linear and nonlinear data.

3. **Numerical Differentiation and Integration (5hrs)**
   Newton's differentiation formulas, Maxima and minima of tabulated function, Newton-Cote's quadrature formulas, Gaussian integration algorithm, Romberg integration formulas.

4. **Solution of Linear Algebraic Equations (10 hrs)**
   Review of the existence of solutions and properties of matrices, Gaussian elimination method, Pivoting, ill-conditioning, Gauss-Jordan method, Inverse of matrix using Gauss elimination method, Method of factorization, Doolittle algorithm, Cholesky's factorization, Iterative solutions, Solving eigen value problems using power method.

5. **Solution of Ordinary Differential Equations (7 hrs)**
   Review of differential equations, Initial value problem, Taylor series method, Picard's method, Euler's method and its accuracy, Heun's method, Runge-Kutta methods, Solution of the higher order equations, Boundary value problems, Shooting method and its algorithm.

6. **Solution of Partial Differential Equations (5 hrs)**
   Review of partial differential equations, Deriving difference equations, Laplacian equation and Poisson's equation.

**Laboratory Works:**

The laboratory experiments will consist of program development and testing of non-linear equations, Interpolation, Numerical integration and differentiation, Linear algebraic equations, ordinary and partial differential equations.

**Text Book:**

- C.F. Gerald and P.O. Wheatley, *Applied Numerical Analysis*, 4th Edition, Addison Wesley Publishing Company, New York
- W. Chency and D. Kinciad, *Numerical Mathematics and Computing*, 2nd edition, Brooks/Cole Publishing Co., 1985

**References:**

- E Balagurusamy, *Numerical Methods*, McGRAW HILL
- W.H. Press, B.P. Flannery et. al., *Numerical Recipes in C*, 1st Edition, Cambridge Press, 1998
- S. Yakwitz and F. Szidarovszky, *An Introduction to Numerical Computations*, 2nd Edition, Macmillan Publishing Co., New York.

Course Title: **Principle of Management**
Course Code: **MAN434**
Semester: **III**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs + Tutorial: 3Hrs)
Evaluation: External (60) +Internal (20+ 20)

**Course Objectives:**
The objective of this course is to provide fundamental understanding of management principles and their usefulness in operation and management of any system, institutions or processes.

**Course Contents:**

**1 Introduction (4 hrs)**
Definition, Characteristics, Principles and Functions of management.

**2 Evolution of Management Theory (6 hrs)**
Scientific management theory, Administrative management theory, Behavior science theories, Management science theory, System approach and Contingency approach.

**3 The Environment of Management (6 hrs)**
Concept of business environment, Internal and external environment, Components of political, economic, socio-cultural and technological environment.
Introduction to corporate social responsibility.
Ethics in management – meaning and significance, Approaches to ethical decision making – utilitarian, universalism, distributive justice and personal freedom.

**4 Planning and Decision-making (9 hrs)**
Meaning and importance of planning, Types of planning – Corporate, tactical and operational plans; Single use and standing plans; Specific and flexible plans, Hierarchy of planning, Methods, steps and process of planning.
Introduction to strategic planning and management – vision and mission statements and SWOT analysis.
Meaning of decision-making; Types of decision making – Programmed and non-programmed; Strategic, tactical and operational and Individual and group decision-making.

**5 Organization and Human Resource Management (6hrs)**
Definition and characteristics of organization; Types of organization – Line, Line and staff, Functional and Matrix type of organization; Learning organization; Centralization Vs. decentralization;
Meaning of HRM; Brief introduction to components of HRM – Acquisition, development, utilization and maintenance.

**6 Motivation, Leadership and Conflict (6 hrs)**

Meaning of motivation; Motivation theories - Hierarchy of needs theory; Motivation – hygiene theory; and Theory X - Theory Y.
Meaning of leadership; Leadership styles – Autocratic, democratic and free rein and Managerial grid theory.
Meaning and sources of conflict; Conflict resolution – Avoidance, diffusion, containment and confrontation.

**7 Communication (4 hrs)**

Meaning and process of communication; Types of communication – Formal and informal communication and Interpersonal and non-verbal communication; Barriers to effective communication; Techniques for improving communication

**8. Quality Management (4 hrs)**

Quality concept; Meaning of QC/QA; Factors affecting quality; Fundamentals of TQM

**Text Book:**


- Robbins, S.P.,DeCenzo,A.D., Bhattacharya,S. &Agrawal, M(2009). *Fundamental of Management*(6th ed.) New Delhi: Printice Hall.


**References:**


- Agrawal, Govind Ram, **Principles of Management in Nepal**, M. K. Publishers & Distributors, Kathmandu,
- Kreitner, Robert, **Management,** AITSB, Delhi

Course Title: **Computer Networks**
Course Code: **COM435**
Semester: **III**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) + Internal (20+20)

**Objectives:**

Computer Networks involves the study of computer systems, computer communications and computer networks. The course includes different kinds of networking topologies and their structure and design. This course also covers the telephone system, electronic email, data flows, networking protocols, and organization around ISO-OSI seven-layer architecture, with review of each layer.

**Course Contents:**

1. **Background Study and Revision** **(1 hrs)**
   Introduction and necessity of computer Networking, Different types of multiplexing: Simplex, Duplex, Half Duplex

2. **Introduction to Network Topologies** **(3 hrs)**
   Definition, use and prospect of LAN, Types of networking: LAN, WAN, MAN, Extra-Net, Intra-Net and Inter-Net

3. **Network Architecture** **(3 hrs)**
   Star, Clustered Star, Bus, Ring: Logical and Physical, Client Server Network Model, Peer-to-peer Network architecture model, Wireless LAN

4. **Reference Model** **(6 hrs)**
   Network software, Protocol Hierarchy and its need, Interfaces and Services, Introduction of OSI Reference Model

5. **Physical Layers and its Design Issues** **(5 hrs)**
   Twisted Pair Cable, Co-axial Cable, Base-band Cable, Broad-band Cable, Fiber Optics, Wireless Networking, Physical Layer Devices (Hub, Repeaters), Introduction of Frame Relay, ATM, ISDN, PSTN and X.25.

6. **Data Link Layers** **(6 hrs)**
   Services and Data Link Layer Devices (Switch, Bridge), Framing, Flow Control and Error Control, Elementary Data link Protocols, Sliding Window Protocols, HDLC, SLIP and PPP, Media Access Control Layer (Carrier Sense Multiple Access/Collision Detection)

7. **TCP / IP Reference Model** **(6 hrs)**

Introduction of TCP / IP Model, Comparison with OSI Reference Model, IPV4 Frame Format, IP Addresses and Classes, Subnet and Subnet mask, Introduction of IPV6

**8. Network Layer and Internet Layer (6 hrs)**

Network Layer and Design Issues, Virtual Circuit and Data grams Subject, Introduction of Routing- Shortest path Routing Algorithm, Flow Based Routing Algorithm, Distance Vector Routing Algorithm, Spanning Tree Routing, Congestion Control, Traffic Shaping and Leaky Bucket Algorithm

**9. Network Severs and Protocols (3 hrs)**

HTTP, DHCP; SMTP, DNS, PROXY, FTP, POP and IMAP; Examples of Clients, Servers Tools and Virtual private Networks

**10. Network Management and Security (3 hrs)**

Introduction to Network management, Internet Network-Management framework (SMI & HIB) & SNMP protocol; Data encryption, Data Encryption standard; Principles of Cryptography (Symmetric Key & public key Encryption), Integrity & firewalls

**11. Introduction to Socket Programming (3 hrs)**

*Clint/Server Computing:* - Distributed Applications (Web Technology), Distributed processing (Three-Tier Architecture); Introduction to socket calls & operating system calls; TCP socket calls & UDP Socket calls.

**Laboratory Works:**

1. Setting up Client /Server Architecture system using Microsoft product and Linux
2. Understanding Route interface and Basic Router using Route simulator.
3. Understanding the socket Interface and window Socket API.

**Text Book:**

- Andrew S. Tanenbaum, *Computer Networks.*

**References:**


- William Stalling, *Data and Computer communications*..
- Computer networking by James F. kurose, keith W. Ross.
- KNJ Jamsa and ken Cope, *Internet programming*.
- Stevens W.R- *Network Programming*.

Course Title: **Operating Systems**
Course Code: **COM441**
Semester: **IV**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**

To introduce the fundamentals of computer operating systems – What the Operating Systems are, what they do, and how they are designed and constructed. Undergoing this course will help a student to use Object Oriented Programming tools in general and JAVA in specific, for the implementation of various application and system related issues.

**Course Contents:**

1. **Operating Systems Structure** **(5 hrs)**
   **Introduction:** Batch Systems, Time-Sharing Systems, Personal-Computer Systems, Parallel Systems, Real-Time Systems, Distributed Systems. Operating-System Structures: System Components, OS Services, System Calls, System Programs and System Structure. Java, System Design and Implementation, System Generation.

2. **Process Management** **(15 hrs)**
   **Processes:** Concept and Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication. Threads: Overview, Benefits of threads, User and Kernel Threads, Multithreading Models. Threads in Java.

   **Processor Scheduling:** Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Java Thread Scheduling, Algorithm Evaluation.

   **Process Synchronization**: Background, Critical-Section Problem, Two-Tasks Solutions, Synchronization Hardware, Semaphores, Classical Synchronization, Java Synchronization, OS Synchronization.

   **Deadlocks:** Model of Deadlocks, Deadlock Characterization, Deadlock Handling Methods: Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

3. **Memory Management** **(15 hrs)**
   **Memory Management**: Concept, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging.

   **Virtual Memory:** Concept, Demand Paging, Page Replacement, Allocation of Frames, Thrashing.

**File Systems:** Concept, File Access Methods, Directory Structure, Protection, File-System Structure, Methods of Allocation, Free-Space Management, Directory Implementation, Efficiency and Performance of File Systems, Recovery.

**4. I/O Management** **(10 hrs)**

**I/O Sub-Systems**: Concept, Application I/O Interface, Kernel I/O Subsystem, I/O Requests Handling, Performance. Mass-Storage Device: Structure, Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Stable-Storage Implementation, Tertiary-Storage Structure.

**Laboratory Works:**

Student simulates at least 10 algorithms which cover IPC, process scheduling, Page Replacement, Free Space management, File System, I/O handling, and deadlock.

**Text Book:**

- *Modern Operating Systems:* Andrew S. Tanenbaum, PHI Publication, Third edition, 2008

**References***:*


- Silberschatz, A., Galvin, P.B., Gagne, G., *Applied Operating Systems Concepts*, John Wiley & Sons, 2009.
- Silberschatz, A., Galvin, P.B., *Operating Systems Concepts*, John Wiley & Sons.

Course Title: **Database Management System**
Course Code: **COM442**
Semester: **IV**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**

1. To provide a theoretical foundation to the fundamentals of database design and database system development.
2. To provide sufficient practical exposure to designing and using database
3. To provide students with experience in the analysis, design and generation of a simple inquiry and update system, using standard RDBMS
4. To give students an understanding of the problem in its context, the need for adequate documentation of the system and management of this data to ensure that the information produced is relevant, accurate and maintainable. Students will use conceptual data analysis methods to produce a logical data model.

**Course Contents:**

**1. Introduction to Database System Architecture (5 hrs)**
Introduction to Database System, Data Independence, Three Levels of Architecture: External, Conceptual and Internal, Mappings. Database Administration, DBMS, Data Communication, Manager, Client-Server Architecture, Distributed Processing, E-R Model. Data Dictionary

**2. Relational Algebra and Relational Calculus (8 hrs)**
Relational Calculus: Introduction, Operators, Syntax, Semantics, Examples. Additional Operators. Grouping and Ungrouping, Relational Comparisons, Relational Algebra: Introduction, Tuple Calculus, Relational Calculus vs. Relational Algebra, Computational Efficiency, Domain Calculus.

**3. Introduction to Relational Database, SQL and Relational Model Basics (8 hrs)**
Relational Database: Introduction. Relational Model and Relations, Optimization. The Catalog, Views. Transactions. SQL: Overview, The Catalog, Views. Transactions. Embedded SQL. Relational Model Basics: Introduction, Domains. Relation Value. Relation Variables. SQL Features.

**4. Data Integrity and Views (7 hrs)**
Data Integrity: Introduction. Type constraints, Attribute Constraints, Relvar Constraints, Database Constraints, State vs. Transition Constraints, Views: Introduction, Retrieval and Updates of Views, Snapshots.

**5. Database Design (7 hrs)**
Functional Dependencies: Introduction, Trivial and Non-trivial Dependencies, Closure of a Set of Dependencies, Closure of a Set of Attributes, Data Normalization: Introduction.

Non-Loss Decomposition and Functional Dependencies. MVD, JD, INF. 2NF and 3NF. BCNF. 4NF, 5NF and PJNF.

**6. Recovery and Concurrency (6 hrs)**

Transaction Recovery: Introduction, Transaction, Transaction Recovery, System Recovery, Media Recovery, Two-Phase Commit Protocol, Transaction Concurrency: Introduction, Locking Deadlock. Serializability, Isolation Levels, Intent Locking

**7. Security (3 hrs)**

Introduction, Discretionary Access Control, Mandatory Discretionary Access Control, Statistical Database, Data Encryption.

**Assignments/Project Works**

The course will be supplemented by assignments/project work. The assignments can involve the design of a schema for a realistic application, and the implementation and coding of the entire application using SQL (and other development tools such as graphical user interfaces or forms packages) on a relational database system.

**Text Book:**

- A. Silberschatz, H.F. Korth, and S. Sudarshan, *Database System Concepts*, 4th Edition, McGraw Hill (ISBN: 0-07-120413)

**References:**

- Date, C.J., *An Introduction to Database*, 7th Edition, Addison Wesley, 2000.
- Elmasri, R. and Navathe, Shamkant B., Fundamentals of Database Systems, Third Edition 2000 Addison Wesley, 2000.

**Course Title: Technical Writing**
Course Code: **ENG443**
Semester: **IV**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**
The main objectives of this course are:

1. To develop the ability to deliver technical knowledge orally in English.
2. To be able to comprehend and take notes after listening.
3. To fasten reading skills in technical and non-technical reading materials.
4. To develop summarizing skills in writings.
5. To write reports, letters, description on technical talks, seminar papers, memoranda, application and tender notices.

**Course Contents:**

**1. Review of Written English (5 hrs)**
Sentence structure (identification of sentence or its types and transformation of sentences).

**2. Oral Communication and Note Taking (12 hrs)**
Types of English (Variety levels of English), Technical talk (Environmental Pollution, Construction, Water resources, Impact of computer in modern society, Impact of satellite communication, urban development).

**3. Technical Writing Skills (13 hrs)**
Preparation of short memoranda (Importance-formats), Business letters (Importance-purposes), Preparation of application (Job application-biodata), Description writing (Process, Mechanism, Place etc.), Seminar papers (Conduction of seminar, Preparation of circular, Presenting seminar paper), Preparation of proposals (Importance-types-formats), Preparation of reports (Importance-types-formats)

**4. Reading Skills (15 hrs)**
Comprehension questions and exercises (fro prescribed passages-Freedom, Kinship and the family, Marconi and the invention of Radio, R foundation, The turbo-prop engine, The use and misuse of Science and grief), Outlining or note making from any passages, Precise writing from any passages. Knowledge and Wisdom, Beauty and Custom

**Laboratory Works:**

1. To familiarize the students with the audio-visual equipment. (Overhead projector, slide projector, Dictaphone).
2. To watch the visual cassettes and to get familiarized with the language (follow me – I).
3. To watch the visual cassettes and to get familiarized with the language (follow me – II)
4. Some general rules of pronunciation.
5. Word accent in English.
6. Attributes of good English.
7. To present a seminar paper.
8. To participate in a group discussion.
9. To conduct a meeting.
10. To prepare and practice to face an interview.

**Text Book:**

- Andrea J. Rutherford. *Basic Communication Skills for Technology*. 2nd Edition. Addision Wesley. Pearson Education Asia (LPE) ISBN: 8178082810.
- Anne Eisenberg, *Effective Technical Communication*, Mc-Graw Hill 1982.

**References:**


- Houp and T.E. Pearsall, *Reporting Technical Information*, Allyn and Bacon, Boston.
- V.R. Narayanaswami, *Strengthen your writing*, Orient Longman, Madras.
- Champa Tickoo & Jaya Sasikumar, *Writing with a Purpose*, Oxford University Press, Bombay.
- A handbook of pronunciation of English words (with 90-minute audio cassettes) Communication Skills in English.

**Course Title: Computer Graphics**
Course Code: **COM444**
Semester: **IV**
Credit: **3**
Class Load: 6 Hrs per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**
To be familiar with the basic techniques used in computer graphics systems.

**Course Contents:**

**1 Introduction (3 hrs)**
History of computer graphics, Applications of computer graphics.

**2 Hardware Concepts (8 hrs)**
Keyboard, mouse, Light pen, Touch screen and tablet input hardware, Raster and vector display architecture, Architecture of simple non-graphical display terminals, Architecture of graphical display terminals including frame buffer and color manipulation techniques, Advanced raster graphic architecture.

**3 Two-Dimensional Algorithms (12 hrs)**
Direct and incremental line drawing algorithms, Bresenham algorithms, Two-dimensional object to screen viewing transforms, Two-dimensional rotation, Scaling and translation transforms, Recent transform concepts and advantages, Data structure concepts and CAP packages.

**4 Graphical Languages (6 hrs)**
Need for machine independent graphical languages, Discussion of available languages and file formats, Detailed discussion of graphical languages to be used in projects.

**5 Three-Dimensional Graphics (12 hrs)**
Three- dimensional object to screen perspective viewing transforms, Extension of two-dimensional transforms to three dimensions, Methods of generating non-planar surfaces, Hidden line and hidden surface removal techniques, Need for shading in data visualization, Algorithms to simulate ambient, diffuse and specular reflections, Constant, Gouraud and Phong shading models, Specialized and future three dimensional display architectures.

**6 Project Development (4 hrs)**
Project planning and description, Project development, Project report and presentation.

**Laboratory Works:**
Develop a graphical project. The topic could be either initiated by the student or selected from a list provided by the instructor. An oral presentation with a demonstration should be part of the laboratory project report.

**Text Book:**


- Hearn and Baker, *Computer Graphics*, Prentice- Hall of India Private Limited.

- Foley, J. D., A. V. Dam, S. K. Feiner, J. F. Hughes, *Computer Graphics Principle and Practices*, Addison Wesley Longman, Singapore Pvt. Ltd., 1999.

Course Title: **Theory of Computation**
Course Code: **COM445**
Semester: **IV**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Tutorial: **3** Hr)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**

To provide the knowledge of automate, context free language, and complexity theory.

**Course Contents:**

**1 Finite Automata and Regular Expression (5 hrs)**
Finite state system, Non-deterministic finite automata, Regular expressions.

**2 Properties of Regular Sets (4 hrs)**
The pumping lemma for regular sets, Closure properties of regular sets, Decision algorithms for regular sets.

**3 Context-free Grammars (8 hrs)**
Derivative trees, Simplification of context- fee grammars, Normal forms.

**4 Push down Automata (4 hrs)**
Push down automata and context-free grammars.

**5 Properties of Context-free Languages (CFL) (6 hrs)**
The pumping lemma for CFL's Closure properties of CFL's, Decision algorithms for CFL's.

**6 Turing Machines (5 hrs)**
Computable languages and functions, Chruch's hypothesis.

**7 Undecidability (5 hrs)**
Properties of recursive and recursively languages, Universal Turing machines and undecidable problem, Recursive function theory

**8 Computational Complexity Theory (4 hrs)**

Computational problems, Complexity classes, Big O notation

**9 Intractable Problems (4 hrs)**
Computable languages and functions, NP-complete problems.

**Laboratory Works:**

All algorithms covered in the text to be implemented in PHIGS/OpenGL in C/C++.

**Text Book:**

- John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, *Introduction to Automata Theory, Languages, and Computation,* 3rd Edition, Pearson - Addison-Wesley.

**References:**

- Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, 2nd Edition, Prentice Hall.
- Efim Kinber, Carl Smith, Theory of Computing: A Gentle introduction, Prentice- Hall.

Course Title: **Artificial Intelligence**
Course Code: **COM451**
Semester: **V**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**
The main objectives of this course are:
**1.** To provide basic knowledge of Artificial Intelligence
**2.** To familiarize students with different search techniques
**3.** To acquaint students with the fields related to AI and the applications of AI

**Course Contents:**

**1. Introduction to AI (4 hrs)**

What is AI, importance of AI, AI and related fields, brief history of AI, applications of Artificial Intelligence, Definition and importance of Knowledge and learning.

**2. Intelligent Agents (4 hrs)**

Introduction of agents, Structure of Intelligent agent, Properties of Intelligent Agents Configuration of Agents, PEAS description of Agents
Types of Agents: Simple Reflexive, Model Based, Goal Based, Utility Based.
Environment Types: Deterministic, Stochastic, Static, Dynamic, Observable, Semi-observable, Single Agent, Multi Agent

**3. Problem Solving (6 hrs)**

Defining problems as a state space search, Problem formulation, Problem types, Well-defined problems, Constraint satisfaction problem, Game playing, Production systems.

**4. Search Techniques (9 hrs)**

Uninformed search techniques- depth first search, breadth first search, depth limit search, and search strategy comparison Informed search techniques-hill climbing, best first search, greedy search, A* search Adversarial search techniques-minimax procedure, alpha beta procedure

**5. Knowledge Representation, Inference and Reasoning (10 hrs)**

Formal logic-connectives, truth tables, syntax, semantics, tautology, validity, well-formed-formula, propositional logic, predicate logic, FOPL, interpretation, quantification, horn clauses, rules of inference, unification, resolution refutation system (RRS), answer extraction from RRS, rule based deduction system, Statistical Reasoning-Probability and Bayes' theorem and causal networks, reasoning in belief network

**6. Structured Knowledge Representation (4 hrs)**

Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation, Semantic nets, frames, conceptual dependencies and scripts

**7. Machine Learning (4 hrs)**

Concepts of learning, learning from examples, explanation based learning, learning by analogy, learning by simulating evolution, learning by training neural nets, learning by training perceptions.

**8. Applications of AI (4 hrs)**

Expert Systems, Neural Network, Natural Language Processing, Machine Vision

**Laboratory Works:**

Laboratory exercises should be conducted in either LISP or PROLOG.

Laboratory exercises must cover the fundamental search techniques, simple question answering, inference and reasoning.

**Text Book:**

- E. Rich and Knight, *Artificial Intelligence*, McGraw Hill, 2010.
- Stuart Russel and Peter Norvig, *Artificial Intelligence A Modern Approach*, Pearson

**References:**


- D. W. Patterson, *Artificial Intelligence and Expert Systems*, Prentice Hall, 2009.
- Ivan Bratko, *PROLOG Programming for Artificial Intelligence*, Addison Wesley, 2012.
- Leon Sterling, Ehud Shapiro, *The Art of PROLOG: Advanced Programming Techniques*, Prentice Hall, 2012.
- P. H. Winston, *Artificial Intelligence*, Addison Wesley.

Course Title: **System Analysis and Design**
Course Code: **COM452**
Semester: **V**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Tutorial: 3 Hr**s**)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**

This course covers the concepts related to the development of information systems in a systematic approach including foundations, planning, analysis, design, implementation and maintenance.

**Course Contents:**

**1. Foundations for Systems Development (8 hrs)**

1.1.The Systems Development Environment: Introduction, A Modern Approach to Systems Analysis and Design, Developing Information Systems and the Systems Development Life Cycle, The Heart of the Systems Development Process, The Traditional Waterfall SDLC, Different Approaches to Improving Development, CASE Tools, Rapid Application Development, Service-Oriented Architecture, Agile Methodologies, extreme Programming, Object-Oriented Analysis and Design

1.2.The Origins of Software: Introduction, System Acquisition, Reuse

1.3.Managing the Information Systems Project: Introduction, Managing the Information Systems Project, Representing and Scheduling Project Plans, Using Project Management Software

**2. Planning (7 hrs)**

2.1. Identifying and Selecting Systems Development Projects

Introduction, Identifying and Selecting Systems Development Projects, Corporate and Information Systems Planning

2.2. Initiating and Planning Systems Development Projects

Introduction, Initiating and Planning Systems Development Projects, the Process of Initiating and Planning IS Development Projects, Assessing Project Feasibility, Building and Reviewing the Baseline Project Plan

3. **Analysis ( 12 hrs)**

3.1. Determining System Requirements: Introduction, Performing Requirements Determination, Traditional Methods for Determining Requirements, Contemporary Methods for Determining System Requirements, Radical Methods for Determining System Requirements, Requirements Management Tools, Requirements Determination Using Agile Methodologies

3.2. Structuring System Process Requirements

Introduction, Process Modeling, Data Flow Diagramming Mechanics, Using Data Flow Diagramming in the Analysis Process, Modeling Logic with Decision Tables

3.3.Structuring System Data Requirements: Introduction, Conceptual Data Modeling; Gathering Information for Conceptual Data Modeling, Introduction to E-R Modeling, Conceptual Data

Modeling and the E-R Model, Representing Supertypes and Subtypes, Business Rules, Role of Packaged Conceptual Data Models – Database Patterns

4. **Design** **(10 hrs)**

4.1.Designing Databases
Introduction, Database Design, Relational Database Model, Normalization, Transforming E-R Diagrams Into Relations, Merging Relations, Physical File and Database Design, Designing Fields, Designing Physical Tables
4.2.Designing Forms and Reports
Introduction, Designing Forms and Reports, Formatting Forms and Reports, Assessing Usability
4.3.Designing Interfaces and Dialogues
Introduction, Designing Interfaces and Dialogues, Interaction Methods and Devices, Designing Interfaces, Designing Dialogues, Designing Interfaces and Dialogues in Graphical Environments

5. **Implementation and Maintenance** **(8 hrs)**
5.1.System Implementation
Introduction, System Implementation, Software Application Testing, Installation, Documenting the System, Training and Supporting Users, Organizational Issues in Systems Implementation
5.2.Maintaining Information Systems
Introduction, Maintaining Information Systems, Conducting Systems Maintenance

**Text Book:**

- Jeffrey L. Whitten, Lonnie Bentley, *System Analysis and Design methods*, 7th Edition, Mc-Graw Hill
- Joseph S. Valacich, Joey F. George, Jefferey A. Hoffer, *Essentials of System Analysis and Design*, 5th Edition, Pearson Education.

**Reference:**


- Jeffrey L. Whitten, Lonnie Bentley, System analysis and design methods, 5th Edition, Mc-Graw Hill.
- Jefferey A. Hoffer, Joey F. George, Joseph S. Valacich, Modern Systems Analysis and Design, 7th Edition, Pearson Education.
- Gary B. Shelly, Harry J. Rosenblatt, System Analysis and Design, 9th Edition, Shelly Cashman Series.
- Alan Dennis, Barbara Haley Wixom, Roberta M. Roth System Analysis and Design, 4th Edition, Wiley Publication.
  V. Rajaraman, Analysis and Design of Information System, 2nd Edition, Prentice Hall

Course Title: **Design and Analysis of Algorithms**
Course Code: **COM453**
Semester: **V**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, Tutorial: 3 Hrs)
Evaluation: External (60)+Internal(20+20)

**Course Objectives:**
Methods and tools for analyzing different algorithms. Different approaches of designing efficient algorithms like divide and conquer paradigm, greedy paradigm, dynamic programming. Algorithms pertainig various problems like sorting, searching, shortest path, spanning trees, geometric problems etc. NP-complete problems.

**Course Contents:**

1. **Algorithm Analysis** **(5 hrs)**

Worst, Best and Average Cases, Space and Time Complexities. Mathematical Background: Asymptotic Behavior, Solving Recurrences.

2. **Data Structures Review** **(5hrs)**

Linear Data Structures, Hierarchical Data Structures, Data Structures for Representing Graphs and their Properties. Search Structures: Heaps, Balanced Trees, Hash Tables.

3. **Algorithm Design Techniques** **(14 hrs)**

3.1 Divide and Conquer: Concepts, Applications, Sorting Problems (Quick, Merge), Searching (Binary), Median Finding Problem and General Order Statistics, Matrix Multiplications.

3.2 Greedy Paradigm: Concepts, Applications, Knapsack Problem, Job Sequencing, Huffman Codes.

3.3 Dynamic Programming: Concepts, Applications, Knapsack Problem, Longest Common Subsequence, Matrix Chain Multiplications.

4. **Graph Algorithm** **(21 hrs)**

4.1.Elementary Graph Algorithm**:** Breadth-first and Depth-first Search and its Applications

4.2 Minimum Spanning Trees: Prim's and Kruskal's Algorithms

4.3 Shortest Path Problems: Dijkstra's and Flyod's Algorithms, Algorithm for Directed Acyclic Graphs (DAGs).

4.4 Geometric Algorithms: Concepts, Polygon Triangulation, Convex Hull Computation.

4.5 NP Completeness: Introduction, Class P and NP, Cooks Theorem, NP Complete Problems: Vertex Cover Problem.

4.6 Approximation Algorithm: Approximation Algorithms Concepts, Randomized Algorithms Concepts Randomized Quick Sort, , Vertex Cover Problem.

**Text Book:**

- T.H. Cormen, C.E. Leiserson, R.L. Rivest, and C. Stein, **Introduction to Algorithms,** 2nd Edition, MIT Press, 2011.

**References:**


- G. Brassard and P. Bratley, *Fundamentals of Algorithmis*, Prentice-Hall, 2012.
- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "*Introduction to algorithms*", Third Edition.. The MIT Press, 2009.
- Kleinberg, Jon, and Eva Tardos, " *Algorithm Design"* , Addison-Wesley, First Edition, 2005

Course Title: **Compiler Design**
Course Code: **COM454**
Semester: **V**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hr**s**)
Evaluation: External (60) +Internal (20+20)

**Course Objectives:**
To be familiar with the basic techniques in the design of a compiler.

**Course Contents:**

**1. Introduction (7hrs)**
Introduction to Compilers, compilers and Interpreters, Phases of Compiler: Lexical analysis, Syntax analysis, Intermediate code generation, Code optimization, Object code generation, Symbol table management, Error handling, Multi-pass compilers, Cross compiler

**2. Lexical Analysis (8 hrs)**
Role of lexical analyzer, Design of lexical analyzer, Finite state machine, Transition diagram, Regular expression, Conversion of NDFSM to DFSM, Regular expression to FSM

**3. Syntax Analysis (10 hrs)**
Syntactic specification of programming language, Context free grammar, Derivation of parser tree, Basic parsing techniques, Types of parser, Shift reduce parser, Operator grammar, Operator precedence grammar, Operator precedence parsing, LL(1) grammar, Predictive parser

**4. Intermediate Code Generation (10 hrs)**
Syntax directed translation schemes, Implementation of SDTS, Intermediate codes: Polish notation, Abstract syntax tree, Three address codes, Quadruples, Triples, indirect triples, Translation of assignment statement, Boolean expression, Declarative statement.

Symbol table and error handling: Data structure of symbol table, Types of errors, lexical and semantic errors.

**5. Code Optimization (10 hrs)**
Sources of code optimization, Loop optimization, Identification of loops, DAG representation, Object code generation: Problem of code generation, Simple code generation, Register allocation and object code generation, Peep hole optimization

## Laboratory Works:

1 Writing a complier, optimization techniques, comparing the compilers.
2. Construction of Lexical Analyzer.
3. Construction of Parser
4. Development of Code Generator
5. Write a code to show the function of symbol table.
6. Implement the parsing techniques.
7. Show the application of different types of grammar.
8. Implement the lexical analyzer generator.
9. Implement the type conversation.
10. The course instructor is allowed to create a group two students.
    a. Assign them to write a small compiler.

**Text Book:**

- Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers Principles, Techniques, and Tools,; Pearson Education
- Aho & Ullman, Principles of Compiler Design, (Narosa)

**References:**

- Compiler Design, Sandeep Saxena, Rajkumar Singh Rathore, S.Chand
- Compiler Design: Theory and Practice by Burrett (McGraw Hill)
- Introduction to Automata Theory, Languages, and Computation, Johne E. Hopcroft, Rajeev Motwani, Jeffrey D. Ulman, Pearson Education

**Elective (Any One)**
Course Title: Management Information System
Course Code: **COM455**A
Course Title: Neural Network
Course Code: **COM455B**
Semester: **V**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

Course Title: **Management Information System**
Course Code: **COM455A**
Semester: **V**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Tutorial**:** 3 Hrs**)**
Evaluation: External (60) + Internal (20+20)

## Course Objectives:

1. To introduce the knowledge of computer based information systems,
2. To enable the students in applying knowledge of computer based information system,
3. To help designing and setting up complex information system to the student,
4. To highlight information systems and their effectiveness in organization success
5. To provide concepts of new ethical issues, security threats, information system development process
6. To select and design MIS systems appropriate to meet management requirements.
7. To evaluate critically MIS contributions to the strategic management of organizations

**Course Contents:**

**I. Introduction to Management Information System (7 hrs)**

1.1 Data and Information
1.2 Information system and Information Technology
1.3 Sources and Dimensions of IS
1.4 Manual and Computer based IS
1.5 Contemporary approaches to IS
1.6 MIS and its components
1.7 MIS Characteristics
1.8 Strategic MIS

**2. Structure and Classification of MIS (8hrs)**

2.1 Structure of MIS
2.1.1 MIS Structure Based on Physical Components
2.1.2 Information System Processing Functions
2.1.3 Decision Support

2.1.4 Levels of Management Activities

2.2 MIS Classification: Transaction Processing System, Management Information System, Decision Support System, Executive Support System, Office Automation System, Business Expert System

**3. MIS for Different Functional Area Business (5hrs)**

3.1 Accounting Information System
3.2 Geographical Information System
3.3 Human Resource Information System
3.4 Manufacturing and Production Systems

**4. Decision Support System in Business (5 hrs)**

4.1 Decision and types
4.2 Decision making process
4.3 Decision Making and MIS
4.4 DSS and characteristics
4.5 Group Decision Support System (GDSS)

**5. Technical Requirement for MIS (4hrs)**

5.1 Computer and its anatomy
5.2 Memory and types
5.3 Input /Output devices
5.4 Storage Devices
5.5 Software and Computer Languages

**6. Ethical and Social Issues in Information System (4hrs)**

6.1 Ethics in Information Society
6.2 Moral Dimension of Information System
6.3 Accountability, Liability and Control

**7. E-commerce (12hrs)**

7.1 E-commerce and E-business
7.2 E-commerce Framework
7.3 Types of E-commerce
7.4 Benefits and Limitations of E-commerce
7.5 Payment systems in E-commerce and its threats
7.6 Network for E-commerce: Needs of Network, I-way and its components
7.7 E-commerce Vs. E-governance
7.8 Electronic business system: Enterprise Resource Planning, Customer Relationship, Management, Supply Chain Management

**Field Visit/Case Study**

First, each student will join a group. The student or student group (at most 4 students) needs to finish a written case study report (2000 – 3000 words) on the effectiveness and limitations of

some existing information system. The Field Visit/Case study report must reflect your understanding on basic concepts taught in the course and capability of using them to analyze practical cases. The case study should be outlined tentatively as follows:

a) Abstract
b) Introduction and purpose of Information System
c) Categorization of the IS
d) Infrastructures required for the IS
   - ☞ Hardware Infrastructure
   - ☞ Software Infrastructure
   - ☞ Network Infrastructure
e) Data Sources and Data Analysis required for the IS
f) Effectiveness of the IS and its Assistance to Management
g) Conclusion, Limitations of the IS and Recommendations for Enhancements

**Text Book:**


- James A. O'Brien, George *Marakas,Management Information Systems*, 7th Edition McGraw-Hill Companies, 2006


**References:**


- Kanter, J., *Managing with Information System*, 4th Edition, New Delhi: Prentice Hall of India Limited,2004
- Laudon, K. C. & Laudon, J. P., *Management Information Systems*, 12th Edition Pearson, 2013
- R. Kelly Rainer, Efraim Turban, Richard E. Potter, *Introduction to Information Systems: Supporting and Transforming Business*, Wiley, 1st Edition, 2006

Course Title: **Neural Network**
Course Code: **COM455B**
Semester: **V**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical**:** 3 Hrs**)**
Evaluation: External (60) + Internal (20+20)

**Objectives:**

This course introduces the fundamental concepts of neural networks and essentials of artificial neural networks with single layer and multilayer Networks.

The objectives of the course are:

1. Introduce the neural networks as means for computational learning
2. Present the basic neural network architectures
3. Give design methodologies for artificial neural networks
4. Introduce learning theories used in neural networks
5. Demonstrate neural network applications on real-world tasks.
6. Explore use of fuzzy system in neural networks

**Contents:**

**I. Introduction (6 hrs)**

1.1. Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological Neuron Model, Artificial Neuron Models, Artificial Network Networks (ANN)

1.2. History of neural network research, characteristics of neural networks, Applications of ANN

**2. Basics of Artificial Neural Networks (8 hrs)**

2.1. Artificial Neuron Model and its Mathematical model

2.2. Activation Function, Types of Neuron Activation Function: Linear, Threshold, Sigmoid, Tangent

2.3. Models of neuron Mc Culloch –Pitts model, Perceptron, Adaline model, Madaline Model

2.4. ANN Architectures: Single-layer, Multilayer Feed Forward, Recurrent

2.5. Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic)

**3. Learning Process (7 hrs)**

3.1.Learning, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application

3.2.Error-Correction Learning, Memory-Based Learning, Hebbian Learning, Competitive Learning, Boltzman Learning

**4. Single Layer Perceptrons (8 hrs)**

4.1.Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks

4.2.Least Mean Square Algorithm

4.3.Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications

**5. Single and Multilayer Feed forward Neural Networks (7 hrs)**

5.1.Basic Concepts of single layered networks, Hopfield Networks
5.2.Multilayer Feed Forward Networks, Feedback Networks,
5.3.Discrete Hopfield Network
5.4.Gradient Descent, Delta Rule
5.5.Derivation of Back-propagation (BP) Training, Summary of Back-propagation Algorithm, Selection of tuning parameters in Back-propagation

**6. Radial Basis Function Networks (5 hrs)**

6.1. Pattern separability and Interpolation
6.2. Regularization Theory
6.3. Regularization and Radial Basis Function (RBF) Networks
6.4. RBF network design and training
6.5. Approximation properties of RBF

**7. Fuzzy Neural Networks ( 4 hrs)**

7.1. Neuro-fuzzy systems
7.2. Background of fuzzy sets and logic, Design of fuzzy systems
7.3. Design of fuzzy neural networks, applications of neuro-fuzzy systems

**Laboratory Works:**

The students should simulate different programs constructing neural networks for solving real world problems. The environments can be decided by the instructor, however it is highly recommended to use MATLAB, Java.

**Text Book:**

1. S. Haykin, *Neural Networks – A Comprehensive Foundation*, Prentice Hall

**References:**

1. C. M. Bishop, *Neural Networks* for *Pattern Recognition*, Clarendon Press Oxford
2. B.Yegnanarayana, *Artificial Neural Networks*, Prentice Hall of India
3. Satish Kumar, *Neural Networks – A Classroom Approach*, Tata McGraw-Hill
4. Robert J. Schalkoff, *Artificial Neural Networks*, McGraw-Hill International Editions
5. Jeff Heaton **,** *Introduction to Neural Networks for Java*, Heaton Research

Course Title: **Simulation and Modeling**
Course Code: **COM461**
Semester: **VI**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

**Course Objectives:**
To provide the knowledge of discrete and continuous system, generation of random variables, analysis of simulation output and simulation output and simulation languages

**Course Contents:**

**1 Introduction to Modeling and Simulation (5 hrs)**
System concepts, System modeling, Mathematical models: Nature and assumptions, Calibration and validation, Monte Carlo simulation method.

**2 Continuous Systems (8 hrs)**
Continuous system model, Differential equation, Analog method, Hybrid computers, Digital-analog simulators, Continuous System Simulation Languages (CSSLs), CSMP III, Hybrid simulation, Feedback systems, examples.

**3 Discrete System Simulation (10 hrs)**
Discrete events, Representation of time, Generation of arrival patterns, Simulation of a telephone system, Delay calls, Simulation of programming tasks, Gathering statistics, Counters and summary statistics, Measuring utilization and occupancy, Recording distribution and transit times, Discrete simulation languages.

**4 Analysis of Simulation Output (10 hrs)**
Estimation methods, Simulation run statistics, Replication of runs, Elimination of internal bias.

**5 Simulation Languages (12 hrs)**
Types of simulation languages, Discrete systems modeling and simulation with GPSS, Resources in GPSS, GPSS programs, applications, Structural data and control statements, hybrid simulation, Feedback systems : typical applications, SIMSCRIPT programs.

**Laboratory Works:**
Develop a simulation model, the topic could be either initiated by the student or selected from a list provided by the instructor. An oral presentation with a demonstration should be part of the laboratory project report.

**Text Book:**

1. G. Gorden, "*System Simulation*", Pretice Hall of India.

**Reference:**


1 J.A Spriest and G.C Vansteenkiste, Computer-Aided Modeling and Simulation, Academic Press.

2 A.M Law and R.F. Perry, Simulation : A Problem-solving approach, Addison Wesley Publishing Company.

3 A.M Law and W.D. Kelton, Simulation Modeling and Analysis, McGraw Hill.

Course Title: **Software Engineering**
Course Code: **COM462**
Semester: **VI**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

**Course Objectives:**

To introduce different types of software, developing process and maintaining the software.

**Course Contents:**

1. **Introduction to Software Engineering (11 hrs)**

   Definition of software, Software engineering, Comparing between other engineering and software engineering.

1.1 System Engineering: Introduction to System, System properties, System and their environment, System modeling.

1.2 Software Process: Introduction, Software process model, Process iteration, Software specification, Software design and implementation, Software validation, Software evolution.

1.3 Project Management: Introduction, Management activities, Project planning, Project scheduling, Risk management.

2. **Software Requirements (12 hrs)**

   Introduction, Types of requirements, Requirements engineering process: Feasibility study, Requirements elicitation and analysis, Requirement validation, Requirement management.

2.1 Software Prototyping: Introduction, Prototyping in the software process, Rapid prototyping techniques, User interface prototyping.
2.2 Formal Specification: Introduction, Formal specification in software process, Interface specification, Behavioral specification.

3. **Architectural Design (6 hrs)**

   3.1Introduction, System structuring, Control models, Modular decomposition, Domain specific architecture.
   3.2 Object Oriented Design: Introduction, Features of object oriented design, Object oriented software engineering.

## 4. Verification & Validation (16 hrs)

4.1 Introduction, Verification and validation planning, Software inspection, Cleanroom software development.

4.2 Software Testing: Introduction, Types of testing, Testing work benches.

4.3 Critical system validation: Introduction, Formal methods and critical systems, Reliability validation, Safety assurance, Security assessment.

4.4Software Cost Estimation: Introduction, Productivity, Estimation techniques.

1.5 Software Reengineering: Introduction, Source code translation, Reverse engineering.

**Laboratory Works**: Developing the software techniques explained in the course.

**Text Book:**

1. Software Engineering, 7th Edition, Ian Sommerville, PEARSON EDUCATON ASIA

**Reference:**

2. Software Engineering: A Practitioner's Approach, 6th Edition, Roger S. Pressman, McGraw Hill International Edition.

Course Title: **Web Technology**
Course Code: **COM463**
Semester: **VI**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

**Course Objectives:**

This course introduces the client-server web technology.

**Course Contents:**

**1. Introduction** (**4 hrs)**

Review of web technology, Review of HTML and JAVA Script

**2. Issues of Web Technology** **(6 hrs)**

Architectural issues of web layer, HTTP & FTP Protocols, Tier Technology: 2-Tier, 3-Tier and n-Tier.

**3. The Client Tier** **(12 hrs)**

Representing content, XML, DTD's, Schemas, Style sheets and Transformation: CSS, XSL/XSLT, SAX, and DOM, Client-side Programming.

**4. The Server Tier** **(20 hrs)**

Web Server Concept, Creating Dynamic Content, Using Control Flow to control Dynamic Control Generation, Sessions and State, Error handling, Authentication, Architecting web application, Using tag libraries, Writing tag libraries .

**5. Introduction to Advanced Server Side Issues** **(3 hrs)**

Server Side Languages, Protocols, Server APIs, Apache modules, AJAX Programming.

**Laboratory Works**: The laboratory work should cover all the topics mentioned above.

**Text Book:**

1. Matt J. Crouch, "*ASP.NET and VB.NET Web Programming"*, Pearson Education Asia, 2012

**Reference:**

**1.** Rahul Banerjee, "*Internetworking Technologies"*, Prentice-Hall of India Limited, Fourth, 2010

Course Title: **Cryptography**
Course Code: **COM464**
Semester: **VI**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

**Course Objectives:**

The course objective is to familiarize basic concepts of cryptography so as the students can use their understanding for information security purpose.

**Course Contents:**

1. **Introduction** (4 hrs)
Security, Attacks, Attack Types, Viruses, Worms, Trojan Horses, Classical Cryptography

2. **Basics of Modern Cryptography** (5 hrs)

Plaintext, Cipher text, Keys, Simple ciphers, Public key cryptography, Digital signatures

3. **Conventional Encryption / Secret Key Cryptography** (10 hrs)

Cryptography, Cryptanalysis, Cipher Structure, Encryption Algorithms, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), Advanced Encryption Standard (AES), Modes of Operation, Symmetric Block Ciphers, Cipher Block Chaining (CBC), Multiple Encryption DES

4. **Public Key Cryptography** ( 6 hrs)

Basic Number Theory, Factorization, Diffie-Hellman Key Exchange, Public Key Cryptography Algorithms, RSA.

5. **Digital Signatures** (4 hrs)

One-time signatures, Digital Signature Standard (DSS).

6. **Hashing and Message Digests** (6 hrs)

Hashes, Motivation and applications. Cryptographically Secure Hashing, Secure Hash Algorithm (SHA), Encryption with Message Digest (MD), MD5.

7. **Authentication and Public Key Infrastructure (PKI)** (5 hrs)

Overview of Authentication Systems (Password, Address, Cryptographic), Security Handshake Pitfalls, Authentication Standards, Kerberos, PKI Trust Models.

8. **Network Security** (5 hrs)

IP Security, Web Security, Secure Socket Layer (SSL), Transport Layer Security (TLS), Different versions of SNMPs, PGP.

**Text Book:**

1. D. R. Stinson. Cryptography: Theory and Practice. CRC Press
2. William Stallings, Network Security Essentials-Applications & Standards, Pearson.

**Reference:**

1. Charlie Kaufman, Radia Perlman, Mike Speciner, "*Nework Security Private Communication in a Public World"*, Second Edition, 2004, Pearson.
2. Matt Bishop, "*Computer Security*", Art and Science, Pearson
3. Bruce Schneier, *" Applied Cryptography*", Pearson

**Elective (Any One)**
Course Title: Information Retrieval
Course Code: **COM465A**
Course Title: Database Administration
Course Code: **COM465B**
Semester: **V**I
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

**Course Title: Information Retrieval**
Course Title: Information Retrieval
Course Code: **COM465A**
Semester: **V**I
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

**Course Objectives:**
To study advance aspects of information retrieval and working principle of search engine, encompassing the principles, research results and commercial application of the current technologies.

**Course Contents:**

**1. Introduction** (2hrs)
Introduction, History of Information Retrieval, The retrieval process, Block diagram and architecture of IR System, Web search and IR, Areas and role of AI for IR

**2. Basic IR Models** (4 hrs)
Introduction, Taxonomy of information retrieval models, Document retrieval and ranking, A formal characterization of IR models, Boolean retrieval model, Vector-space retrieval model, probabilistic model, Text-similarity metrics: TF-IDF (term frequency/inverse document frequency) weighting and cosine similarity.

**3.Basic Tokenizing, Indexing, and Implementation of Vector-Space Retrieval** ( 4 hrs)
Simple tokenizing, Word tokenization, Text Normalization, Stop-word removal, Word Stemming (Porter Algorithm), Case folding, Lemmatization, Inverted indices (Indexing architecture), Efficient processing with sparse vectors, Sentence segmentation and Decision Trees

**4. Experimental Evaluation of IR** (4 hrs)
Relevance and Retrieval, performance metrics, Basic Measures of text retrieval (Recall, Precision and F-measure)

**5. Query Operations and Languages** (3 hrs)
Relevance feedback and pseudo relevance feedback, Query expansion/reformulation (with a thesaurus or WordNet, Spelling correction like techniques), Query languages (Single-Word Queries, Context Queries, Boolean Queries, Natural Language)

**6. Text Representation** (3 hrs)
Word statistics (Zipf's law), Morphological analysis, Index term selection, Using thesauri, Metadata, Text representation using markup languages (SGML, HTML, XML)

**7. Search Engine** **(** 6 hrs)
Search engines (working principle), Spidering (Structure of a spider, Simple spidering algorithm, multithreaded spidering, Bot), Directed spidering(Topic directed, Link directed) ,Crawlers (Basic crawler architecture), Link analysis (e.g. hubs and authorities, Page ranking, Google Page Rank), shopping agents

**8. Text Categorization and Clustering** (6 hrs)
Categorization algorithms (Rocchio, naive Bayes, decision trees and nearest neighbor), Clustering algorithms (agglomerative clustering, k-means, expectation maximization (EM)), Applications to information filtering, Organization

**9. Recommender Systems** (3 hrs)
Personalization, Collaborative filtering recommendation, Content-based recommendation

**10. Information Extraction and Integration** (3 hrs)
Information extraction and applications, Extracting data from text, Evaluating IE Accuracy, XML and Information Extraction, Semantic web (purpose, Relation to hypertext page), Collecting and integrating specialized information on the web.

**11. Advanced IR Models with Indexing and Searching Text** (4 hrs)
Probabilistic models, Generalized Vector Space Model, Latent Semantic Indexing (LSI), Efficient string searching, Pattern matching

**12. Multimedia IR** (3 hrs)
Introduction, multimedia data support in commercial DBMSs, Query languages, Trends and research issues

**Laboratory Works:** The laboratory should contain all the features mentioned in a course
Samples
1. Program to demonstrate the Boolean Retrieval Model and Vector Space Model
2. Program to find the similarity between documents
3. Tokenize the words of large documents according to type and token.
4. Segment the documents according to sentences
5. Implement Porter stemmer
6. Try to build a stemmer for Nepali language
7. Build a spider that tracks only the link of Nepali documents
8. Group the online news onto different categorize like sports, entertainment, politics

9. Build a recommender system for online music store

**Text Book:**

1. Modern Information Retrieval, Ricardo Baeza-Yates, Berthier Ribeiro-Neto.
2. Information Retrieval; Data Structures & Algorithms: Bill Frakes

Course Title: **Database Administration**
Course Code: **COM465B**
Semester: **V**I
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

## Course Objectives:

The course covers about: principles of DBA Roles, DB backup, restoration and recovery, Tuning of database and overall DB administration which could be useful for administrator in the future.

**Course Contents:**

**1. Introduction (5 hrs)**

DBMS architecture and data independence, DBA roles and responsibilities, SQL *PLUS Overview: SQL Plus Fundamentals, Producing more readable outputs, Accepting values at runtime, Using iSQL *Plus.

**2. Control and Redo Log Files (5hrs )**

Managing the control files, Maintaining and monitoring redo log files.

**3. Managing Users and Security (10 hrs )**

Profiles, Managing users, Managing privileges, Managing roles, Querying role information, Database Security and Auditing, Creating and managing DB's , Tables, Indexes, Triggers, Views, Stored procedures, Advanced Stored Procedures, Analysis and integration services.

**4. Backup and Recovery Overview (15 hrs )**

Database backup, Restoration and recovery, Defining a backup and recovery strategy, Testing the backup and recovery plan, Parallel instance recovery, Recovering from non-critical loses Database corruption, Automatic database management, Automatic storage management, RMAN

**6. Introduction to Performance Tuning (10 hrs)**

Brief overview of Tuning methodology, General tuning concepts, AADM (Automatic Database Diagnostic Monitor) and SQL Tuning Advisor, Virtual Private Database: Policy types, Selective columns, column masking.

**Laboratory Works**: Labs should cover all the chapters using Oracle/SQL-Server or any other database server tools.

**Text Book:**

1. C.J. Date, Database Systems, Addison Wesley, 2000
2. Introduction to Database Administration, by O'reilly

**Reference :**

3. ORACLE DBA handbooks

Course Title: **Advanced Java**
Course Code: **COM471**
Semester: **VII**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**

This course covers the ideas of Java programming beyond the basic concepts and emphasizes GUI and event-driven programming, Database Connectivity, Socket Programming, Remote Method Invocation and Servlets and JSP Technology

**Course Contents:**

**1. Programming in Java (8 hrs)**

1.1 Introduction to Java: Java Architecture, Advantages of Java, PATH and CLASSPATH variables, Compiling and Running Java Programs
1.2 Class and Object: Creating Classes, Interfaces, Creating Objects, Access Modifiers, Arrays, Packages, Inheritance
1.3 Exception Handling and Threading: Try, Catch, Finally, Throws, Creating Multithreaded Programs, Thread Life Cycle
1.4 File IO: Byte Stream Classes (File Input Stream and File Output Stream), Character Stream Classes (File Reader and File Writer), Random Access File Class

**2. User Interface Components with Swing (10 hrs)**

2.1 Swing and MVC Design Patterns: Design Pattern, MVC Pattern, MVC Analysis of Swing Buttons
2.2 Layout Management: Border Layout, Grid Layout, Gridbag Layout, Group Layout, Using No Layout managers, Custom layout Managers
2.3 Text Input: Text Fields, Password Fields, Text Areas, Scroll Pane, Label and Labeling Components
2.4 Choice Components: Check Boxes, Radio Buttons, Borders, Combo Boxes, Sliders
2.5 Menus: Menu Building, Icons in Menu Items, Check box and Radio Buttons in Menu Items, Pop-up Menus, Keyboard Mnemonics and Accelerators, Enabling and Design menu Items, Toolbars, Tooltips
2.6 Dialog Boxes: Option Dialogs, Creating Dialogs, Data Exchange, File Choosers, Color Choosers
2.7 Components Organizers: Split Panes, Tabbed Panes, Desktop Panes and Internal Frames, Cascading and Tiling
2.8 Advance Swing Components: List, Trees, Tables, Progress Bars

**3. Event Handling (4 hrs)**

3.1 Introduction: Standard Event Handling, Using Delegated Class, Using Action Commands, Listener Interfaces, Adapter Classes

3.2 Handling Events: Action Events, Key Events, Focus Events, Window Event, Mouse Event, Item Events

**4. Database Connectivity (4 hrs)**

4.1 Design of JDBC: Driver Types, Typical Uses of JDBC

4.2 JDBC Configuration: Database URLS, Driver JAR Files, Starting Database, Registering Driver class, Connecting to the database

4.3 Executing SQL Statements: Managing Connections, Statements, Result Set, SQL Exceptions, Populating Database

4.4 Query Execution: Prepared Statements, Reading and Writing LOBs, SQL Escapes, Multiple Results, Scrollable Result Sets, Updateable Result Sets, Row Sets and Cached Row Sets, Transactions.

**5. Network Programming (5 hrs)**

5.1 Networking Basics: Transmission control Protocol (TCP), User Datagram Protocol (UDP), Ports, IP Address Network Classes in JDK

5.2 Working with URLS: Connecting to URLS, Reading Directly from URLS, Inetaddress Class

5.3 Sockets: TCP Sockets, UDP Sockets, Serving Multiple Clients, Half Close, Interruptible Sockets, Sending Email

**6. Java Beans (3 hrs)**

6.1 Introduction: Creating, Updating and Reading from JAR Files, Java Beans, Advantages of Java Beans, Class vs Beans, BDK and Bean Box

6.2 Java Bean: Creating a Java Bean, Creating a Bean Manifest File, Creating a Bean JAR File, Using a New Bean, Adding Controls to Beans, Giving a Bean Properties, Creating Bound Properties, Giving a Bean Methods, Giving a Bean an Icon

**7. Servlets and Java Server pages (8 hrs)**

7.1 Servelets: Introduction to Servlets,Life cycle of servlets, Java Servlets Development Kit, Creating, Compiling and running servlet, The servlet API ( javax.servlet package), Reading the servlet Parameters, Reading Initialization parameter, The javax.servlet.http.Package, Handling HTTP Request and Response (GET / POST Request), Using Cookies, Session Tracking

7.2 Java Server Pages: Advantage of JSP technology (Comparison with ASP / Servlet), JSP Architecture, JSP Access Model, JSP Syntax Basic (Directions, Declarations, Expression, Scriplets, Comments), JSP Implicit Object, Object Scope, Synchronization Issue, Exception Handling, Session Management, Creating and Processing Forms.

**8. RMI** **(3 hrs)**

8.1 Remote Method Invocation: Introduction of RMI, Architecture of RMI, Remote Objects, Creating and Executing RMI Applications

**Text Book:**


1. Cay Horstmann and Grazy Cornell, Core Java Volume I-Fundamentals, Eighth Edition
2. Cay Horstmann and Grazy Cornell, Core Java Volume II-Advance Features, Eighth Edition


**Reference:**


3. Steven Holzner, Java 2 Pagramming-AWT, Swing, XML and Java Beans Black Book, Dreamtech Press
4. Pallvi Jain and Shadab Siddiqui, J2EE Professional Projects, Premier Press

Course Title: **Real Time Systems**

Course Code: **COM472**
Semester: **VII**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

**Course Objectives:**
The main objective of this course is to understand the fundamental concepts of Real time operating systems and the issues pertaining to scheduling, resource access control, and communication in the time critical system.

**Course Contents:**

1. **Introduction (6 hrs)**
   Digital control, High-level controls, Signal processing, Real time applications
   Jobs and processors, Hard and soft timing constraints, Hard real-time systems, Soft real-time systems, Firm real time systems, Scheduling hierarchy

2. **Parameters of Real-Time Work Load (4 hrs)**
   Processor and resources, Temporal parameters: Release times, Deadlines, and timing constraints, Periodic task model, Precedence constraints and data dependency, Other dependencies, Functional parameters, Resource parameters of jobs and parameters of resources,

3. **Clock-Driven Scheduling (8 hrs)**
   Dynamic versus static system and Off-line versus on-line scheduling, Notations and assumptions of Clock-driven approach, Timer-driven scheduler, General structure of cyclic schedules, Cyclic executives, Effective release times and deadlines, Algorithm for constructing static schedules, Pros and cons of clock-driven scheduling

4. **Priority-Driven Scheduling of Periodic Tasks (6 hrs)**
   Fixed-priority versus dynamic-priority algorithms, Maximum schedule utilization, Optimality of the RM and DM algorithms, A schedulability test for fixed-priority tasks with short and arbitrary response times, Sufficient schedulability conditions for the RM and DM algorithms, Optimality and Non Optimality of the EDF and LST algorithms,

5. **Scheduling Aperiodic and Sporadic Jobs in Priority-Driven Systems (6 hrs)**
   Sporadic and Aperiodic jobs, Deferrable servers, Sporadic servers, Constant utilization, total bandwidth, and weighted fair-queuing servers, Slack stealing in deadline-driven systems, Slack stealing in fixed-priority systems, Scheduling of sporadic jobs, Real-time performance for jobs with soft timing constraints, Two-level scheme for integrated scheduling

6. **Resources Sharing and Resource Access Control (5 hrs)**

Priority Inversion and unbounded Priority Inversion, Effects of resources contention and resource access control, Nonpreemptive critical sections, Basic priority-inheritance protocol, Basic priority-ceiling protocol, Use of priority-ceiling protocol in dynamic-priority system, Controlling accesses to multiple-unit resources, Controlling concurrent accesses to data objects, Multiprocessor priority-ceiling protocol

**7. Commercial Real-time Operating System (5 hrs)**

Unix as a Real-time operating system, Windows as a Real-time operating system Extension to Unix, Host target approach, Preemption points, Fully preemptable kernel, Overview of some commercial embedded operating system, PSOS, VRTX, RT Linux, WinCE,

**8. Real –Time Communication (5 hrs)**

Real-time communication Model, Priority-based service disciplines for switched networks, Internet and resource reservation protocols, Real-time protocol, Communication in multi computer systems

**Laboratory Works:**

The practical classes should include

- POSIX compliant thread programming (pthreads) in Linux.
- Compilation and installation of a Real-time + la+ Linux kernel
- Use of RT-Linux API for injecting object modules in the *kernel space* of a Real time Linux kernel to study the behavior of a Real time kernel
- RT-UML (Rational Rose Real time etc.) for visualizing real time systems

**Text Book:**

1. Real-Time Systems, Jane W. S. Liu, Third Edition, Pearson Education Asia.
2. Real time systems Design and Analysis, Wiley India Pvt Limited, 2006

**Reference:**

1. Third Edition, Terry Quatrani, "Visual Modeling with Rational Rose and UML", Pearson Education Asia, Nov 2002
2. The Linux Kernel Module Programming Guide, Peter Jay Salzman, Michael Burian, Ori Pomerantz , 2001

Course Title: **Data Mining & Data Warehousing**
Course Code: **COM473**
Semester: **VII**
Credit: **3**
Class Load: **6** Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**

The objective of the course is to make understand the data mining and data warehousing principles and then provide the various techniques for knowledge discovery in large corporate databases.

**Course Contents:**

1. **Introduction** **(4 hrs)**
   Introduction to data mining, Classification of data-mining systems, Data-mining major issues and challenges, KDD and DBMS vs Data-mining, Data-mining techniques, Data-mining applications.

2. **Data-warehousing** **(5 hrs)**
   Data-warehousing, Multi-dimensional data model, data-warehousing architecture, data-warehousing implementation, Data cubes

3. **Data Processing & Data Mining** **(12 hrs)**
   Data Cleaning, Integration, Transformation and Reduction, Discretization and Concept Hierarchy generation, Data-mining primitives, Knowledge to be mined, data-mining query language, Mining class comparison, Association Rules, Discovering Association Rule, single Dimensional Boolean Association Rule, Multilevel Association Rule, Multidimensional Association rule, Algorithms for association rules.

4. **Classification and Prediction** **(12 hrs)**
   Decision trees, Tree construction principle, Tree construction Algorithm, Tree construction with presorting, Pruning techniques, Integration of pruning and construction. Bayesian Belief network, Neural Net, Learning in Neural Net. Unsupervised learning, Data mining using neural net, Genetic algorithm, Rough sets, Support vector machines, Case-based, Fuzzy set; Prediction based on linear and nonlinear regression, Classifier accuracy.

5. **Cluster Analysis** **(6 hrs)**
   Types of data in cluster analysis, Major clustering methods, partitioning methods, Hierarchical methods, Density based methods, Grid based methods, Model based clustering methods.

6. **Mining Complex Data Types** **(6 hrs)**
   Mining spatial databases, Multimedia database, Time-series and Sequence data, Web mining, and Text mining.

**Laboratory Works:**
The practical classes should include all the topics mentioned above.

**Recommended Book:**
1. Han Jiawei, M. Kamber, "Data Mining Concepts and Techniques" Academic Press, Harcourt India Private Limited, 2010

**Reference:**
1. Pujari A. K., "Data Mining Techniques" University Press (India) Limited, Hyderabad, India, 2011.
2. Adriaans Pieter, D. Zantige, " Data Mining", Pearson Education Asia Pte. Ltd, 2009

Course Title: **Project**
Course Code: **COM474**
Semester: **VII**
Credit: **3**
Class Load: 6 Hrs. per Week (Practical: 6 Hrs)
Evaluation: Supervisor (50) + Internal (20) + HoD and External (30), at the mid of project work by supervisor, HoD/internal/external

**Course Objectives:**
The objective of this project work is to provide the students to plan and complete an individual engineering design project in the area of electronics under the supervision of Instructors.

**Suggested Materials:**

Relevant texts, Manuals, Computer Journals and Proceeding, Internet.

**Procedures**:

The project course involves working on a proposed design project under direct supervision of faculty members of FoST. Same project could be supervised by instructors of departments other than computer. The selected project shall be electronic hardware based or electronics computer based but it should be relevant, as possible, to the local industries environment and may in fact, be selected in consultation with the industries.

The project must be started at the beginning of seventh semester. But the evaluation will be made on eight semesters.

**Evaluation:**
There are three stages in evaluation, they are:

**First Stages**: 10% of the mark shall be based on the followings:
1 Project Proposal
2 Project plan
3 Budgeting

**Second Stage**: 60% of total mark shall be based on the following:

**a. Work Performed (80 %)**
1. System Design
2. Thoroughness
3. Understanding of methods used in the project
4. Amount of work performed
5. Level of achievement
6. Ability to work with others
7. Ability to identify problems
8. Project planning skills.

**b. Documentation (20%)**

1. Report organization
2. Writing style
3. Completeness of the report
4. Readability
5. Organization and analysis of data and results

**Third Stage (30%):**

An oral defense of the project work to be conducted on the last week of final semester term. The defense will be evaluated by external examiner (external to the department or from industries). The oral defense will carry 30% of total marks.

**Elective (Any One)**
Course Title: **Software Project Management**
Course Code: **COM475**A

Course Title: **Network Security**
Course Code: **COM475B**

Course Title: **System Administration**
Course Title: **COM475C**

Semester: **VII**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

Course Title: **Software Project Management**
Course Code: **COM475A**
Semester: **V**II
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Tutorial**:** 3 Hrs)
Evaluation: External (60) + Internal (20+20)

## Course Objectives:

The course in software project management discusses the software engineering approach to modern software development process (Unified Process) to the student familiar with this course. The project enables the students to develop computer package for independent practical use.

## Course Contents:

**1. Introduction to Software Project Management** (2 hrs)
1.1 Introduction
1.2 Software project versus other project
1.3 Steps of Software Project Management
1.4 Problems with software projects
1.5 System and Project

**2. Software Management Practice and Software Economics (**7 hrs**)**
10.1 Conventional Software Management Theory and Practice
10.2 Software economics and cost estimation
10.3 Improving software economics
10.4 Software process
10.5 Team effectiveness and software environment

10.6 Quality target
10.7 Principles of conventional software engineering
10.8 Principles of modern software management
10.9 Iterative process

**3. Software Process Primitives and Process Management Framework** (9hrs)

11.1 Software process life-cycle phases.
11.2 Various elements of the software process (Management, Engineering and Pragmatic).
11.3 Technical and management perspective of software architecture.
11.4 Software process workflow and iteration workflow.
11.5 Status monitoring - software process checkpoints and milestones.

**4. Techniques of Planning, Controlling and Automating Software Process** (7hrs)

12.1 Iterative process planning
  12.1.1 Process work breakdown structure
  12.1.2 Planning guidelines
  12.1.3 Cost and schedule estimation process
  12.1.4 Iteration planning process
12.2 Project organization and responsibilities
12.3 Process automation - tools and environment
12.4 Project control and process automation
12.5 Process customization

**5. Modern Approach to Software Project and Economics** (2hrs)

13.1 Elements of modern software projects and management principles
13.2 Next-generation software economics and cost models
13.3 Modern process transition - paradigm shifts

**6. Project** (18 hrs)

The project should be based on the subjects studied earlier and the students should develop a complete package

**Case Study:**

Here case study will be completed by the students according to Unit 6 : "Project" in the above syllabus. This will be evaluated as internal works.

**Text Book:**


1. Royce, W. (2000). *Software project management - A unified framework*. New Delhi: Addison-Wesley, ISBN: 81-7808-013-3.
2. Bob Hughes and Mike Cotterell, *Software Project Management* (Second Edition), Published by McGraw-Hill Publishing Company ; ISBN: 007-709505-7

Course Title: **Network Security**
Course Code: **COM475B**

Semester: **VII**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

**Course Objectives:**
In this age of universal electronic connectivity, viruses and hackers, electronic eavesdropping, and electronic fraud, security is paramount. This course provides a practical survey of the principles and practice of network security.

**Course Contents:**

1 **Introduction** (**6hrs**)
- 1.1 Computer Security Concepts
- 1.2 The OSI Security Architecture
- 1.3 Security Attacks
- 1.4 Security Services
- 1.5 Security Mechanisms
- 1.6 A Model for Network Security

**2 Key Management and Distribution** (6**hrs)**
- 2.1 Symmetric Key Distribution Using Symmetric Encryption
- 2.2 Symmetric Key Distribution Using Asymmetric Encryption
- 2.3 Distribution of Public Keys
- 2.4 X.509 Certicates
- 2.5 Public Key Infrastructure

**3 User Authentication Protocols (6hrs)**
- 3.1 Remote User Authentication Principles
- 3.2 Remote User Authentication Using Symmetric Encryption
- 3.3 Kerberos
- 3.4 Remote User Authentication Using Asymmetric Encryption
- 3.5 Federated Identity Management

**4 Transport-Level Security ( 7hrs)**
- 4.1 Web Security Issues
- 4.2 Secure Sockets Layer (SSL)
- 4.3 Transport Layer Security (TLS)
- 4.4 HTTPS
- 4.5 Secure Shell (SSH)

**5 Wireless Network Security ( 8hrs)**
- 5.1 IEEE 802.11 Wireless LAN Overview

5.2 IEEE 802.11i Wireless LAN Security
5.3 Wireless Application Protocol Overview
5.4 Wireless Transport Layer Security
5.5 WAP End-to-End Security

**6 Electronic Mail Security** (4 **hrs)**

6.1 Pretty Good Privacy (PGP)
6.2 S/MIME
6.3 Domain Keys Identified Mail (DKIM)

**7 IP Security** **(8 hrs)**

7.1 IP Security Overview
7.2 IP Security Policy
7.3 Encapsulating Security Payload
7.4 Combining Security Associations
7.5 Internet Key Exchange
7.6 Cryptographic Suites

**Text Book:**

1. Cryptography and Network Security: Principles and Practice, 5/E,**William Stallings ,** ISBN-10: 0136097049 ,Prentice HallIndia Limited ,

Course Title: **System Administration**
Course Title: **COM475C**

Semester: **VII**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

**Course Objectives:**

The main objective of the course is to introduce concepts of System Administration. The general objectives are,

1. To learn about system administration
2. To use different tools and techniques for system administration
3. To identify and access file system, storage and network management services
4. To learn about the system kernels, security essentials and system monitoring

**Course Contents:**

**1. Introduction (6 hrs)**

Linux workstation installation, Linux server installation, Post-install system configuration, Scripting installation of custom setups using kick start, Linux boot process, Sysvinit concepts and configuration, Managing startup of system daemons, Controlling startup of services in xinetd / inetd

**2. User Management (4 hrs)**

Creation, modification, and deletion of users and groups, creating group directories, Password aging under Linux, The Linux login process and login authentication, Regulating access to the root account via su and sudo

**3. File System and Storage (4 hrs)**

Path Names: Absolute and Relative Paths, File Types, File Attributes, Access Control Lists, Creation, modification, and deletion of partitions and file systems, Management of RAID devices under Linux, Disk space regulation using quotas, Backing up and restoring Linux file systems,

**4. Process and Network Service Management (12 hrs)**

Scheduling jobs using cron, anacron, and at, Management of processes running on the system, Usage of process accounting and implementation of process limits, Configuration and analysis of system logs, System performance analysis, Configuring network interfaces, Setup of DNS and DHCP clients, Diagnosing network setup issues, Configuring NFS clients, Basic installation and configuration of common network services: telnet and SSH servers file sharing via NFS, SMB, HTTP, FTP, and TFTP e-mail services via SMTP, POP, and IMAP ISC DHCP services

**5. Working with Kernels (9 hrs)**

Configuration of optimized Linux kernels, Compiling and installing custom Linux kernels, Using third-party patches with Linux kernels, Updating userland to support new kernels, Concepts for troubleshooting Linux, Analysis of system logs to identify problems, Use of systems-level debugging aids in troubleshooting, Usage of the Linux rescue environment

**6. Security (5 hrs)**

Securing freshly installed Linux systems, Protecting files and the file system, User authentication, Keeping Linux systems up-to-date, Configuration of Linux firewalls

**7. Managing System Resources (5 hrs)**

Monitoring and Controlling Processes, Managing CPU Resources, Managing Memory, Monitoring Disk Space Usages, Managing Network Performances

**Laboratory Works:**

Student should have practical session for configuring and using above mentioned topics in Linux However, nature of Linux Platform can be decided by the instructor. The lab work should be practiced for minimum of 3 lab hours per week.

**Reference Book**


1. **Æleen Frisch**, *Essential System Administration*, O'Reilly


**References**


2. Fedora System Administrator's Guide
3. Red Hat Enterprise Linux System Administrator's Guide
4. **Evi Nemeth, Garth Snyder, Trent R. Hein**, *Linux Administration Handbook*, Addison-Wesley Professional
5. **Evi Nemeth, Garth Snyder, Trent R. Hein , Ben Whaley** *Unix and Linux System Administration Handbook*, Prentice Halls
6. **Ronald McCarty,** *Ubuntu Linux System Administration*

Course Title: **Image Processing**
Course Code: **COM481**
Semester: **VIII**
Credit: **3**
Class Load: **6** Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**

To provide working knowledge of theories and applications of thermal science

1. To make able to apply laws of thermodynamics in various systems.
2. To make able to distinguish the cycles in various engines, and pumps.
3. To make able to calculate energy/quantity of heat transfer by conduction and radiation.

**Course Contents:**

**1. Introduction to Digital Image Processing (4 hrs)**
Digital image representation, Digital image processing: Problems and application, Elements of visual perception, Sampling and Quantization, Relationships between pixels.

**2. Tow-dimensional Systems (5 hrs)**
Fourier transform and Fast Fourier Transform, Other image transforms, Other image transforms and their properties: Cosine transform, Hadamard transform, Haar transform.

**3. Image Enhancement and Restoration (8 hrs)**
Point operations, Contrast stretching, Clipping and thresholding, Digital negative, intensity level slicing, Bit extraction, Histogram modeling, Equalization modification, Specification, Spatial operations, Averaging, Directional smoothing, Median, Filtering spatial low pass, High pass and band pass filtering, Magnification by replication and interpolation.

**4. Image Coding and Compression (4 hrs)**
Pixel coding: run length, bit plan, Predictive and inter-frame coding.

**5. Introduction to Pattern Recognition and Images (3 hrs)**

**6. Recognition and Classification (5 hrs)**
Recognition classification, Feature extraction, Models, Division of sample space.

**7. Grey Level Features Edges and Lines (6 hrs)**

Similarity and correlation, Template matching, Edge detection using templates, Edge detection using gradient models, Model fitting, Line detection, Problems with feature detectors.

**8. Segmentation (3 hrs)**

Segmentation by thresholding, Regions for edges, line and curve detection.

**9. Frequency Approach and Transform Domain (3 hrs)**

**10. Advanced Topics (4 hrs)**

Neural network and their application to pattern recognition, Hopfield nets, hamming nets, perception

**Laboratory Works:**

Laboratory exercises using image processing and pattern recognition packages.

**Recommended Books:**


1. K. Castlemann, *Digital Image Processing*, Prentice Hall of India Pvt. Ltd., 2010.
2. A.K. Jain, *Fundamental of Digital Image Processing*, Prentice Hall of India Pvt. Ltd., 2011.


**Reference:**


1. Sing_tze Bow, M. Dekker, *Pattern Recognition and Image Processing*, 2008.
2. R.C. Gonzalez and P. Wintz, *Digital Image Processing*, Addision-Wesley Publishing, 2009.
3. M. James, *Pattern Recognition*, BSP Professional books, 2008.

Course Title: **Cloud Computing**
Course Code: **COM482**
Semester: **VIII**
Credit: **3**
Class Load: **6** Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) + Internal (20+20)

**Course Objectives:**
The objective of this course is to provide cloud computing, cloud security, Cloud computing platforms and Cloud for the enterprise as service.

**Course Contents:**

1. **Introduction to Cloud Computing (6 hrs)**
    1. Definition, Characteristics,
    2. Components,
    3. Cloud provider,
    4. Organizational scenarios of clouds,
    5. Administering & Monitoring cloud services, Benefits and limitations,
    6. Deploy application over cloud,
    7. Comparison among SAAS, PAAS, IAAS
    8. Cloud computing platforms:
    9. Infrastructure as service

2. **Introduction to Cloud Technologies ( 6 hrs)**
    1. Study of Hypervisors
    2. Compare SOAP and REST
    3. **Webservices, AJAX and mashups**-Web services: SOAP and REST, SOAP versus REST, AJAX: asynchronous 'rich' interfaces, Mashups: user interface services
    4. **Virtualization Technology**: Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization
    5. **Multitenant software:** Multi-entity support, Multi-schema approach, Multi-tenance using cloud data stores, Data access control for enterprise applications,

3. **Data in the Cloud (6 hrs)**
    1. Relational databases
    2. Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Map-Reduce model

4. **Cloud Security Fundamentals (15 hrs)**
    1. Vulnerability assessment tool for cloud
    2. Privacy and Security in cloud

3. **Cloud computing security architecture:** Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control-Identity management, Access control, Autonomic Security

4. **Cloud computing security challenges**: Virtualization security management- virtual threats, VM Security Recommendations, VM-Specific Security techniques,
5. Secure Execution Environments and Communications in cloud
6. Issues in cloud computing
7. Implementing real time application over cloud platform
8. QOS Issues in Cloud
9. Dependability
10. Data migration, streaming in Cloud

11. Quality of Service (QoS) monitoring in a Cloud computing environment
12. Cloud Middleware
13. Mobile Cloud Computing
14. Inter Cloud issues
15. A grid of clouds
16. Sky computing
17. load balancing
18. Resource optimization
19. Resource dynamic reconfiguration
20. Monitoring in Cloud

**5. Cloud computing platforms (6hrs)**

1. Installing cloud platforms and performance evaluation
2. Features and functions of cloud platforms:
3. Xen Cloud Platform,
4. Eucalyptus,
5. OpenNebula,
6. Nimbus, TPlatform,
7. Apache Virtual Computing Lab (VCL)

**6. Cloud for the enterprise as service ( 6 hrs)**

1. Storage
2. Database
3. Information
4. Process
5. Platform
6. Integration
7. Security

8. Management/ Governance
9. Infrastructure

**Laboratory Works:**

The practical classes should include all the topics mentioned above.

**Text Book:**

1. Judith Hurwitz, R.Bloor, M. Kanfman, F. Halper "*Cloud Computing for Dummies*", Wiley India Edition.

**Reference:**

1. Gautam Shroff, "*Enterprise Cloud Computing"*, Cambridge.
2Ronald Krutz and Russell Dean Vines, "Cloud Security ", Wiley-India.
3. David S. Linthicum, *"Cloud Computing and SOA Convergence in your Enterprise"*, Pearson.

Course Title: **Internship**
Course Code: **COM483**
Semester: **VIII**
Credit: **6**
Class Load: 6 Hrs. per Week (Practical: 6 Hrs)
Evaluation: Supervisor (60) + Mentor (60) + Internal (30) + External (50) = 200

**Course Objectives:**

The students are required to complete a six credit (minimum ten weeks long) internship as a part of the course requirement. Industry is a crucial requirement of the Internship course and this will have to be secured before getting started with the course. The work that the students perform during the Internship will have to be supervised by the faculty members as well as by representatives from the participating Industries. The internship experience is expected to enable the students to assist in the resolution of complex problem associated with some aspect of computer networking.

At the end of the Internship, the student(s) are required to write a report on their internship work. Such a report needs to be structured according to the prescribed format. The Report forms a major aspect of the evaluation of the Internship work.

**Goal:** To assist students in focusing their interests, thus aiding in the selection of future coursework and the assessment of ultimate career pursuits. It gives students the opportunity to re-examine their career objectives and explore the variety of opportunities in the field of computer networking.

**Preparation**
Students, the advisors, and the industry/organization, with which the student team is affiliated, will have to agree on a problem that needs to be addressed during the internship. An internship is designed by the advisor and the student according to mutual interests, needs and availability of related industry/organization. To develop a rewarding program, at the beginning of the internship, the advisor and student are asked to establish an internship plan, in the form of written objectives and goals, and to develop a strategy for attaining those goals. The plan may include a schedule of activities that need to be carried out in order to reach a solution for the problem being addressed. The internship plan is not intended to be rigid. Advisor may be unable to assess certain responsibilities until the student demonstrates his or her ability. The plan should be flexible and subject to revision. The advisor and student should assess the student's progress throughout the term of the internship both to evaluate the student's performance, and to establish new directions as needed.

**Role of the Advisor**

1. Advisors are expected to share their experience, insight, and enthusiasm with the student throughout the internship.

2. Advisors should continually monitor the progress of the student, assessing written and oral communications and guiding the development of the student's technical and managerial skills, effectiveness and presentation of self.
3. Advisors are expected to submit a post-internship evaluation of the student's accomplishments and abilities and of the internship program in general.

**Role of the Student**

In order for the internship to be a mutually beneficial experience, a student should begin with a definition of his/her objectives and specific interests for the 10-week period to ensure that appropriate activities and projects are selected by the advisor and the student. The student will be responsible for the timely completion and professional quality of all activities and projects assigned. The student is expected to speak frequently with the advisor on his/her progress and interest in other projects, as well as to discuss observations and questions about meetings, projects and other activities with which he/she is involved.

The student is required to submit to Advisor, within the first two weeks of the internship, a brief plan for the internship.

**Elective (Any One)**
Course Title: **Geographical Information System**
Course Code: **COM484A**

Course Title: **Mobile Application Development**
Course Title: **COM484B**

Course Title: E-Governance
Course Code: **COM484C**

Course Title: **Bioinformatics**
Course Title: **COM484D**

Semester: V**III**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

**Course Title: Geographical Information System (GIS)**
Course Title: **COM484A**

Semester: V**III**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

**Course Objectives:**
The course covers about spatial data modelling and database design, capturing the real world, spatial analysis and visualization, overview of open GIS

**Course Contents:**

**1. Introduction (6hrs)**
Overview, History and concepts of GIS, Scope and application areas of GIS, Purpose and benefits of GIS, Functional components of GIS , Importance of GPS and remote sensing data in GIS

**2. Digital Mapping Concept (3 hrs)**
Map concept: Map elements, Map layers, Map scales and representation, Map projection: Coordinate system and projection system

**3. Spatial Data Modeling and Database Design (9 hrs)**

Introduction to geographic phenomena and data modeling , Spatial relationships and topology, Scale and resolution, Vector, Raster and digital terrain model, Spatial database design with the concepts of geodatabase.

**4. Capturing the Real World (8hrs)**

Different methods of data capture, Map projection and spatial reference, Data preparation, conversion and integration, Quality aspects of spatial data, GPS, Remote Sensing

**5. Spatial Analysis and Visualization (7hrs)**

Spatial analysis
i. Overlay
ii. Buffering
Map outputs and its basic elements

**6. Introduction to Spatial Data Infrastructure (8hrs)**

SDI concepts and its current trend, The concept of metadata and clearing house, Critical factors around SDIs

**7. Open GIS (4hrs)**

Introduction of open concept in GIS, Open source software for spatial data analysis, Web Based GIS system, System Analysis and Design with GIS

**Laboratory Works:**

The lab should cover at least the concepts given the chapters.

**Text Book:**

**1.** Rolf De , Richard A. knippers, Yuxian sun
" *Principles of geographic information systems*: An introductory textbook, international institute for Geo-information science and Earth observation, the Netherlands"

**Reference:**

1. Andy Mitchell "*ESRI guide to GIS analysis*", ESRI press.

Course Title: **Mobile Application Development**
Course Title: **COM484B**

Semester: V**III**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

**Course Objectives:**

The objective of the course are

1. To understand system requirements for mobile applications
2. To generate suitable design using specific mobile development frameworks
3. To generate mobile application design
4. To implement the design using specific mobile development frameworks
5. To deploy the mobile applications in marketplace for distribution

**Course Contents:**

**1. Mobile Applications (8 hrs)**

Mobile Web Presence: Mobile Content, Mobile Browser, Mobile Applications: When to Create App, Benefits of Mobile App, App as Web App, Web Services: Definition, Examples, and Advantages of Web Services, Web Service Language Formats: XML, JSON, Transferring Non-textual Data, Creating Example Web Service: Using MS Stack, Using LAMP Stack, Debugging Web Services: Tools, Advanced Web Service Techniques

**2. Mobile UI Design and Mobile Web Sites (10 hrs)**

Effective Use of Screen Real Estate, Understanding Mobile Application Users, Understanding mobile Information Design, and Mobile Platforms, Using Tools of Mobile Interface Design, Choosing Mobile Web Option, Adaptive Mobile Websites, Dedicated Mobile Websites, Mobile Web Apps with HTML5

**3. Working with Android (10 hrs)**

Why Android?, Supporters of Android, Competition with itself, Tools: JDK, Eclipse, SDK, Eclipse ADT Plug-in, Additional SDK Components, Development, Connecting to the Google Play, Android Development Practices, Building App in Android

**4. Working with IOS (12 hrs)**

Apple iPhone, Tools (Hardware, xCode, iOS SDK iOSGuideline), Anatomy of iOS App, xCode IDE, iOS Simulator, Debugging Code, Instruments, Objective C Basics: Classes, Control Structures, Try-Catch, Hello World App, Building App iOSOther useful iOS things

**5. Working with BlackBerry (5 hrs)**

BlackBerry Devices and Playbook, Tools: BlackBerry Developer Program, Code signing Keys BlackBerry Java Development Environment, Developing App with BlackBerry, Eclipse Specifics for BlackBerry, Development with WebWorks, Other useful BlackBerry things, Blackberry Distribution

**Laboratory Works:**

Student should write programs and prepare lab sheet for all of the units in the syllabus. Students should be able to Mobile Apps by using various concepts and Platforms discussed in class. The lab work should be practiced for minimum of 3 lab hours per week

**Books**


1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012
2. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012
3. James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012
4. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6
5. Development: Exploring the iOS SDK”, Apress, 2013.

Course Title: **E-Governance**
Course Code: **COM484C**
Semester: V**III**
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs**,** Practical: 3 Hrs)
Evaluation: External (60) +Internal (20+20)

**Course Objectives:**
To provide the knowledge of good governance using information and communication technologies and case studies of different countries.

**Course Contents:**

1. **Introduction** (4 hrs)

E-Governance: Needs of E-Governance, Issues in E-Governance applications and the Digital Divide; Evolution of E-Governance, Its scope and content; Present global trends of growth in E-Governance: Other issues.

2. **Models of E-Governance** (10 hrs)

Introduction; Model of Digital Governance: Broadcasting/ Wilder Dissemination Model, Critical Flow Model, Comparative Analysis Model, Mobilization and Lobbying Model, Interactive-service Model/Government-to-Citizen-to-Government Model (G2C2G); Evolution in E-Governance and Maturity Models: Five Maturity Levels, Characteristics of Maturity Levels, Key areas, Towards Good Governance through E-Governance Models.

3. **E-Governance Infrastructure and Strategies** (6 hrs)

E-readiness: Digital System Infrastructure, Legal Infrastructural Preparedness, Institutional Infrastructural Preparedness, Human Infrastructural Preparedness, Technological Infrastructural Preparedness; Evolutionary Stages in E-Governance.

4. **Data Warehousing and Data Mining in Government** (5 hrs)

Introduction; National Data Warehouses: Census Data, Prices of Essential Commodities; Other areas for Data Warehousing and Data Mining: Agriculture, Rural Development, Health, Planning, Education, Commerce and Trade, Other Sectors.

5. **Case Studies** (20 hrs)
Nepalese Context: Cyber Laws, Implementation in the Land Reform, Human Resource Management Software; India: NICNET, Collectorate, Computer-aided Administration of Registration Department

(CARD), Smart Nagarpalika, National Reservoir Level and Capacity Monitoring System, Computerization in Andra Pradesh, Ekal Seva Kentra, Sachivalaya Vahini, Bhoomi, IT in Judiciary, E-Khazana, DGFT, PRAJA, E-Seva, E-Panchyat, General Information Services of National Informatics Centre; E-Governance initiative in USA; E-Governance in China; E-Governance in Brazil and Sri Lanka.

**Text Book:**

1.E-Governance: Concepts and Case Studies, C.S.R. Prabhu, Prentice-Hall of India Private Limited, 2004.

**Reference:**

1. Backus, Michiel, e-Governance in Developing Countries, IICD Research Brief, No. 1, March 2001.