ENGINEERING MATHEMATICS I

SH 401

Lecture : 3 **Year : I**
Tutorial : 2 **Part : I**
Practical : 0

Course Objective:

To provide students a sound knowledge of calculus and analytic geometry to apply them in their relevant fields.

1. Derivatives and their Applications **(14 hours)**

1.1 Introduction
1.2 Higher order derivatives
1.3 Mean value theorem
  1.3.1 Rolle's Theorem
  1.3.2 Lagrange's mean value theorem
  1.3.3 Cauchy's mean value theorem
1.4 Power series of single valued function
  1.4.1 Taylor's series
  1.4.2 Maclaurin's series
1.5 Indeterminate forms; L'Hospital rule
1.6 Asymptotes to Cartesian and polar curves
1.7 Pedal equations to Cartesian and polar curves; curvature and radius of curvature

2. Integration and its Applications **(11 hours)**

2.1 Introduction
2.2 Definite integrals and their properties
2.3 Improper integrals
2.4 Differentiation under integral sign
2.5 Reduction formula; Beta Gama functions
2.6 Application of integrals for finding areas, arc length, surface and solid of revolution in the plane for Cartesian and polar curves

3. Plane Analytic Geometry **(8 hours)**

3.1 Transformation of coordinates: Translation and rotation
3.2 Ellipse and hyperbola; Standard forms, tangent, and normal
3.3 General equation of conics in Cartesian and polar forms

4. Ordinary Differential Equations and their Applications **(12 hours)**

4.1 First order and first degree differential equations
4.2 Homogenous differential equations
4.3 Linear differential equations
4.4 Equations reducible to linear differential equations; Bernoulli's

equation

4.5 First order and higher degree differential equation; Clairaut's equation

4.6 Second order and first degree linear differential equations with constant coefficients.

4.7 Second order and first degree linear differential equations with variable coefficients; Cauchy's equations

4.8 Applications in engineering field

References:

1. Erwin Kreyszig, "Advance Engineering Mathematics" , John Wiley and Sons Inc
2. Thomas,Finney, "Calculus and Analytical Geometry" Addison- Wesley
3. M. B. Singh, B. C. Bajrachrya, "Differential Calculus", Sukunda Pustak Bhandar,Nepal
4. M. B. Singh, S. P. Shrestha, "Applied Mathematics", RTU, Department of Engineering Science and Humanities.
5. G.D. Pant, G. S. Shrestha, "Integral Calculus and Differential Equations", Sunila Prakashan, Nepal
6. M. R. Joshi, "Analytical Geometry", SukundaPustak Bhandar,Nepal
7. S. P. Shrestha, H. D. Chaudhary, P. R. Pokharel, "A Textbook of Engineering Mathematics - Vol I", Vidyarthi Pustak Bhandar.
8. Santosh Man Maskey, "Calculus", Ratna Pustak Bhandar, Nepal

COMPUTER PROGRAMMING
CT 401

Lecture : 3 **Year : I**
Tutorial : 0 **Part : I**
Practical : 3

Course Objective:
To familiarize the student with computer software and high level programming languages and to develop the programming skill using C language

1. Overview of Computer Software & Programming Languages (3 hours)

1.1. System software
1.2. Application software
1.3. General software features and recent trends
1.4. Generation of programming languages
1.5. Categorization of high level languages

2. Problem Solving Using Computer (3 hours)

2.1. Problem analysis
2.2. Algorithm development and Flowchart
2.3. Compilation and Execution
2.4. Debugging and Testing
2.5. Programming Documentation

3. Introduction to 'C' Programming (4 hours)

3.1. Character set, Keywords, and Data types
3.2. Preprocessor Directives
3.3. Constants and Variables
3.4. Operators and statements

4. Input and Output (3 hours)

4.1. Formatted input/output
4.2. Character input/output
4.3. Programs using input/output statements

5. Control Statements (6 hours)

5.1. Introduction
5.2. The goto, if, if ... ... else, switch statements
5.3. The while, do ... while, for statements

6. User-Defined Functions (4 hours)

6.1. Introduction
6.2. Function definition and return statement
6.3. Function Prototypes

6.4. Function invocation, call by value and call by reference, Recursive Functions

7. Arrays and Strings **(5 hours)**

7.1. Defining an Array
7.2. One-dimensional Arrays
7.3. Multi-dimensional Arrays
7.4. Strings and string manipulation
7.5. Passing Array and String to function

8. Structures **(4 hours)**

8.1. Introduction
8.2. Processing a Structure
8.3. Arrays of Structures
8.4. Arrays within Structures
8.5. Structures and Function

9. Pointers **(4 hours)**

9.1. Introduction
9.2. Pointer declaration
9.3. Pointer arithmetic
9.4. Pointer and Array
9.5. Passing Pointers to a Function
9.6. Pointers and Structures

10. Data Files **(5 hours)**

10.1. Defining opening and closing a file
10.2. Input/Output operations on Files
10.3. Error handling during input/output operations

11. Programming Languages: FORTRAN **(4 hours)**

11.1 Character set
11.2 Data types, Constants and variables
11.3 Arithmetic operations, Library Functions
11.4 Structure of Fortran program
11.5 Formatted and Unformatted Input/Output Statements
11.6 Control Structures: Goto, Logical IF, Arithmetic IF, Do loops
11.7 Arrays: one dimensional and two dimensional

Practical

- Minimum 6 sets of computer programs in C (from Unit 4 to Unit 10) and 2 sets in FORTRAN (from Unit 11) should be done individually. (30 marks out of 50 marks)
- Student (maximum 4 persons in a group) should submit a mini project at the end of course. (20 marks out of 50 marks)

References:

1. Kelly & Pohl, "A Book on C", Benjamin/Cumming
2. Brian W. Keringhan & Dennis M. Ritchie, "The 'C' Programming Language", PHI
3. Daya Sagar Baral, Diwakar Baral and Sharad Kumar Ghimire "The Secrets of C Programming Language", Bhundipuran Publication
4. Bryons S. Gotterfried, "Programming with C", TMH
5. Yashavant Kanetkar, "Let Us C", BPB
6. Alexis Leon, Mathews Leon, "Fundamentals of Information Technology", Leon Press and Vikas Publishing House

ENGINEERING DRAWING I

ME 401

Lectures : 1
Tutorial : 0
Practical : 3

Year : I
Part : I

Course Objective:

To develop basic projection concepts with reference to points, lines, planes and geometrical solids. Also to develop sketching and drafting skills to facilitate communication.

1. Instrumental Drawing, Technical Lettering Practices and Techniques (2 hours)

1.1 Equipment and materials
1.2 Description of drawing instruments, auxiliary equipment and drawing materials
1.3 Techniques of instrumental drawing
1.4 Pencil sharpening, securing paper, proper use of T- squares, triangles, scales dividers, compasses, erasing shields, French curves, inking pens
1.5 Lettering strokes, letter proportions, use of pencils and pens, uniformity and appearance of letters, freehand techniques, inclined and vertical letters and numerals, upper and lower cases, standard English lettering forms

2. Dimensioning (2 hours)

2.1 Fundamentals and techniques
2.2 Size and location dimensioning, SI conversions
2.3 Use of scales, measurement units, reducing and enlarging drawings
2.4 Placement of dimensions: aligned and unidirectional

3. Applied Geometry (6 hours)

3.1 Plane geometrical construction: Proportional division of lines, arc & line tangents
3.2 Methods for drawing standard curves such as ellipses, parabolas, hyperbolas, involutes, spirals, cycloids and helices (cylindrical and conical)
3.3 Techniques to reproduce a given drawing (by construction)

4. Basic Descriptive Geometry (14 hours)

4.1 Introduction to Orthographic projection, Principal Planes, Four Quadrants or Angles
4.2 Projection of points on first, second, third and fourth quadrants
4.3 Projection of Lines: Parallel to one of the principal plane, Inclined to one of the principal plane and parallel to other, Inclined to both principal planes

4.4 Projection Planes: Perpendicular to both principal planes, Parallel to one of the principal planes and Inclined to one of the principal planes, perpendicular to other and Inclined to both principal planes
4.5 True length of lines: horizontal, inclined and oblique lines
4.6 Rules for parallel and perpendicular lines
4.7 Point view or end view of a line
4.8 Shortest distance from a point to a line
4.9 Edge View and True shape of an oblique plane
4.10 Angle between two intersecting lines
4.11 Intersection of a line and a plane
4.12 Angle between a line and a plane
4.13 Dihedral angle between two planes
4.14 Shortest distance between two skew lines
4.15 Angle between two non- intersecting (skew) lines

5. Multi view (orthographic) projections **(18 hours)**

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

5.2 Sectional Views: Full, half, broken revolved, removed (detail) sections, phantom of hidden section, Auxiliary sectional views, specifying cutting planes for sections, conventions for hidden lines, holes, ribs, spokes
5.3 Auxiliary views: Basic concept and use, drawing methods and types, symmetrical and unilateral auxiliary views. Projection of curved lines and boundaries, line of intersection between two planes, true size of dihedral angles, true size and shape of plane surfaces

6. Developments and Intersections **(18 hours)**

6.1 Introduction and Projection of Solids
6.2 Developments: general concepts and practical considerations, development of a right or oblique prism, cylinder, pyramid, and cone, development of truncated pyramid and cone, Triangulation method for approximately developed surfaces, transition pieces for connecting different shapes, development of a sphere
6.3 Intersections: lines of intersection of geometric surfaces, piercing point of a line and a geometric solid, intersection lines of two planes, intersections of -prisms and pyramids, cylinder and an oblique plane. Constructing a development using auxiliary views, intersection of - two cylinders, a cylinder & a cone

Practical:

1. Drawing Sheet Layout, Freehand Lettering, Sketching of parallel lines, circles, Dimensioning
2. Applied Geometry(Sketch and Instrumental Drawing)
3. Descriptive Geometry I: Projection of Point and Lines (4.1 to 4.3)(Sketch and Instrumental Drawing)
4. Descriptive Geometry II: Projection of Planes (4.4) (Sketch and Instrumental Drawing)
5. Descriptive Geometry III: Applications in Three dimensional Space (4.5 to 4.15) (Sketch and Instrumental Drawing)
6. Multiview Drawings (5.1) (Sketch and Instrumental Drawing)
7. Multiview, Sectional Drawings and Dimensioning I (5.2)(Sketch and Instrumental Drawing)
8. Multiview, Sectional Drawings and Dimensioning II (5.2) (Sketch and Instrumental Drawing)
9. Auxiliary View, Sectional Drawings and Dimensioning (5.3) (Sketch and Instrumental Drawing)
10. Projection of Regular Geometrical Solids (Sketch and Instrumental Drawing)
11. Development and Intersection I (6.1) (Sketch and Instrumental Drawing)
12. Development and Intersection II (6.2) (Sketch and Instrumental Drawing)
13. Development and Intersection III (6.3) (Sketch and Instrumental Drawing)

References:

1. M. C. Luintel, "Engineering Drawing (Vol.I)", Athrai Publication (P) Limited.
2. W. J. Luzadder, "Fundamentals of Engineering Drawing", Prentice Hall.
3. T. E. French, C. J. Vierck, and R. J. Foster, "Engineering Drawing and Graphic Technology", Mc Graw Hill Publshing Co.
4. A . Mitchell, H. C. Spencer and J. T. Dygdone, "Technical Drawing", F. E. Giescke, Macmillan Publshing Co.
5. N. D. Bhatt, "Elementary Engineering Drawing", Charotar Publshing House, India.
6. P. S. Gill, "A Text Book of Engineering Drawing", S. K. Kataria and Sons, India
7. R. K. Dhawan, "A Text Book of Engineering Drawing", S. Chand and Company Limited, India

ENGINEERING PHYSICS
SH 402

Lecture : 4 **Year : I**
Tutorial : 1 **Part : I**
Practical : 2

Course objectives:

To provide the concept and knowledge of physics with the emphasis of present day application.

1. Oscillation: **(7 hours)**

1.1 Mechanical Oscillation: Introduction
1.2 Free oscillation
1.3 Damped oscillation
1.4 Forced mechanical oscillation
1.5 EM Oscillation: Free, damped and Forced electromagnetic oscillation

2. Wave motion **(2 hours)**

2.1 Waves and particles,
2.2 Progressive wave,
2.3 Energy, power and intensity of progressive wave

3. Acoustics **(3 hours)**

3.1 Reverberation,
3.2 Sabine' Law
3.3 Ultrasound and its applications

4. Physical Optics **(12 hours)**

4.1 Interference,
  4.1.1 Intensity in double slit interference,
  4.1.2 Interference in thin films,
  4.1.3 Newton's rings,
  4.1.4 Hadinger fringes
4.2 Diffraction,
  4.2.1 Fresnel and Fraunhoffer's diffraction,
  4.2.2 Intensity due to a single slit;
  4.2.3 Diffraction grating,
  4.2.4 X-ray diffraction, x-ray for material test
4.3 Polarization,
  4.3.1 Double refraction,
  4.3.2 Nichol prism, wave plates,
  4.3.3 Optical activity, specific rotation

5. Geometrical Optics **(3 hours)**

5.1 Lenses, combination of lenses,

5.2 Cardinal points,
5.3 Chromatic aberration

6. Laser and Fiber Optics **(4 hours)**

6.1 Laser production,
  6.1.1 He-Ne laser,
  6.1.2 Uses of laser
6.2 Fiber Optics,
  6.2.1 Self focusing,
  6.2.2 Applications of optical fiber

7. Electrostatics **(8 hours)**

7.1 Electric charge and force,
7.2 Electric field and potential,
7.3 Electrostatic potential energy,
7.4 Capacitors, capacitor with dielectric,
7.5 Charging and discharging of a capacitor

8. Electromagnetism **(11 hours)**

8.1 Direct current: Electric current,
  8.1.1 Ohm's law, resistance and resistivity,
  8.1.2 Semiconductor and superconductor
8.2 Magnetic fields:
  8.2.1 Magnetic force and Torque,
  8.2.2 Hall effect,
  8.2.3 Cyclotron, synchrotron,
  8.2.4 Biot-Savart law,
  8.2.5 Ampere's circuit law; magnetic fields straight conductors,
  8.2.6 Faraday's laws, Induction and energy transformation, induced field,
  8.2.7 LR circuit, induced magnetic field,
  8.2.8 Displacement current

9. Electromagnetic waves **(5 hours)**

9.1 Maxwell's equations,
9.2 Wave equations, speed,
9.3 E and B fields,
9.4 Continuity equation,
9.5 Energy transfer

10. Photon and matter waves **(5 hours)**

10.1 Quantization of energy;
10.2 Electrons and matter waves;
10.3 Schrodinger wave equation;
10.4 Probability distribution;
10.5 One dimensional potential well;
10.6 Uncertainty principle;
10.7 Barrier tunneling

Practical:

1. To determine the acceleration due to gravity and radius of gyration of the bar about an axis passing through its center of gravity.
2. To determine the value of modulus of elasticity of the materials given and moment of inertia of a circular disc using torsion pendulum.
3. To determine the angle of prism and dispersive power of materials of the prism using spectrometer.
4. To determine the wavelength of sodium light by Newton's rings.
5. To determine the wavelength of He-Ne laser light and use it to measure the thickness of a thin wire by diffraction of light.
6. To study the variation of angle of rotation of plane of polarization using concentration of the cane sugar solution
7. To determine the specific rotation of the cane sugar solution using polarimeter.
8. To determine the low resistance of a given wire by Carey Foster bridge and to determine the resistance per unit length of the wire of the bridge.
9. To determine the capacitance of a given capacitor by charging and discharging through resistor.
10. To plot a graph between current and frequency in an LRC series circuit and find the resonant frequency and quality factor.
11. To determine dielectric constant of a given substance and study its variation with frequency by resonance method.
12. To determine the susceptibility of a solution of given materials by Quinkes method.
13. To study the electric field mapping.

References:

1. Halliday, Resnick, Walker, "Fundamentals of Physics", John Wiley & Sons. Inc.
2. Sapkota, Pokharel, Bhattarai, "Fundamentals of Engineering Physics", Benchmark Publication.
3. Brij Lal and Subrahmanyam, "A text book of Optics", S. Chand Publisher.
4. A. S. Basudeva, "Modern Engineering Physics", S. Chand Publisher.
5. R. K. Gaur and S. L. Gupta, "Engineering Physics", Dhanpat Publisher.
6. Brij Lal and Subrahmanyam, "Waves and Oscillation", S. Chand Publisher.

BASIC ELECTRICAL ENGINEERING

EE 401

Lecture : 3 **Year : I**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

To provide the fundamental concept of DC, AC & 3-phase electrical circuits

1. General Electric System **(6 hours)**

1.1 Constituent parts of an electrical system (source, load, communication & control)
1.2 Current flow in a circuit
1.3 Electromotive force and potential difference
1.4 Electrical units
1.5 Ohm's law
1.6 Resistors, resistivity
1.7 Temperature rise & temperature coefficient of resistance
1.8 Voltage & current sources

2. DC circuits **(4 hours)**

2.1 Series circuits
2.2 Parallel networks
2.3 Krichhhof's laws
2.4 Power and energy

3. Network Theorems **(12 hours)**

3.1 Application of Krichhof's laws in network solution
  3.1.1 Nodal Analysis
  3.1.2 Mesh analysis
3.2 Star-delta & delta-star transformation
3.3 Superposition theorem
3.4 Thevninn's theorem
3.5 Nortan's theorem
3.6 Maximum power transfer theorem
3.7 Reciprocity theorem

4. Inductance & Capacitance in electric circuits **(4 hours)**

4.1 General concept of capacitance
  4.1.1 Charge & voltage
  4.1.2 Capacitors in series and parallel
4.2 General concept of inductance
  4.2.1 Inductive & non-inductive circuits
  4.2.2 Inductance in series & parallel

5. Alternating Quantities **(3 hours)**

5.1 AC systems
5.2 Wave form, terms & definitions
5.3 Average and rms values of current & voltage
5.4 Phasor representation

6. Single-phase AC Circuits **(6 hours)**

6.1 AC in resistive circuits
6.2 Current & voltage in an inductive circuits
6.3 Current and voltage in an capacitive circuits
6.4 Concept of complex impedance and admittance
6.5 AC series and parallel circuit
6.6 RL, RC and RLC circuit analysis & phasor representation

7. Power in AC Circuits **(4 hours)**

7.1 Power in resistive circuits
7.2 Power in inductive and capacitive circuits
7.3 Power in circuit with resistance and reactance
7.4 Active and reactive power
7.5 Power factor, its practical importance
7.6 Improvement of power factor
7.7 Measurement of power in a single-phase AC circuits

8. Three-Phase Circuit Analysis **(6 hours)**

8.1 Basic concept & advantage of Three-phase circuit
8.2 Phasor representation of star & delta connection
8.3 Phase and line quantities
8.4 Voltage & current computation in 3-phase **balance & unbalance** circuits
8.5 Real and reactive power computation
8.6 Measurements of power & power factor in 3-phase system

Practical:

1. Measurement of Voltage, current& power in DC circuit
   Verification of Ohm's Law
   Temperature effects in Resistance
2. Krichoff's Voltage & current Law
   Evaluate power from V & I
   Note loading effects of meter
3. Measurement amplitude, frequency and time with oscilloscope
   Calculate & verify average and rms value
   Examine phase relation in RL & RC circuit
4. Measurements of alternating quantities
   R, RL,RC circuits with AC excitation
   AC power, power factor, VARs, phasor diagrams

5. Three-phase AC circuits
   Measure currents and voltages in three-phase balanced AC circuits
   Prove Y-Δ transformation
   Exercise on phasor diagrams for three-phase circuits
6. Measurement of Voltage, current & power in a three-phase circuit
   Two-wattmeter method of power measurement in R, RL and RC three phase circuits
   Watts ratio curve

References:

1. J. R. Cogdell, " Foundations of Electrical Engineering", printice Hall, Englewood Chiffs, New Jersy.
2. I. M. Smith," Haughes Electrical Technology", Addison-Wesley, ISR Rprint.

DIGITAL LOGIC

EX 502

Lecture : 3
Tutorial : 0
Practical : 3

Year : I
Part : I

Course Objective:

To introduce basic principles of digital logic design, its implementation and applications

1. Introduction **(3 hours)**

- 1.1 Definitions for Digital Signals
- 1.2 Digital Waveforms
- 1.3 Digital Logic
- 1.4 Moving and Storing Digital Information
- 1.5 Digital Operations
- 1.6 Digital Computer
- 1.7 Digital Integrated Circuits
- 1.8 Digital IC Signal Levels
- 1.9 Clock wave form
- 1.10 Coding
  - 1.10.1 ASCII Code
  - 1.10.2 BCD
  - 1.10.3 The Excess – 3 Code
  - 1.10.4 The Gray Code

2. Digital Logic **(1 hours)**

- 2.1 The Basic Gates – NOT, OR, AND
- 2.2 Universal Logic Gates – NOR, NAND
- 2.3 AND-OR-INVERT Gates
- 2.4 Positive and Negative Logic
- 2.5 Introduction to HDL

3. Combinational Logic Circuits **(5 hours)**

- 3.1 Boolean Laws and Theorems
- 3.2 Sum-of-Products Method
- 3.3 Truth Table to Karnaugh Map
- 3.4 Pairs, Quads, and Octets
- 3.5 Karnaugh Simplifications
- 3.6 Don't Care Conditions
- 3.7 Product-of-Sums Method
- 3.8 Product-of-Sums Simplification
- 3.9 Hazards and Hazard Covers
- 3.10 HDL Implementation Models

4. Data Processing Circuits **(5 hours)**

4.1 Multiplexer
4.2 DeMultiplexer
4.3 Decoder
4.4 BCD-to-Decimal Decoders
4.5 Seven-Segment Decoders
4.6 Encoder
4.7 Exclusive-OR Gates
4.8 Parity Generators and Checkers
4.9 Magnitude Comparator
4.10 Read-Only Memory
4.11 Programmable Array Logic
4.12 Programmable Logic Arrays
4.13 Troubleshooting with a Logic Probe
4.14 HDL Implementation of Data Processing Circuits

5. Arithmetic Circuits **(5 hours)**

5.1 Binary Addition
5.2 Binary Subtraction
5.3 Unsigned Binary Numbers
5.4 Sign-Magnitude Numbers
5.5 2's Complement Representation
5.6 2's Complement Arithmetic
5.7 Arithmetic Building Blocks
5.8 The Adder-Subtracter
5.9 Fast Adder
5.10 Arithmetic Logic Unit
5.11 Binary Multiplication and Division
5.12 Arithmetic Circuits Using HDL

6. Flip Flops **(5 hours)**

6.1 RS Flip-Flops
6.2 Gated Flip-Flops
6.3 Edge-Triggered RS Flip-Flops
6.4 Egde Triggered D Flip-Flops
6.5 Egde Triggered J K Flip-Flops
6.6 Flip-Flop Timing
6.7 J K Mater- Slave Flip-Flops
6.8 Switch Contacts Bounds Circuits
6.9 Varius Representation of Flip-Flops
6.10 Analysis of Sequencial Circuits

7. Registers **(2 hours)**

7.1 Types of Registers
7.2 Serial In – Serial Out
7.3 Serial In – Parallel Out

7.4 Parallel In – Serial Out
7.5 Parallel In – Parallel Out
7.6 Applications of Shift Registers

8. Counters **(5 hours)**

8.1 Asynchronous Counters
8.2 Decoding Gates
8.3 Synchronous Counters
8.4 Changing the Counter Modulus
8.5 Decade Counters
8.6 Presettable Counters
8.7 Counter Design as a Synthesis Problem
8.8 A Digital Clock

9. Sequential Machines **(8 hours)**

9.1 Synchronous machines
  9.1.1 Clock driven models and state diagrams
  9.1.2 Transition tables, Redundant states
  9.1.3 Binary assignment
  9.1.4 Use of flip-flops in realizing the models
9.2 Asynchronous machines
  9.2.1 Hazards in asynchronous system and use of redundant branch
  9.2.2 Allowable transitions
  9.2.3 Flow tables and merger diagrams
  9.2.4 Excitation maps and realization of the models

10. Digital Integrate Circuits **(4 hours)**

10.1 Switching Circuits
10.2 7400 TTL
10.3 TTL parameters
10.4 TTL Overvew
10.5 Open Collecter Gates
10.6 Three-state TTL Devices
10.7 External Drive for TTL Loads
10.8 TTL Driving External Loads
10.9 74C00 CMOS
10.10 CMOS Characteristics
10.11 TTL- to –CMOS Interface
10.12 CMOS- to- TTL Interface

11. Applications **(2 hours)**

11.1 Multiplexing Displays
11.2 Frequency Counters
11.3 Time Measurement

Practical:

1. DeMorgan's law and it's familiarization with NAND and NOR gates
2. Encoder, Decoder, and Multiplexer
3. Familiarization with Binary Addition and Subtraction
4. Construction of true complement generator
5. Latches, RS, Master-Slave and T type flip flops
6. D and JK type flip flops
7. Ripple Counter, Synchronous counter
8. Familiarization with computer package for logic circuit design
9. Design digital circuits using hardware and software tools
10. Use of PLAs and PLDs

References:

1. Donald P. Leach, Albert Paul Malvino and GoutamSaha, " Digital Principles and Applications", Tata McGraw-Hill
2. David J Comer "Digital Logic And State Machine Design" Oxfored University Press
3. William I. Fletcher "An Engineering Approach to Digital Design" Printice Hall of India, New Delhi
4. William H. Gothmann, "Digital Electronics, An Introduction to Theory and Practice"

ENGINEERING MATHEMATICS II

SH 451

Lecture : 3 **Year : I**
Tutorial : 2 **Part : II**
Practical : 0

Course Objective:

To develop the skill of solving differential equations and to provide knowledge of vector algebra and calculus. To make students familiar with calculus of several variables and infinite series.

1. Calculus of Two or More Variables **(6 hours)**

1.1 Introduction: limit and continuity
1.2 Partial derivatives
  1.2.1 Homogeneous function, Euler's theorem for the function of two and three variables
  1.2.2 Total derivatives
1.3 Extreme of functions of two and three variables; Lagrange's Multiplier

2. Multiple Integrals **(6 hours)**

2.1 Introduction
2.2 Double integrals in Cartesian and polar form; change of order of integration
2.3 Triple integrals in Cartesian, cylindrical and spherical coordinates;
2.4 Area and volume by double and triple integrals

3. Three Dimensional Solid Geometry **(11 hours)**

3.1 The straight line; Symmetric and general form
3.2 Coplanar lines
3.3 Shortest distance
3.4 Sphere
3.5 Plane Section of a sphere by planes
3.6 Tangent Planes and lines to the spheres
3.7 Right circular cone
3.8 Right circular cylinder

4. Solution of Differential Equations in Series and Special Functions (9 hours)

4.1 Solution of differential equation by power series method
4.2 Legendre's equation
4.3 Legendre polynomial function; Properties and applications.
4.4 Bessel's equation
4.5 Bessel's function of first and second kind. Properties and applications

5. Vector Algebra and Calculus **(8 hours)**

5.1 Introduction

5.2 Two and three dimensional vectors
5.3 Scalar products and vector products
5.4 Reciprocal System of vectors
5.5 Application of vectors: Lines and planes
5.6 Scalar and vector fields
5.7 Derivatives – Velocity and acceleration
5.8 Directional derivatives

6. Infinite Series **(5 hours)**

6.1 Introduction
6.2 Series with positives terms
6.3 convergence and divergence
6.4 Alternating series. Absolute convergence
6.5 Radius and interval of convergence

References:

1. Erwin Kreyszig, "Advanced Engineering Mathematics ", John Wiley and Sons Inc.
2. Thomas, Finney, "Calculus and Analytical Geometry", Addison- Wesley
3. M. B. Singh, B. C. Bajrachrya, "Differential Calculus", Sukunda Pustak Bhandar,Nepal
4. M. B. Singh, B. C. Bajrachrya, "A Text Book of Vectors", Sukunda Pustak Bhandar,Nepal
5. M. B. Singh, S. P. Shrestha, "Applied Engineering Mathematics", RTU, Department of Engineering Science and Humanities.
6. G.D. Pant, G. S. Shrestha, "Integral Calculus and Differential Equations", Sunila Prakashan,Nepal
7. Y. R. Sthapit, B. C. Bajrachrya, "A Text Book of Three Dimensional Geometry", Sukunda Pustak Bhandar,Nepal
8. Santosh Man Maskey, "Calculus", Ratna Pustak Bhandar, Nepal

MICROPROCESSORS

EX 551

Lecture : 3
Tutorial : 1
Practical : 3

Year : I
Part : II

Course Objective:

To familiarize students with architecture, programming, hardware and application of microprocessor

1. Introduction **(4 hours)**

- 1.1 Introduction and History of Microprocessors
- 1.2 Basic Block Diagram of a Computer
- 1.3 Organization of Microprocessor Based System
- 1.4 Bus Organization
- 1.5 Stored program Concept and Von Neumann Machine
- 1.6 Processing Cycle of a Stored Program Computer
- 1.7 Microinstructions and Hardwired/Microprogrammed Control Unit
- 1.8 Introduction to Register Transfer Language

2. Programming with 8085 Microprocessor **(10 hours)**

- 2.1 Internal Architecture and Features of 8085 microprocessor
- 2.2 Instruction Format and Data Format
- 2.3 Addressing Modes of 8085
- 2.4 Intel 8085 Instruction Set
- 2.5 Various Programs in 8085
  - 2.5.1 Simple Programs with Arithmetic and Logical Operations
  - 2.5.2 Conditions and Loops
  - 2.5.3 Array and Table Processing
  - 2.5.4 Decimal BCD Conversion
  - 2.5.5 Multiplication and Division

3. Programming with 8086 Microprocessor **(12 hours)**

- 3.1 Internal Architecture and Features of 8086 Microprocessor
  - 3.1.1 BIU and Components
  - 3.1.2 EU and Components
  - 3.1.3 EU and BIU Operations
  - 3.1.4 Segment and Offset Address
- 3.2 Addressing Modes of 8086

3.3 Assembly Language Programming
3.4 High Level versus Low Level Programming
3.5 Assembly Language Syntax
  3.5.1 Comments
  3.5.2 Reserved words
  3.5.3 Identifiers
  3.5.4 Statements
  3.5.5 Directives
  3.5.6 Operators
  3.5.7 Instructions
3.6 EXE and COM programs
3.7 Assembling, Linking and Executing
3.8 One Pass and Two Pass Assemblers
3.9 Keyboard and Video Services
3.10 Various Programs in 8086
  3.10.1 Simple Programs for Arithmetic, Logical, String Input/Output
  3.10.2 Conditions and Loops
  3.10.3 Array and String Processing
  3.10.4 Read and Display ASCII and Decimal Numbers
  3.10.5 Displaying Numbers in Binary and Hexadecimal Formats

4. Microprocessor System **(10 hours)**

4.1 Pin Configuration of 8085 and 8086 Microprocessors
4.2 Bus Structure
  4.2.1 Synchronous Bus
  4.2.2 Asynchronous Bus
  4.2.3 Read and Write Bus Timing of 8085 and 8086 Microprocessors
4.3 Memory Device Classification and Hierarchy
4.4 Interfacing I/O and Memory
  4.4.1 Address Decoding
  4.4.2 Unique and Non Unique Address Decoding
  4.4.3 I/O Mapped I/O and Memory Mapped I/O
  4.4.4 Serial and Parallel Interfaces
  4.4.5 I/O Address Decoding with NAND and Block Decoders (8085, 8086)
  4.4.6 Memory Address Decoding with NAND, Block and PROM Decoders (8085, 8086)
4.5 Parallel Interface
  4.5.1 Modes: Simple, Wait, Single Handshaking and Double Handshaking

4.5.2 Introduction to Programmable Peripheral Interface (PPI)

4.6 Serial Interface

4.6.1 Synchronous and Asynchronous Transmission

4.6.2 Serial Interface Standards: RS232, RS423, RS422, USB

4.6.3 Introduction to USART

4.7 Introduction to Direct Memory Access (DMA) and DMA Controllers

5. Interrupt Operations **(5 hours)**

5.1 Polling versus Interrupt

5.2 Interrupt Processing Sequence

5.3 Interrupt Service Routine

5.4 Interrupt Processing in 8085

5.4.1 Interrupt Pins and Priorities

5.4.2 Using Programmable Interrupt Controllers (PIC)

5.4.3 Interrupt Instructions

5.5 Interrupt Processing in 8086

5.5.1 Interrupt Pins

5.5.2 Interrupt Vector Table and its Organization

5.5.3 Software and Hardware Interrupts

5.5.4 Interrupt Priorities

6. Advanced Topics **(4 hours)**

6.1 Multiprocessing Systems

6.1.1 Real and Pseudo-Parallelism

6.1.2 Flynn's Classification

6.1.3 Instruction Level, Thread Level and Process Level Parallelism

6.1.4 Interprocess Communication, Resource Allocation and Deadlock

6.1.5 Features of Typical Operating System

6.2 Different Microprocessor Architectures

6.2.1 Register Based and Accumulator Based Architecture

6.2.2 RISC and CISC Architectures

6.2.3 Digital Signal Processors

Practical:

There will be about 12 lab exercises to program 8085 and 8086 microprocessors.

References:

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Application with 8085", Prentice Hall
2. Peter Abel, "IBM PC Assembly Language and Programming", Pearson Education Inc.
3. D. V. Hall, "Microprocessor and Interfacing, Programming and Hardware", Tata McGraw Hill
4. John Uffenbeck, "Microcomputers and Microprocessors, The 8080, 8085 and Z-80 Programming, Interfacing and Troubleshooting", Prentice Hall
5. Walter A. Triebel and Avtar Singh, "The 8088 and 8086 Microprocessors, Programming, Interfacing, Software, Hardware and Applications", Prentice Hall
6. William Stalling, "Computer Organization and Architecture", Prentice Hall

OBJECT ORIENTED PROGRAMMING

CT 501

Lecture : 3
Tutorial : 0
Practical : 3

Year : I
Part : II

Course Objective:

To familiarize students with the C++ programming language and use the language to develop object oriented programs

1. Introduction to Object Oriented Programming **(3 hours)**

- 1.1 Issues with Procedure Oriented Programming
- 1.2 Basic of Object Oriented Programming (OOP)
- 1.3 Procedure Oriented versus Object Oriented Programming
- 1.4 Concept of Object Oriented Programming
  - 1.4.1 Object
  - 1.4.2 Class
  - 1.4.3 Abstraction
  - 1.4.4 Encapsulation
  - 1.4.5 Inheritance
  - 1.4.6 Polymorphism
- 1.5 Example of Some Object Oriented Languages
- 1.6 Advantages and Disadvantages of OOP

2. Introduction to C++ **(2 hours)**

- 2.1 The Need of C++
- 2.2 Features of C++
- 2.3 C++ Versus C
- 2.4 History of C++

3. C++ Language Constructs **(6 hours)**

- 3.1 C++ Program Structure
- 3.2 Character Set and Tokens
  - 3.2.1 Keywords
  - 3.2.2 Identifiers
  - 3.2.3 Literals
  - 3.2.4 Operators and Punctuators
- 3.3 Variable Declaration and Expression
- 3.4 Statements
- 3.5 Data Type
- 3.6 Type Conversion and Promotion Rules
- 3.7 Preprocessor Directives
- 3.8 Namespace
- 3.9 User Defined Constant const
- 3.10 Input/Output Streams and Manipulators

- 3.11 Dynamic Memory Allocation with new and delete
- 3.12 Condition and Looping
- 3.13 Functions
  - 3.13.1 Function Syntax
  - 3.13.2 Function Overloading
  - 3.13.3 Inline Functions
  - 3.13.4 Default Argument
  - 3.13.5 Pass by Reference
  - 3.13.6 Return by Reference
- 3.14 Array, Pointer and String
- 3.15 Structure, Union and Enumeration

4. Objects and Classes **(6 hours)**

- 4.1 C++ Classes
- 4.2 Access Specifiers
- 4.3 Objects and the Member Access
- 4.4 Defining Member Function
- 4.5 Constructor
  - 4.5.1 Default Constructor
  - 4.5.2 Parameterized Constructor
  - 4.5.3 Copy Constructor
- 4.6 Destructors
- 4.7 Object as Function Arguments and Return Type
- 4.8 Array of Objects
- 4.9 Pointer to Objects and Member Access
- 4.10 Dynamic Memory Allocation for Objects and Object Array
- 4.11 this Pointer
- 4.12 static Data Member and static Function
- 4.13 Constant Member Functions and Constant Objects
- 4.14 Friend Function and Friend Classes

5. Operator Overloading **(5 hours)**

- 5.1 Overloadable Operators
- 5.2 Syntax of Operator Overloading
- 5.3 Rules of Operator Overloading
- 5.4 Unary Operator Overloading
- 5.5 Binary Operator Overloading
- 5.6 Operator Overloading with Member and Non Member Functions
- 5.7 Data Conversion: Basic – User Defined and User Defined – User Defined
- 5.8 Explicit Constructors

6. Inheritance **(5 hours)**

- 6.1 Base and Derived Class
- 6.2 protected Access Specifier
- 6.3 Derived Class Declaration
- 6.4 Member Function Overriding

6.5 Forms of Inheritance: single, multiple, multilevel, hierarchical, hybrid, multipath
6.6 Multipath Inheritance and Virtual Base Class
6.7 Constructor Invocation in Single and Multiple Inheritances
6.8 Destructor in Single and Multiple Inheritances

7. Polymorphism and Dynamic Binding (4 hours)

7.1 Need of Virtual Function
7.2 Pointer to Derived Class
7.3 Definition of Virtual Functions
7.4 Array of Pointers to Base Class
7.5 Pure Virtual functions and Abstract Class
7.6 Virtual Destructor
7.7 reinterpret_cast Operator
7.8 Run-Time Type Information
  7.8.1 dynamic_cast Operator
  7.8.2 typeid Operator

8. Stream Computation for Console and File Input /Output (5 hours)

8.1 Stream Class Hierarchy for Console Input /Output
8.2 Testing Stream Errors
8.3 Unformatted Input /Output
8.4 Formatted Input /Output with ios Member functions and Flags
8.5 Formatting with Manipulators
8.6 Stream Operator Overloading
8.7 File Input/output with Streams
8.8 File Stream Class Hierarchy
8.9 Opening and Closing files
8.10 Read/Write from File
8.11 File Access Pointers and their Manipulators
8.12 Sequential and Random Access to File
8.13 Testing Errors during File Operations

9. Templates (5 hours)

9.1 Function Template
9.2 Overloading Function Template
  9.2.1 Overloading with Functions
  9.2.2 Overloading with other Template
9.3 Class Template
  9.3.1 Function Definition of Class Template
  9.3.2 Non-Template Type Arguments
  9.3.3 Default Arguments with Class Template
9.4 Derived Class Template
9.5 Introduction to Standard Template Library
  9.5.1 Containers
  9.5.2 Algorithms
  9.5.3 Iterators

10. Exception Handling **(4 hours)**

10.1 Error Handling
10.2 Exception Handling Constructs (try, catch, throw)
10.3 Advantage over Conventional Error Handling
10.4 Multiple Exception Handling
10.5 Rethrowing Exception
10.6 Catching All Exceptions
10.7 Exception with Arguments
10.8 Exceptions Specification for Function
10.9 Handling Uncaught and Unexpected Exceptions

Practical:

There will be about 12 lab exercises covering the course. At the end of the course students must complete a programming project on object oriented programming with C++.

References :

1. Robert Lafore, "Object Oriented Programming in C++", Sams Publication
2. DayaSagarBaral and DiwakarBaral, "The Secrets of Object Oriented Programming in C++", BhundipuranPrakasan
3. Harvey M. Deitel and Paul J. Deitel, "C++ How to Program", Pearson Education Inc.
4. D. S. Malik, "C++ Programming", Thomson Course Technology
5. Herbert Schildt, "C++: The Complete Reference", Tata McGraw Hill

ENGINEERING CHEMISTRY
SH 453

Lecture : 3
Tutorial : 1
Practical : 3

Year : I
Part : II

Course Objective:

To develop the basic concepts of Physical Chemistry, Inorganic Chemistry and Organic Chemistry relevant to problems in engineering.

1. Electro-chemistry and Buffer **(6 hours)**

1.1 Electro-chemical cells
1.2 Electrode Potential and Standard Electrode Potential
1.3 Measurement of Electrode Potential
1.4 Nernst equation
1.5 EMF of Cell
1.6 Application of Electrochemical and Electrolytic cells
1.7 Electrochemical Series and its Application
1.8 Buffer: its type and mechanism
1.9 Henderson's equation for pH of buffer and related problems
1.10 Corrosion and its type
1.11 Factors influencing corrosion
1.12 Prevention of corrosion

2. Catalyst **(4 hours)**

2.1 Introduction
2.2 Action of Catalyst (Catalytic Promoters and Catalytic Poisons)
2.3 Characteristics of Catalyst
2.4 Types of Catalyst
2.5 Theories of Catalysis
2.6 Industrial Applications of Catalysts

3. Environmental Chemistry **(5 hours)**

3.1 Air Pollution
3.2 Air Pollutants i) gases SO_x, NO_x, CO, CO_2, O_3 and hydrocarbons ii) particulates dust, smoke and fly ash
3.3 Effects of Air Pollutants on human beings and their possible remedies
3.4 Ozone depletion and its photochemistry
3.5 Water Pollution (Ref of surface water and pound water)
3.6 Water Pollutants (Ref of surface water) their adverse effect and remedies
3.7 Soil pollution
3.8 Pollutants of soil their adverse effects and possible remedies

4. Engineering Polymers **(6 hours)**

4.1 Inorganic polymers
4.2 General properties of inorganic polymers
4.3 Polyphosphazines
4.4 Sulpher Based Polymers
4.5 Chalcogenide Glasses
4.6 Silicones
4.7 Organic Polymers
4.8 Types of Organic Polymers
4.9 Preparation and application of
i) Polyurethane ii) Polystyrene iii) Polyvinylchloride iv) Teflon v) Nylon 6,6 and vi) Bakelite vii) Epoxy Resin viii) Fiber Reinforced Polymer
4.10 Concept of bio-degradable, non-biodegradable and conducting polymers

5. 3-d Transition elements and their applications **(5 hours)**

5.1 Introduction
5.2 Electronic Configuration
5.3 Variable oxidation states
5.4 Complex formation tendency
5.5 Color formation
5.6 Magnetic properties
5.7 Alloy formation
5.8 Applications of 3-d transition elements

6. Coordination Complexes **(5 hours)**

6.1 Introduction
6.2 Terms used in Coordination Complexes
6.3 Werner's Theory Coordination Complexes
6.4 Sidgwick's model and Sidgwick's effective atomic number rule
6.5 Nomenclature of coordination compounds (Neutral type, simple cation and complex anion and complex cation and simple anion type)
6.6 Valence Bond Theory of Complexes
6.7 Application of valence bond theory in the formation of i) Tetrahedral Complexes ii) Square planar Complexes and iii) Octahedral Complexes
6.8 Limitations of Valence Bond Theory
6.9 Applications of Coordination Complexes

7. Explosives **(3 hours)**

7.1 Introduction
7.2 Types of explosives: Primary, Low and High explosives
7.3 Preparation and application of TNT, TNG, Nitrocellulose and Plastic explosives

8. Lubricants and Paints **(3 hours)**

8.1 Introduction
8.2 Function of Lubricants
8.3 Classification of Lubricants (Oils, Greases and Solid)
8.4 Paints
8.5 Types of Paint
8.6 Application of Paints

9. Stereochemistry **(4 hours)**

9.1 Introduction
9.2 Geometrical Isomerism (Cis Trans Isomerism) Z and E concept of Geometrical Isomerism
9.3 Optical Isomerism with reference to two asymmetrical carbon center molecules
9.4 Terms Optical activity, Enantiomers, Diastereomers, Meso structures, Racemic mixture and Resolution

10. Reaction Mechanism in Organic reactions **(4 hours)**

10.1 Substitution reaction
10.2 Types of substitution reaction SN^1 and SN^2
10.3 Elimination reaction
10.4 Types of elimination reaction El and E2
10.5 Factors governing SN^1, SN^2, El and E2 reaction mechanism path

References:

1. Jain and Jain, "Engineering Chemistry", Dhanpat Rai Publishing Co.
2. Shashi Chawala, "A Text Book of Engineering Chemistry", Dhanpat Rai Publishing Co.
3. J. D. Lee, "A New Concise Inorganic Chemistry", Wiley India Pvt. Limited.
4. Marron and Prutton, "Principles of Physical Chemistry", S. Macmillan and Co. Ltd.
5. Bahl and Tuli, "Essential of Physical Chemistry", S. Chand and Co. Ltd.
6. Satya Prakash and Tuli, "Advanced Inorganic Chemistry Vol 1 and 2", S. Chand and Co. Ltd
7. Morrison and Boyd, "Organic chemistry"
8. Moti Kaji Sthapit, "Selected Topics in Physical Chemistry", Taleju Prakashan, Kathmandu.
9. Peavy, Rowe and Tchobanoglous, "Environmental Engineering", McGraw-Hill, New York.
10. R. K. Sharma, B. Panthi and Y. Gotame, "Textbook of Engineering Chemistry", Athrai Publication.

Practical:

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

ELECTRIC CIRCUITS AND MACHINES

EE .....

Lecture : 4
Tutorial : 1
Practical : 3/2

Year : I
Part : II

Course Objectives:

To continue work in Basic Electrical Engineering including transient analysis and electric machines.

1. **Network Analysis of AC circuit & dependent sources (6 hours)**
   - 1.1 Mesh Analysis
   - 1.2 Nodal Analysis
   - 1.3 Series & parallel resonance in RLC circuits
     - 1.3.1 Impedance and phase angle of series Resonant Circuit
     - 1.3.2 Voltage and current in series resonant circuit
     - 1.3.3 Band width of the RLC circuit.
     - 1.3.4 High-Q and Low-Q circuits

2. **Initial Conditions (2 hours)**
   - 2.1 Characteristics of various network elements
   - 2.2 Initial value of derivatives
   - 2.3 Procedure for evaluating initial conditions
   - 2.4 Initial condition in the case of R-L-C network

3. **Transient analysis in RLC circuit by direct solution (10 hours)**
   - 3.1 Introduction
   - 3.2 First order differential equation
   - 3.3 Higher order homogeneous and non-homogeneous differential equations
   - 3.4 Particular integral by method of undetermined coefficients
   - 3.5 Response of R-L circuit with DC, Sinusoidal and Exponential excitations
   - 3.6 Response of R-C circuit with DC, Sinusoidal and Exponential excitations
   - 3.7 Response of series R-L-C circuit with DC, Sinusoidal and Exponential excitations

4. **Transient analysis in RLC circuit by Laplace Transform (8 hours)**
   - 4.1 Introduction
   - 4.2 The Laplace Transformation
   - 4.3 Important properties of Laplace transformation
   - 4.4 Use of Partial Fraction expansion in analysis using Laplace Transformations
   - 4.5 Heaviside's partial fraction expansion theorem
   - 4.6 Response of R-L circuit with DC, Sinusoidal and Exponential excitations
   - 4.7 Response of R-C circuit with DC, Sinusoidal and Exponential excitations
   - 4.8 Response of series R-L-C circuit with DC, Sinusoidal and Exponential excitations
   - 4.9 Transfer functions Poles and Zeros of Networks

5. **Two-port Parameter of Networks (6 Hours)**
   - 5.1 Definition of two-port networks
   - 5.2 Short circuit admittance parameters
   - 5.3 Open circuits impedance parameters
   - 5.4 Transmission Short circuit admittance parameters

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5.5 Hybrid parameters
5.6 Relationship and transformations between sets of parameters
5.7 Application to filters
5.8 Applications to transmission lines
5.9 Interconnection of two-port network (Cascade, series, parallel)

6. **Magnetic Circuits and Induction** (4hours)
6.1 Magnetic Circuits
6.2 Ohm's Law for Magnetic Circuits
6.3 Series and Parallel magnetic circuits
6.4 Core with air gap
6.5 B-H relationship (Magnetization Characteristics)
6.6 Hysteresis with DC and AC excitation
6.7 Hysteresis Loss and Eddy Current Loss
6.8 Faraday's Law of Electromagnetic Induction, Statically and Dynamically Induced EMF
6.9 Force on Current Carrying Conductor

7. **Transformer** (8 hours)
7.1 Constructional Details, recent trends
7.2 Working principle and EMF equation
7.3 Ideal Transformer
7.4 4No load and load Operation
7.5 Operation of Transformer with load
7.6 Equivalent Circuits and Phasor Diagram
7.7 Tests: Polarity Test, Open Circuit test, Short Circuit test and Equivalent Circuit Parameters
7.8 Voltage Regulation
7.9 Losses in a transformer
7.10 Auto transformer: construction, working principle and Cu saving

8. **DC Machines** (8 hours)
8.1 Constructional Details and Armature Winding
8.2 Working principle of DC generator and EMF equation
8.3 Working principle of DC motor and Torque equation
8.4 Back EMF
8.5 Method of excitation, Types of DC motor
8.6 Performance Characteristics of D.C. motors
8.7 Starting of D.C. Motors: 3 point and 4 point starters
8.8 Speed control of D.C. motors: Field Control, Armature Control
8.9 Losses and Efficiency

9. **AC Motors** (8 hours)
9.1 Three phase induction motor- construction, operating principle and torque speed characteristics
9.2 Single phase Induction Motors: Construction and Characteristics

9.3 Double Field Revolving Theory

9.4 Split phase Induction Motor

9.3.1 Capacitors start and run motor

9.3.2 Reluctance start motor

9.5 Alternating Current Series motor and Universal motor

9.6 Special Purpose Machines: Stepper motor, Schrage motor and Servo motor

Practical:

1. **Resonance in RLC series circuit**
   - measurement of resonant frequency

2. **Transient Response in first Order System passive circuits**
   - measure step and impulse response of RL and RC circuit using oscilloscope
   - relate time response to analytical transfer functions calculations

3. **Transient Response in Second Order System passive circuits**
   - measure step and impulse response of RLC series and parallel circuits using oscilloscope
   - relate time response to transfer functions and pole-zero configuration

4. **Two Winding Transformers**
   - To perform turn ratio test
   - To perform open circuit (OC) and short circuit (SC) test to determine equivalent circuit parameter of a transformer and hence to determine the regulation and efficiency at full load

5. **DC Motor**
   - Speed control of DC Shunt motor by (a) armature control method (b) field control method
   - To observe the effect of increasing load on DC shunt motor's speed, armature current, and field current.

6. **Single Phase AC Motors**
   - To study the effect of a capacitor on the starting and running of a single-phase induction motor
   - Reversing the direction of rotation of a single phase capacitor induct

References:

1. M. E. Van Valkenburg, "Network Analysis", Prentice Hall, 2010.
2. William H. Hyat. Jr. & Jack E. Kemmerly, "Engineering Circuits Analysis", McGraw Hill International Editions, Electrical Engineering Series, 1987.
3. Michel D. Cilletti, "Introduction to Circuit Analysis and Design", Holt, Hot Rinehart and Winston International Edition, New York, 1988.
4. P.C.Sen, " Principles of Electric Machines and Power Electronics", Wiley.
5. I.J. Nagrath & D.P.Kothari," Electrical Machines", Tata McGraw Hill
6. S. K. Bhattacharya, "Electrical Machines", Tata McGraw Hill
7. B. L. Theraja and A. K. Theraja, "Electrical Technology (Vol-II)", S. Chand
8. Husain Ashfaq ," Electrical Machines", DhanpatRai& Sons

WORKSHOP TECHNOLOGY

ME 453

Lecture : 1 **Year : I**
Tutorial : 0 **Part : II**
Practical : 3

Course Objective:

To impart knowledge and skill components in the field of basic workshop technology. To be familiar with different hand and machine tools required for manufacturing simple metal components and articles.

1. General Safety Considerations **(2 hours)**

1.1 Bench Tools
1.2 Machinist's Hammers
1.3 Screw Drivers
1.4 Punches
1.5 Chisels
1.6 Scrapers
1.7 Scribers
1.8 Files
1.9 Pliers and Cutters
1.10 Wrenches
1.11 Hacksaw
1.12 Bench Vise
1.13 Hand drill
1.14 Taps and Dies
1.15 Hand Shears
1.16 Rules, Tapes and Squares
1.17 Soldering Iron
1.18 Rivets

2. Hand Working Operations **(1 hours)**

2.1 Sawing
2.2 Filing
2.3 Threading
2.4 Scribing
2.5 Shearing
2.6 Soldering
2.7 Riveting

3. Measuring and Gauging **(1hours)**

3.1 Introduction
3.2 Semi – Precision Tools – Calipers, depth Gauge, Feeler Gauge
3.3 Precision Tools – Micrometers, Vernier Calipers, Vernier Height Gauge,

Telescopic Gauge, Hole Gauge, Bevel Protractor, Dial Indicator, Gauge Blocks and Surface Plate

4. Drills and Drilling Processes **(1 hours)**

4.1 Introduction
4.2 Types of Drill Presses
4.3 Work Holding Devices and Accessories
4.4 Cutting Tools
4.5 Geometry of Drill Bits
4.6 Grinding of Drill Bits
4.7 Operations – Drilling, Counter - boring, Counter - sinking, Reaming, Honning, Lapping
4.8 Cutting Speeds
4.9 Drilling Safety

5. Machine Tools **(4 hours)**

5.1 General Safety Considerations
5.2 Engine Lathes
- 5.2.1 Introduction
- 5.2.2 Physical Construction
- 5.2.3 Types of Lathe
- 5.2.4 Lathe Operations – Facing, Turning, Threading

5.3 Shapers
- 5.3.1 Introduction
- 5.3.2 Types of Shapers
- 5.3.3 Physical Construction
- 5.3.4 General Applications

5.4 Milling Machines
- 5.4.1 Introduction
- 5.4.2 Types of Milling Machines
- 5.4.3 Physical Construction
- 5.4.4 Milling Cutters – Plain, Side, Angle, End, Form
- 5.4.5 Milling Operations – Plain, Side, Angular, Gang, End, Form, Keyway
- 5.4.6 Work Holding Devices
- 5.4.7 Cutter Holding Devices

5.5 Grinding Machines
- 5.5.1 Abrasives, Bonds, Grinding Wheels
- 5.5.2 Rough Grinders – Portable Grinders, Bench Grinders, Swing Frame Grinders, Abrasive Belt Grinders
- 5.5.3 Precision Grinders – Cylindrical Grinders, Surface Grinders

6. Material Properties **(1 hours)**

6.1 Tool materials – Low, medium and high carbon steels; Hot and cold rolled steels; Alloy steels; Carbide and Ceramic materials

6.2 Heat treating methods for steels – Annealing, Tempering, Normalizing, Hardening and Quenching
6.3 Non – ferrous metals – Brass, Bronze, Aluminum – Comparative Properties

7. Sheet Metal Works **(1 hours)**

7.1 Introduction
7.2 Sheet Metal Tools
7.3 Marking and Layout
7.4 Operations – Bending, Cutting, Rolling

8. Foundry Practice **(1 hours)**

8.1 Introduction
8.2 Pattern Making
8.3 Foundry Tools
8.4 Core Making
8.5 Melting Furnace – Cupola
8.6 Sand Casting Process

9. Forging Practice **(1 hours)**

9.1 Introduction
9.2 Forging Tools
9.3 Operations – Upsetting, Drawing, Cutting, Bending, Punching
9.4 Forging Presses and Hammers
9.5 Advantages and Limitations

10. Metal Joining **(2 hours)**

10.1 Safety Considerations
10.2 Introduction
10.3 Soldering
10.4 Brazing
10.5 Welding – Gas Welding, Arc Welding, Resistance Welding, Tungsten Inert Gas Welding (TIG), Metal Inert Gas Welding (MIG)

Practical:

1. Bench Tools and hand operations: Measuring, Marking, Layout, Cutting, Filling, Drilling, Tapping, Assembly
2. Bench Tools and hand operations: (Contd.)
3. Drilling machines
4. Measuring and Gauging Instruments
5. Engine lathe: Basic operations such as Plain turning, facing, cutting off, knurling.
6. Engine lathe: Taper turning, drilling and boring
7. Basic Shaper Operations
8. Milling Machines

. Grinding Machines
0. Sheet Metal works
1. Foundry Practice
2. Forging Practice
3. Electric Arc Welding
4. Gas Welding

eferences:

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. O. D. Lascoe, C. A. Nelson and H. W. Porter, "Machine shop operations and setups", American Technical society.
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2. H. S. Bawa, "Workshop Technology - Vol. II" , Tata Mc – Graw Hill publishing company Limited, New Delhi, INDIA,
3. R. S. Khurmi and J. K. Gupta, "A text book of Workshop Technology", S. Chand and Company Ltd, New Delhi. INDIA

ENGINEERING MATHEMATICS III

SH 501

Lecture : 3 **Year : II**
Tutorial : 2 **Part : I**
Practical : 0

Course Objective:

To round out the students' preparation for more sophisticated applications with an introduction to linear algebra, Fourier series, Laplace Transforms, integral transformation theorems and linear programming.

1. Determinants and Matrices (11 hours)

1.1 Determinant and its properties
1.2 Solution of system of linear equations
1.3 Algebra of matrices
1.4 Complex matrices
1.5 Rank of matrices
1.6 System of linear equations
1.7 Vector spaces
1.8 Linear transformations
1.9 Eigen value and Eigen vectors
1.10 The Cayley-Hamilton theorem and its uses
1.11 Diagonalization of matrices and its applications

2. Line, Surface and Volume Integrals (12 hours)

2.1 Line integrals
2.2 Evaluation of line integrals
2.3 Line integrals independent of path
2.4 Surfaces and surface integrals
2.5 Green's theorem in the plane and its applications
2.6 Stoke's theorem (without proof) and its applications
2.7 Volume integrals; Divergence theorem of Gauss (without proof) and its applications

3. Laplace Transform (8 hours)

3.1 Definitions and properties of Laplace Transform
3.2 Derivations of basic formulae of Laplace Transform
3.3 Inverse Laplace Transform: Definition and standard formulae of inverse Laplace Transform
3.4 Theorems on Laplace transform and its inverse
3.5 Convolution and related problems
3.6 Applications of Laplace Transform to ordinary differential equations

4. Fourier Series **(5 hours)**

4.1 Fourier Series
4.2 Periodic functions
4.3 Odd and even functions
4.4 Fourier series for arbitrary range
4.5 Half range Fourier series

5. Linear Programming **(9 hours)**

5.1 System of Linear Inequalities in two variables
5.2 Linear Programming in two dimensions: A Geometrical Approach
5.3 A Geometric introduction to the Simplex method
5.4 The Simplex method: Maximization with Problem constraints of the form "$\leq$"
5.5 The Dual: Maximization with Problem Constraints of the form "$\geq$"
5.6 Maximization and Minimization with mixed Constraints. The two-phase method
(An alternative to the Big M Method)

References:

1. S. K. Mishra, G. B. Joshi, V. Parajuli, "Advance Engineering Mathematics", Athrai Publication.
2. E. Kreszig, "Advance Engineering Mathematics", Willey, New York.
3. M.M Gutterman and Z.N.Nitecki, "Differential Equation, a First Course", Saunders, New York.

ELECTRONIC DEVICES AND CIRCUITS

EX 501

Lecture : 3 **Year : II**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

To introduce the fundamentals of analysis of electronic circuits and to provide basic understanding of semiconductor devices and analog integrated circuits

1. Diodes **(5 hours)**

1.1 The Ideal Diode
1.2 Terminal Characteristics of Junction Diodes
1.3 Physical Operation of Diodes
1.4 Analysis of Diode Circuits
1.5 Small Signal Model and Its Application
1.6 Operation in the Reverse Breakdown Region - Zener Diodes

2. The Bipolar Junction Transistor **(10 hours)**

2.1 Operation of the npn transistor in the Active Mode
2.2 Graphical Representation of Transistor Characteristics
2.3 Analysis of Transistor Circuits at DC
2.4 Transistor as an Amplifier
2.5 Small Signal Equivalent Circuit Models
2.6 Graphical Load Line Analysis
2.7 Biasing BJT for Discrete-Circuit Design
2.8 Basic Single-Stage BJT Amplifier Configurations (C-B, C-E, C-C)
2.9 Transistor as a Switch – Cutoff and Saturation
2.10 A General Large-Signal Model for the BJT: The Ebers-Moll Model

3. Field-Effect Transistor **(9 hours)**

3.1 Structure and Physical Operation of Enhancement-Type MOSFET
3.2 Current-Voltage Characteristics of Enhancement-Type MOSFET
3.3 The Depletion-Type MOSFET
3.4 MOSFET Circuits at DC
3.5 MOSFET as an Amplifier
3.6 Biasing in MOS Amplifier Circuits
3.7 Junction Field-Effect Transistor

4. Output Stages and Power Amplifiers (9 hours)

4.1 Classification of Output Stages
4.2 Class A Output Stage
4.3 Class B Output Stage
4.4 Class AB Output Stage
4.5 Biasing the Class AB Stage
4.6 Power BJTs
4.7 Transformer-Coupled Push-Pull Stages *
4.8 Tuned Amplifiers

5. Signal Generator and Waveform-Shaping Circuits (6 hours)

5.1 Basic Principles of Sinusoidal Oscillator
5.2 Op Amp-RC Oscillator Circuits
5.3 LC and Crystal Oscillators
5.4 Generation of Square and Triangular Waveforms Using AstableMultivibrators
5.5 Integrated Circuit Timers
5.6 Precision Rectifier Circuits

6. Power Supplies, Breakdown Diodes, and Voltage Regulators (6 hours)

6.1 Unregulated Power Supply
6.2 Bandgap Voltage Reference, a Constant Current Diodes
6.3 Transistor Series Regulators
6.4 Improving Regulator Performance
6.5 Current Limiting
6.6 Integrated Circuit Voltage Regulator

Practical:

1. Bipolar Junction Transistor Characteristics and Single Stage Amplifier
2. Field-Effect Transistor Characteristics and Single Stage Amplifier
3. Power Amplifiers
4. Relaxation Oscillator and Sinusoidal Oscillator
5. Series and Shunt Voltage Regulators

References:

1. A.S. Sedra and K.C. Smith, "Microelectronic Circuits", Oxford University Press.
2. David A. Bell, " Electronics Device and Circuits ", PHI.

3. Robert Boylestad and Louis Nashelsky, " Electronic Device and Circuit Theory", PHI
4. Thomas L. Floyd, "Electronic Devices", Pearson Education Inc.
5. Mark N. Horenstein, "Microelectronic Circuits and Devices", PHI
6. Paul Horowitz and Winfield Fill, "The Art of Electornics", Cambridge Publication
7. Jacob Millman and Christos C. Halkias,andSatyabrataJit "Millman's Electronic Device and Circuits", Tata McGraw- Hill

CONTROL SYSTEM
EE 602

Lecture : 3 **Year : II**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

To present the basic concepts on analysis and design of control system and to apply these concepts to typical physical processes.

1. Control System Background **(2 hours)**

1.1 History of control system and its importance
1.2 Control system: Characteristics and Basic features
1.3 Types of control system and their comparison

2. Component Modeling **(6 hours)**

2.1 Differential equation and transfer function notations
2.2 Modeling of Mechanical Components: Mass, spring and damper
2.3 Modeling of Electrical components: Inductance, Capacitance, Resistance, DC and AC motor, Transducers and operational amplifiers
2.4 Electric circuit analogies (force-voltage analogy and force- current analogy)
2.5 Linearized approximations of non-linear characteristics

3. System Transfer Function and Responses **(6 hours)**

3.1 Combinations of components to physical systems
3.2 Block diagram algebra and system reduction
3.3 Signal flow graphs
3.4 Time response analysis:
  3.4.1 Types of test signals (Impulse, step, ramp, parabolic)
  3.4.2 Time response analysis of first order system
  3.4.3 Time response analysis of second order system
  3.4.4 Transient response characteristics
3.5 Effect of feedback on steady state gain, bandwidth, error magnitude and system dynamics

4. Stability **(4 hours)**

4.1 Introduction of stability and causes of instability
4.2 Characteristic equation, root location and stability
4.3 Setting loop gain using Routh-Hurwitz criterion
4.4 R-H stability criterion
4.5 Relative stability from complex plane axis shifting

5. Root Locus Technique **(7 hours)**

5.1 Introduction of root locus

5.2 Relationship between root loci and time response of systems
5.3 Rules for manual calculation and construction of root locus
5.4 Analysis and design using root locus concept
5.5 Stability analysis using R-H criteria

6. Frequency Response Techniques **(6 hours)**

6.1 Frequency domain characterization of the system
6.2 Relationship between real and complex frequency response
6.3 Bode Plots: Magnitude and phase
6.4 Effects of gain and time constant on Bode diagram
6.5 Stability from Bode diagram (gain margin and phase margin)
6.6 Polar Plot and Nyquist Plot
6.7 Stability analysis from Polar and Nyquist plot

7. Performance Specifications and Compensation Design **(10 hours)**

7.1 Time domain specification
  7.1.1 Rise time, Peak time, Delay time, settling time and maximum overshoot
  7.1.2 Static error co-efficient
7.2 Frequency domain specification
  7.2.1 Gain margin and phase margin
7.3 Application of Root locus and frequency response on control system design
7.4 Lead, Lag cascade compensation design by Root locus method.
7.5 Lead, Lag cascade compensation design by Bode plot method.
7.6 PID controllers

8. State Space Analysis **(4 hours)**

8.1 Definition of state -space
8.2 State space representation of electrical and mechanical system
8.3 Conversion from state space to a transfer function.
8.4 Conversion from transfer function to state space.
8.5 State-transition matrix.

Practical:

1. To study open loop and closed mode for d.c motor and familiarization with different components in D.C motor control module.
2. To determine gain and transfer function of different control system components.
3. To study effects of feedback on gain and time constant for closed loop speed control system and position control system.
4. To determine frequency response of first order and second order system and to get transfer function.
5. Simulation of closed loop speed control system and position control system and verification

References:

1. Ogata, K., "Modern Control Engineering", Prentice Hall
2. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill
3. Kuo, B.C., "Automatic Control System", Prentice Hall
4. Nagrath & Gopal, "Modern Control Engineering", New Ages International

PROBABILITY AND STATISTICS

SH 602

Lecture : 3
Tutorial : 1
Practical : 0

Year : II
Part : I

Course Objective:

To provide the students with practical knowledge of the principles and concept of probability and statistics and their application in engineering field.

1. Descriptive statistics and Basic probability **(6 hours)**

- 1.1 Introduction to statistics and its importance in engineering
- 1.2 Describing data with graphs (bar, pie, line diagram, box plot)
- 1.3 Describing data with numerical measure(Measuring center, Measuring variability)
- 1.4 Basic probability, additive Law, Multiplicative law, Baye's theorem.

2. Discrete Probability Distributions **(6 hours)**

- 2.1 Discrete random variable
- 2.2 Binomial Probability distribution
- 2.3 Negative Binomial distribution
- 2.4 Poison distribution
- 2.5 Hyper geometric distribution

3. Continuous Probability Distributions **(6 hours)**

- 3.1 Continuous random variable and probability densities
- 3.2 Normal distribution
- 3.3 Gama distribution
- 3.4 Chi square distribution

4. Sampling Distribution **(5 hours)**

- 4.1 Population and sample
- 4.2 Central limit theorem
- 4.3 Sampling distribution of sample mean
- 4.4 Sampling distribution of sampling proportion

5. Inference Concerning Mean **(6 hours)**

- 5.1 Point estimation and interval estimation
- 5.2 Test of Hypothesis
- 5.3 Hypothesis test concerning One mean
- 5.4 Hypothesis test concerning two mean
- 5.5 One way ANOVA

6. Inference concerning Proportion **(6 hours)**

6.1 Estimation of Proportions
6.2 Hypothesis concerning one proportion
6.3 Hypothesis concerning two proportion
6.4 Chi square test of Independence

7. Correlation and Regression **(6 hours)**

7.1 Correlation
7.2 Least square method
7.3 An analysis of variance of Linear Regression model
7.4 Inference concerning Least square method
7.5 Multiple correlation and regression

8. Application of computer on statistical data computing **(4 hours)**

8.1 Application of computer in computing statistical problem. eq scientific calculator, EXCEL, SPSS , Matlab etc

References:

1. Richard A. Johnson, "Probability and Statistics for Engineers", Miller and Freund's publication.
2. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Brooks/Cole publishing Company, Monterey, California.
3. Richard I. Levin, David S Rubin, "Statistics For Management", Prentice Hall publication.
4. Mendenhall Beaver Beaver, "Introduction Probability and statistics", Thomson Brooks/Cole.

ELECTROMAGNETICS

EX 503

Lecture : 3 **Year : II**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

To provide basic understanding of the fundamentals of Electromagnetics

1. Introduction **(3 hours)**

1.1 Co-ordinate system.
1.2 Scalar and vector fields.
1.3 Operations on scalar and vector fields.

2. Electric field **(12 hours)**

2.1 Coulomb's law.
2.2 Electric field intensity.
2.3 Electric flux density.
2.4 Gauss's law and applications.
2.5 Physical significance of divergence, Divergence theorem.
2.6 Electric potential, potential gradient.
2.7 Energy density in electrostatic field.
2.8 Electric properties of material medium.
2.9 Free and bound charges, polarization, relative permittivity, electric dipole.
2.10 Electric Boundary conditions.
2.11 Current, current density, conservation of charge, continuity equation, relaxation time.
2.12 Boundary value problems, Laplace and Poisson equations and their solutions, uniqueness theorem.
2.13 Graphical field plotting, numerical integration.

3. Magnetic field **(9 hours)**

3.1 Biot-Savart's law.
3.2 Magnetic field intensity.
3.3 Ampere's circuital law and its application.
3.4 Magnetic flux density.
3.5 Physical significance of curl, Stoke's theorem.
3.6 Scalar and magnetic vector potential.
3.7 Magnetic properties of material medium.
3.8 Magnetic force, magnetic torque, magnetic moment, magnetic dipole, magnetization.
3.9 Magnetic boundary condition.

4. Wave equation and wave propagation **(13 hours)**

4.1 Faraday's law, transformer emf, motional emf.
4.2 Displacement current.

4.3 Maxwell's equations in integral and point forms.
4.4 Wave propagation in lossless and lossy dielectric.
4.5 Plane waves in free space, lossless dielectric, good conductor.
4.6 Power and pointing vector.
4.7 Reflection of plane wave at normal incidence.

5. Transmission lines **(5 hours)**

5.1 Transmission line equations.
5.2 Input impedance, reflection coefficient, standing wave ratio.
5.3 Impadance matching, quarter wave transformer, single stub matching, double stub matching.

6. Wave guides **(2 hours)**

6.1 Rectangular wave guide.
6.2 Transverse electric mode, transverse magnetic mode.

7. Antennas **(1 hour)**

7.1 Introduction to antenna, antenna types and properties.

Practical:

1. Teledeltos (electro-conductive) paper mapping of electrostatic fields.
2. Determination of dielectric constant, display of a magnetic Hysteresis loop
3. Studies of wave propagation on a lumped parameter transmission line
4. Microwave sources, detectors, transmission lines
5. Standing wave patterns on transmission lines, reflections, power patterns on transmission lines, reflections, power measurement.
6. Magnetic field measurements in a static magnetic circuit, inductance,leakage flux.

References:

1. W. H. Hayt, "Engineering Electromagnetics", McGraw-Hill Book Company.
2. J. D. Kraus, "Electromagnetics", McGraw-Hill Book Company.
3. N. N. Rao, "Elements of Engineering Electromagnetics", Prentice Hall.
4. Devid K. Cheng, "Field and Wave Electromagnetics", Addison-Wesley.
5. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Press.

Instrumentation
EX .....

Lecture: 4 **Year: II**
Tutorial: 1 **Part: I**
Practical: 3
Course objectives:

To provide the basic concept of instrumentation and knowledge of microprocessor based instrumentation system to interface different kinds of peripherals, circuit design techniques and instruments for a wide range of measurement problems

1. **Instrumentation System** **(2 hours)**
   - 1.1 Analog and Digital Signals and Systems
   - 1.2 Instrumentation System: Definition, Block Diagram, Component Descriptions
   - 1.3 Need of Electrical, Electronics, Pneumatic and Hydraulic Working Media Systems and Conversion Devices

2. **Theory of Measurement** **(6 hours)**
   - 2.1 Static Performance Parameters: Accuracy, Precision, Sensitivity, Resolution, Linearity
   - 2.2 Dynamic Performance Parameters: Frequency Response, Bandwidth, Response Time
   - 2.3 Errors in Measurement and Their Statistical Analysis
   - 2.4 Measurement of Voltage and Current (Moving Coil and Moving Iron Instruments)
   - 2.5 Measurement of Resistance (Low, Medium and High)
   - 2.6 AC Bridge (Wheatstone Bridge, Maxwell's Bridge, Schering Bridge)

3. **Transducer** **(8 hours)**
   - 3.1 Introduction and Classification
   - 3.2 Application of Transducers:
     - 3.2.1 Measurement of Mechanical Variables – Displacement, Strain, Velocity, Acceleration, Vibration
     - 3.2.2 Measurement of Process Variables – Temperature, Pressure, Level, Fluid
     - 3.2.3 Measurement of Bio - Physical Variables – Blood Pressure, Mayo Electric Potential

4. **Microprocessor Base System** **(2 hours)**
   - 4.1 Basic Features, Advantages and Disadvantages of Microprocessor Based Instrumentation System
   - 4.2 Types: Open – Loop and Closed – Loop
   - 4.3 PC Interfacing Techniques
   - 4.4 Review of Address Decoding, Mapping I/O and Interfacing of I/O Ports and Memories

5. **Parallel Interfacing with Microprocessor Based System** **(6 hours)**
   - 5.1 Methods of Parallel Data Transfer: Simple I/O, Simple Strobe I/O, Single & Double Handshake I/O
   - 5.2 8255 as a General Purpose Programmable Peripheral Device: Block Diagram, modes of Operation, Generating control Words
   - 5.3 Interfacing Examples – I/O Ports, Keyboard, Printer, Seven Segment Display etc
   - 5.4 Introduction to ISA and PCI Bus

6. **Serial interfacing with Microprocessor Based System** **(6 hours)**
   - 6.1 Advantages and Disadvantages of Serial Transfer on Parallel
   - 6.2 Basic Concepts in Serial I/O
     - 6.2.1 Interfacing Requirements
     - 6.2.2 Alphanumeric Codes
     - 6.2.3 Transmission formats: Synchronous & Asynchronous, Simplex & Duplex, Rate of Transmission
     - 6.2.4 Error and Error Checks in Data Communication
     - 6.2.5 Data Communication over Telephone Lines
     - 6.2.6 Standards in Serial I/O: RS 232, RS 422, RS 423
     - 6.2.7 Interfacing Examples
   - 6.3 USB: Different Standards, Signals, Throughput, Protocols, Wireless USB and On-The-Go

7. **Interfacing ADC and DAC** **(5 hours)**
   - 7.1 DAC: Characteristics, Weighted Resistor Type, R – 2R Ladder Type
   - 7.2 ADC: Characteristics, Successive Approximation Type, Ramp Type, Dual – Slope Type, Flash Type
   - 7.3 Interfacing Different DAC and ADC to Microprocessor
   - 7.4 Errors in ADC and DAC

8. **Data Acquisition System** **(2 hours)**
   - 8.1 Data Acquisition system
   - 8.2 Data Loggers
   - 8.3 Data Archiving and Storage
   - 8.4 Bluetooth Devices and Characteristics

9. **Grounding and Shielding** **(4 hours)**
   - 9.1 Outline for Grounding and Shielding, Safety
   - 9.2 Noise: Sources, Energy Coupling Mechanisms, Prevention
   - 9.3 Grounding: Single – Point Grounding, Ground Plane and Ground Loop
   - 9.4 Filtering: Bandwidth Minimization, Ferric Beads, Decoupling Capacitors, Line Filters, Isolators and Transient Suppressors
   - 9.5 Shielding: Definition and Types
   - 9.6 Protecting Against Electrostatic Discharge
   - 9.7 General Rules for Design

10. **Circuit Design** **(3 hours)**
   - 10.1 Converting Requirement into Design
   - 10.2 Reliability and Fault Tolerance
   - 10.3 High Speed Design: Bandwidth, Decoupling, Ground Bounce, Cross Talk, Impedance Matching, Timing
   - 10.4 Low Power Design
   - 10.5 Reset and Power Failure Detection

11. **Circuit Layout** **(3 hours)**
   - 11.1 Circuit Boards and PCBs
   - 11.2 Component Placement
   - 11.3 Routing Signal Traces: Trace Density, Common Impedance, Distribution Signals and Returns, Transmission Line Concerns, Trace Impedance and Matching, Avoiding Crosstalk
   - 11.4 Grounds, Returns and Shields
   - 11.5 Connectors and Cables
   - 11.6 Testing and Maintenance

12. **Software for Instrumentation System** **(3 hours)**
   - 12.1 Types of Software, Selection and Purchase
   - 12.2 Different Software Models with Metrics, Advantages and Limitations
   - 12.3 Risk Abatement and Failure Prevention: Issues, Development Plan, Safety and Reliability, Fault Tolerance
   - 12.4 Software Bugs and Testing
   - 12.5 Good Programming Practice

13. **Electrical Equipments** **(4 hours)**
   - 13.1 Wattmeter: Types and working principle
   - 13.2 Energy Meter: Types and working principle
   - 13.3 Frequency Meter: Types and working principle
   - 13.4 Power Factor Meter: Types and working principle

14. **Case Study** **(6 hours)**

Examples chosen from local industrial situations with particular attention paid to the basic measurement requirements, accuracy and specific hardware employed environmental conditions under which the instruments must operate, signal processing and transmission, output devices:

i) Instrumentation for power station including all electrical and non electrical parameters

ii) Instrumentation for wire and cable manufacturing and bottling plant
iii) Instrumentations for a beverage manufacturing and bottling plant
iv) Instrumentations required for a biomedical application such as a medical clinic or hospital
v) Other industries can be selected with the consent of the subject teacher or needs

Practical:

1. Use of resistive, inductive & inductive transducers and other types of transducers
2. Review of assembly programming and simple I/O interfacing with 8255
3. Interfacing of LEDs, Seven Segment Display
4. Interfacing of Motors
5. Interfacing of different types of ADC
6. Interfacing of different types of DAC
7. Small Group Project: Design of simple microprocessor based instrumentation system

References:

1. D. V. Hall, "Microprocessor and Interfacing, Programming and Hardware", Tata McGraw Hill
2. Ramesh S. Goankar, "Microprocessor Architecture, Programming and Application with 8085", Prentice Hall
3. K. R. Fowler, "Electronic Instrument Design: Architecting for the Life Cycle", Oxford University Press
4. Jan Axelson, "USB Complete", Penram International Publishing
5. A. K. Sawhney, "A Course in Electronic Measurement and Instrumentation", Dhanpat Rai and Sons
6. J. B. Gupta, "A Course in Electrical and Electronics Measurement and Instrumentation", Kataria and Sons

Marks Distribution (There may be minor deviations in marks allocation)

Unit/ Chapter	Hours Allocation	Marks Allocation
Chapters 1, 8	2, 2	6
Chapter 2	6	8
Chapter 3	8	8
Chapter 4	2	4
Chapter 5	6	8
Chapter 6	6	8
Chapter 7	5	5
Chapter 9	4	5
Chapter 10	3	5
Chapter 11	3	5
Chapter 12	3	5
Chapter 13	4	5
Chapter 14	6	8

APPLIED MATHEMATICS

SH 551

Lecture : 3 **Year : II**
Tutorial : 1 **Part : II**
Practical : 0

Course Objective

This course focuses on several branches of applied mathematics. The students are exposed to complex variable theory and a study of the Fourier and Z-Transforms, topics of current importance in signal processing. The course concludes with studies of the wave and heat equations in Cartesian and polar coordinates.

1. Complex Analysis **(18 hours)**

1.1 Complex Analytic Functions
- 1.1.1 Functions and sets in the complex plane
- 1.1.2 Limits and Derivatives of complex functions
- 1.1.3 Analytic functions. The Cauchy –Riemann equations
- 1.1.4 Harmonic functions and it's conjugate

1.2 Conformal Mapping
- 1.2.1 Mapping
- 1.2.2 Some familiar functions as mappings
- 1.2.3 Conformal mappings and special linear functional transformations
- 1.2.4 Constructing conformal mappings between given domains

1.3 Integral in the Complex Plane
- 1.3.1 Line integrals in the complex plane
- 1.3.2 Basic Problems of the complex line integrals
- 1.3.3 Cauchy's integral theorem
- 1.3.4 Cauchy's integral formula
- 1.3.5 Supplementary problems

1.4 Complex Power Series, Complex Taylor series and Lauren series
- 1.4.1 Complex power series
- 1.4.2 Functions represented by power series
- 1.4.3 Taylor series, Taylor series of elementary functions
- 1.4.4 Practical methods for obtaining power series, Laurent series
- 1.4.5 Analyticity at infinity, zeros, singularities, residues, Cauchy's residue theorem
- 1.4.6 Evaluation of real integrals

2. The Z-Transform **(9 hours)**

2.1 Introduction
2.2 Properties of Z-Transform
2.3 Z- transform of elementary functions
2.4 Linearity properties
2.5 First shifting theorem, second shifting theorem, Initial value theorem,

2.6 Final value theorem, Convolution theorem
2.7 Some standard Z- transform
2.8 Inverse Z-Transform
2.9 Method for finding Inverse Z-Transform
2.10 Application of Z-Transform to difference equations

3. Partial Differential Equations (12 hours)

3.1 Linear partial differential equation of second order, their classification and solution
3.2 Solution of one dimensional wave equation, one dimensional heat equation, two dimensional heat equation and Laplace equation (Cartesian and polar form) by variable separation method

4. Fourier Transform (6 hours)

4.1 Fourier integral theorem, Fourier sine and cosine integral; complex form of Fourier integral
4.2 Fourier transform, Fourier sine transform, Fourier cosine transform and their properties
4.3 Convolution, Parseval's identity for Fourier transforms
4.4 Relation between Fourier transform and Laplace transform

References:

1. S. K. Mishra, G. B. Joshi, S. Ghimire, V. Parajuli, " A text book of Applied Mathematics", Dibya Deurali Prakashan.
2. E. Kreyszig, "Advance Engineering Mathematics", Fifth Edition, Wiley, New York.
3. A. V. Oppenheim, "Discrete-Time Signal Processing", Prentice Hall.
4. K. Ogata, "Discrete-Time Control System", Prentice Hall, Englewood Cliffs, New Jersey, 1987.

DISCRETE STRUCTURE
CT 551

Lecture : 3 **Year : II**
Tutorial : 0 **Part : II**
Practical : 0

Course Objectives:

To gain knowledge in discrete mathematics and finite state automata in an algorithmic approach and to gain fundamental and conceptual clarity in the area of Logic, Reasoning, Algorithms, Recurrence Relation, Graph Theory, and Theory of Automata

1. Logic, Induction and Reasoning **(12 hours)**

1.1 Proposition and Truth function
1.2 Propositional Logic
1.3 Expressing statements in Logic Propositional Logic
1.4 The predicate Logic
1.5 Validity
1.6 Informal Deduction in Predicate Logic
1.7 Rules of Inference and Proofs
1.8 Informal Proofs and Formal Proofs
1.9 Elementary Induction and Complete Induction
1.10 Methods of Tableaux
1.11 Consistency and Completeness of the System

2. Finite State Automata **(10 hours)**

2.1 Sequential Circuits and Finite state Machine
2.2 Finite State Automata
2.3 Language and Grammars
2.4 Non-deterministic Finite State Automata
2.5 Language and Automata
2.6 Regular Expression and its characteristics

3. Recurrence Relation **(8 hours)**

3.1 Recursive Definition of Sequences
3.2 Solution of Linear recurrence relations
3.3 Solution to Nonlinear Recurrence Relations
3.4 Application to Algorithm Analysis

4. Graph Theory **(15 hours)**

4.1 Undirected and Directed Graphs
4.2 Walk Paths, Circuits, Components
4.3 Connectedness Algorithm
4.4 Shortest Path Algorithm
4.5 Bipartite Graphs, Planar Graphs, Regular Graphs

4.6 Planarity Testing Algorithms
4.7 Eulerian Graph
4.8 Hamiltonian Graph
4.9 Tree as a Directed Graph
4.10 Binary Tree, Spanning Tree
4.11 Cutsets and Cutvertices
4.12 Network Flows, Maxflow and Mincut Theorem
4.13 Data Structures Representing Trees and Graphs in Computer
4.14 Network Application of Trees and Graphs
4.15 Concept of Graph Coloring

References:

1. Kenth Rosen, "Discrete Mathematical Structures with Applications to Computer Science", WCB/ McGraw Hill
2. G. Birkhoff, T.C. Bartee, "Modern Applied Algebra", CBS Publishers.
3. R. Johnsonbaugh, "Discrete Mathematics", Prentice Hall Inc.
4. G.Chartand, B.R.Oller Mann, "Applied and Algorithmic Graph Theory", McGraw Hill
5. Joe L. Mott, AbrahanKandel, and Theodore P. Baker, "Discrete Mathematics for Computer Scientists and Mathematicians", Prentice-Hall of India

DATA STRUCTURE AND ALGORITHMS

CT 552

Lecture : 3 **Year : II**
Tutorial : 0 **Part : II**
Practical : 3

Course Objectives:

To provide fundamental knowledge of various data structures and their implementation and to provide the fundamental knowledge of various algorithms and their analysis

1. Concept of data structure **(2 hours)**

1.1 Introduction: data types, data structures and abstract data types
1.2 Introduction to algorithms

2. The Stack and Queue **(6 hours)**

2.1 Stack operation
2.2 Stack application: Evaluation of Infix, Postfix and Prefix expressions
2.3 Operations in queue, Enqueue and Dequeue
2.4 Linear and circular queue
2.5 Priority queue

3. List **(3 hours)**

3.1 Definition
  3.1.1 Static and dynamic list structure
  3.1.2 Array implementation of lists
  3.1.3 Queues as list

4. Linked lists **(5 hours)**

4.1 Dynamic implementation
4.2 Operations in linked list
4.3 Linked stacks and queues
4.4 Doubly linked lists and its applications

5. Recursion **(4 hours)**

5.1 Principle of recursion
5.2 TOH and Fibonacci sequence
5.3 Applications of recursion

6. Trees **(7 hours)**

6.1 Concept
6.2 Operation in Binary tree
6.3 Tree search, insertion/deletions
6.4 Tree traversals (pre-order, post-order and in-order)
6.5 Height, level and depth of a tree

6.6 AVL balanced trees and Balancing algorithm
6.7 The Huffman algorithm
6.8 B-Tree
6.9 Red Black Tree

7. Sorting **(5 hours)**

7.1 Types of sorting: internal and external
7.2 Insertion and selection sort
7.3 Exchange sort
7.4 Merge and Redix sort
7.5 Shell sort
7.6 Heap sort as a priority queue
7.7 Big 'O' notation and Efficiency of sorting

8. Searching **(5 hours)**

8.1 Search technique
8.2 Sequential, Binary and Tree search
8.3 General search tree
8.4 Hashing
8.4.1 Hash function and hash tables
8.4.2 Collision resolution technique

9. Growth Functions **(2 hours)**

Asymptotic notations: θ, O, Ω, o, ω notations and their properties

10. Graphs **(6 hours)**

10.1 Representation and applications
10.2 Transitive closure
10.3 Warshall's algorithm
10.4 Graphs type
10.5 Graph traversal and Spanning forests
10.5.1 Depth First Traversal and Breadth First Traversal
10.5.2 Topological sorting: Depth first, Breadth first topological sorting
10.5.3 Minimum spanning trees, Prim's, Kruskal's and Round-Robin algorithms
10.6 Shortest-path algorithm
10.6.1 Greedy algorithm
10.6.2 Dijkstra's Algorithm

Practical:

There shall be 10 to 12 lab exercises based on C or C++

1. Implementation of stack
2. Implementations of linear and circular queues
3. Solutions of TOH and Fibonacci sequence by Recursion
4. Implementations of linked list: singly and doubly linked list
5. Implementation of trees: AVL trees, and balancing

6. Implementation of Merge sort
7. Implementation of search: sequential, Binary and Tree search
8. Implementation of Graphs: Graph Traversals
9. Implementation of hashing
10. Implementation of Heap

References

11. Y. Langsam, M. J. Augenstein and A. M Tenenbaum, "Data Structures using C and C++", PHI
12. T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein, "Introduction to Algorithms", PHI
13. G.W. Rowe, "Introduction to Data Structure and Algorithms with C and C++", PHI
14. R. L. Kruse, B. P. Leung, C. L. Tondo, "Data Structure and Program design in C", PHI
15. G. Brassard and P. Bratley, "Fundamentals of Algorithms", PHI

ADVANCED ELECTRONICS

EX 601

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : II
Part : II

Course Objectives:

To provide knowledge on data conversion, amplifiers, instrumentation and power circuits

1. Operational Amplifier Circuits **(6 hours)**

1.1 Bias circuits suitable for IC Design
1.2 The Widlar current source
1.3 The differential amplifier
1.4 Active loads
1.5 Output stages

2. Operational Amplifier Characterization **(8 hours)**

2.1 Input offset voltage
2.2 Input bias and input offset currents
2.3 Output impedance
2.4 Differential and common-mode input impedance
2.5 DC gain, bandwidth, gain-bandwidth product
2.6 Common-mode and power supply rejection ratios
2.7 Higher frequency poles settling time
2.8 Slew rate
2.9 Noise in operational amplifier circuits

3. Digital-To-Analog and Analog-To-Digital Conversion **(8 hours)**

3.1 The R-2R ladder circuit
3.2 Unipolar and bipolar D/A converters
3.3 Count-up and Tracking A/D's based on D/A's
3.4 Successive approximation A/D converters
3.5 Integrating voltage-to-time conversion A/D converters, dual and quad slope types
3.6 Sigma delta A/D converters
3.7 Flash A/D converters

4. Instrumentation and Isolation Amplifiers **(4 hours)**

4.1. One and two operational amplifier instrumentation amplifiers
4.2. The three operational amplifier instrumentation amplifier
4.3. Consideration of non-ideal properties
4.4. Isolation amplifier principles and realization
4.5. Consideration of non-ideal properties

5. Operational Amplifier-Bipolar Transistor Logarithmic Amplifier (3 hours)

5.1 The basic logarithmic amplifier
5.2 Non-ideal effects
5.3 Stability consideration
5.4 Anti-logarithmic operations

6. Log-Antilog Circuit Application (5 hours)

6.1 Analog multiplier based on log-antilog principles
6.2 The multifunction converter circuit
6.3 Proportional to absolute temperature (PTAT) devices
6.4 RMS to dc conversion

7. Introduction to Power Electronics (7 hours)

7.1 Diodes, thyristors, triacs, IGBT
7.2 Controlled rectifier circuits
7.3 Inverters
7.4 Choppers
7.5 DC-to-DC conversion
7.6 AC-to-AC conversion

8. Switched Power Supplies (4 hours)

8.1 Voltage step-down regulators
8.2 Voltage step-up regulators
8.3 Step-up/step-down regulators
8.4 Filtering considerations
8.5 Control circuits, IC switched

Practical:

1. Characteristics of operational amplifier
2. 4 bit D to A converter
3. Differential amplifier, Instrumentation amplifier
4. Logarithmic amplifier
5. Study of switched voltage regulator
6. Study of Silicon-controlled-rectifier (SCR) and TRIAC circuit

Reference:

1. A.S. Sedra and K.C. Smith, "Microelectronic Circuits", Oxford University Press.
2. W. Stanely, "Operational Amplifiers with Linear Integrated Circuits", Charles E. Merrill Publishing Company, Toronto.
3. Jacob Millman and Christos C. Halkias, "Integrated Electronics", TATA McGRAW- Hill Edition.
4. Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education.

5. Ramakant A. Gayakwad, "Operational Amplifiers with Linear Integrated Circuits", Prentice Hall, New Delhi.
6. Robert F. Coughlin and Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Prentice Hall, New Delhi.
7. C.W. Lander, "Power Electronics", McGraw-Hill Book Company, New York.
8. J.G. Graeme, "Application of Operational Amplifiers: Third Generation Techniques", The Burr-Brown Electronics Series, McGraw-Hill, New York.
9. N. Mohan, T. M. Undeland and W. P, Robbins, "Power Electronics: Converters, Applications and Design", John Willey and Sons, New York.

COMPUTER GRAPHICS
EX 603

Lecture : 3 **Year : II**
Tutorial : 1 **Part : I**
Practical : 3/2

Course Objectives:

To familiarize with graphics hardware, line and curve drawing techniques, techniques for representing and manipulating geometric objects, illumination and lighting models

1. Introduction and application **(2 hours)**

History of computer graphics, Applications of computer graphics, Hardware: Raster-Scan Displays, Vector Displays, Hard copy devices, Input Hardwares, Display Architectures, Applications in various fields like medicine, engineering, art, uses in virtual realism.

2. Scan-Conversion **(6 hours)**

2.1 Scan-Converting A Point
2.2 Scan-Converting A Straight Line: DDA Line Algorithm, Bresenham's Line Algorithm
2.3 Scan-Converting a Circle and an Ellipse: Mid-Point Circle and Ellipse Algorithm

3. Two –Dimensional Transformations **(6 hours)**

3.1 Two –dimensional translation, rotation, scaling, reflection, shear transforms
3.2 Two-dimensional composite transformation
3.3 Two-dimensional viewing pipeline, world to screen viewing transformations and clipping (Cohen-Sutherland Line Clipping, Liang-Barsky Line Clipping)

4. Three-Dimensional Graphics **(6 hours)**

4.1 Three –dimensional translation, rotation, scaling, reflection, shear transforms
4.2 Three-dimensional composite transformation
4.3 Three-dimensional viewing pipeline, world to screen viewing transformation, projection concepts (orthographic, parallel, perspective projections)

5. Curve Modeling **(4 hours)**

Introduction to Parametric cubic Curves, Splines, Bezier curves

6. Surface modeling **(4 hours)**

Polygon surface, vertex table, edge table, polygon table, surface normal and spatial orientation of surfaces

7. Visible Surface Determination **(6 hours)**

7.1 Image Space and Object Space techniques
7.2 Back Face Detection, Z-Buffer, A-Buffer, Scan-Line method

8. Illumination and Surface Rendering methods **(8 hours)**

8.1 Algorithms to simulate ambient, diffuse and specular reflections
8.2 Constant , Gouraud and phong shading models

9. Introduction to Open GL **(3 hours)**

Introduction to OpenGl, callback functions, Color commands, drawing pixels, lines, and polygons using OpenGL, Viewing, Lighting.

Practical:

There shall be 5 to 6 lab exercise including following concepts:

1. DDA Line Algorithm
2. Bresenham's Line algorithm
3. Mid Point Circle Algorithm
4. Mid Point Ellipse Algorithm
5. Lab on 2-D Transformations
6. Basic Drawing Techniques in OpenGL

References

1. Donald Hearn and M. Pauline Baker, "Computer Graphics C version"
2. Donald D. Hearn and M. Pauline Baker, "Computer Graphics with OpenGL"
3. Foley, Van Dam, Feiner, Hughes "Computer Graphics Principles and Practice"

NUMERICAL METHODS

SH 553

Lecture : 3 **Year : II**
Tutorial : 1 **Part : II**
Practical : 3

Course objective:

To introduce numerical methods used for the solution of engineering problems. The course emphasizes algorithm development and programming and application to realistic engineering problems.

1. Introduction, Approximation and errors of computation (4 hours)

1.1 Introduction, Importance of Numerical Methods
1.2 Approximation and Errors in computation
1.3 Taylor's series
1.4 Newton's Finite differences (forward , Backward, central difference, divided difference)
1.5 Difference operators, shift operators, differential operators
1.6 Uses and Importance of Computer programming in Numerical Methods.

2. Solutions of Nonlinear Equations (5 hours)

2.1 Bisection Method
2.2 Newton Raphson method (two equation solution)
2.3 Regula-Falsi Method , Secant method
2.4 Fixed point iteration method
2.5 Rate of convergence and comparisons of these Methods

3. Solution of system of linear algebraic equations (8 hours)

3.1 Gauss elimination method with pivoting strategies
3.2 Gauss-Jordan method
3.3 LU Factorization
3.4 Iterative methods (Jacobi method, Gauss-Seidel method)
3.5 Eigen value and Eigen vector using Power method

4. Interpolation (8 hours)

4.1 Newton's Interpolation (forward, backward)
4.2 Central difference interpolation: Stirling's Formula, Bessel's Formula
4.3 Lagrange interpolation
4.4 Least square method of fitting linear and nonlinear curve for discrete data and continuous function
4.5 Spline Interpolation (Cubic Spline)

5. Numerical Differentiation and Integration (6 hours)

5.1 Numerical Differentiation formulae
5.2 Maxima and minima
5.3 Newton-Cote general quadrature formula
5.4 Trapezoidal, Simpson's 1/3, 3/8 rule
5.5 Romberg integration
5.6 Gaussian integration (Gaussian – Legendre Formula 2 point and 3 point)

6. Solution of ordinary differential equations (6 hours)

6.1 Euler's and modified Euler's method
6.2 Runge Kutta methods for 1st and 2nd order ordinary differential equations
6.3 Solution of boundary value problem by finite difference method and shooting method.

7. Numerical solution of Partial differential Equation (8 hours)

7.1 Classification of partial differential equation(Elliptic, parabolic, and Hyperbolic)
7.2 Solution of Laplace equation (standard five point formula with iterative method)
7.3 Solution of Poisson equation (finite difference approximation)
7.4 Solution of Elliptic equation by Relaxation Method
7.5 Solution of one dimensional Heat equation by Schmidt method

Practical:

Algorithm and program development in C programming language of following:

1. Generate difference table.
2. At least two from Bisection method, Newton Raphson method, Secant method
3. At least one from Gauss elimination method or Gauss Jordan method. Finding largest Eigen value and corresponding vector by Power method.
4. Lagrange interpolation. Curve fitting by Least square method.
5. Differentiation by Newton's finite difference method. Integration using Simpson's 3/8 rule
6. Solution of 1st order differential equation using RK-4 method
7. Partial differential equation (Laplace equation)
8. Numerical solutions using Matlab.

References:

1. Dr. B.S.Grewal, "Numerical Methods in Engineering and Science ", Khanna Publication.

2. Robert J schilling, Sandra l harries , "Applied Numerical Methods for Engineers using MATLAB and C.", Thomson Brooks/cole.
3. Richard L. Burden, J.Douglas Faires, "Numerical Analysis", Thomson / Brooks/cole
4. John. H. Mathews, Kurtis Fink, "Numerical Methods Using MATLAB", Prentice Hall publication
5. JAAN KIUSALAAS , "Numerical Methods in Engineering with MATLAB" , Cambridge Publication

ENGINEERING ECONOMICS
CE 655

Lecture : 3
Tutorial : 1
Practical : 0

Year : III
Part : I

Course Objectives:

To provide concept and knowledge of economic studies that will be useful for the evaluation engineering projects and make decisions related to investment.

1. Introduction **(3 hours)**

- 1.1 Origin of Engineering Economy
- 1.2 Principles of Engineering Economy
- 1.3 Role of Engineers in Decision Making
- 1.4 Cash Flow Diagram

2. Interest and Time Value of Money **(6 hours)**

- 2.1 Introduction to Time Value of Money
- 2.2 Simple Interest
- 2.3 Compound Interest
  - 2.3.1 Nominal Interest Rate
  - 2.3.2 Effective Interest Rate
  - 2.3.3 Continuous Compounding
- 2.4 Economic Equivalence
- 2.5 Development of Interest Formulas
  - 2.5.1 The Five Types of Cash Flows
  - 2.5.2 Single Cash Flow Formulas
  - 2.5.3 Uneven Payment Series
  - 2.5.4 Equal Payment Series
  - 2.5.5 Linear Gradient Series.
  - 2.5.6 Geometric Gradient Series.

3. Basic Methodologies of Engineering Economic Analysis **(8 hours)**

- 3.1 Determining Minimum Attractive (Acceptable) Rate of Return (MARR).
- 3.2 Payback Period Method
- 3.3 Equivalent Worth Methods
  - 3.3.1 Present Worth Method
  - 3.3.2 Future Worth Method
  - 3.3.3 Annual Worth Method
- 3.4 Rate of Return Methods
  - 3.4.1 Internal Rate of Return Method.
  - 3.4.2 External/Modified Rate of Return Method
- 3.5 Public Sector Economic Analysis (Benefit Cost Ratio Method)
- 3.6 Introduction to Lifecycle Costing

3.7 Introduction to Financial and Economic Analysis

4. Comparative Analysis of Alternatives **(6 hours)**

4.1 Comparing Mutually Exclusive Alternatives having Same Useful Life by
- 4.1.1 Payback Period Method and Equivalent Worth Method
- 4.1.2 Rate of Return Methods and Benefit Cost Ratio Method

4.2 Comparing Mutually Exclusive Alternatives having Different Useful Lives by
- 4.2.1 Repeatability Assumption
- 4.2.2 Co-terminated Assumption
- 4.2.3 Capitalized Worth Method

4.3 Comparing Mutually Exclusive, Contingent and Independent Projects in Combination

5. Replacement Analysis **(6 hours)**

5.1 Fundamentals of Replacement Analysis
- 5.1.1 Basic Concepts and Terminology
- 5.1.2 Approaches for Comparing Defender and Challenger

5.2 Economic Service Life of Challenger and Defender

5.3 Replacement Analysis When Required Service Life is Long
- 5.3.1 Required Assumptions and Decision Framework
- 5.3.2 Replacement Analysis under the Infinite Planning Horizon
- 5.3.3 Replacement Analysis under the Finite Planning Horizon

6. Risk Analysis **(6 hours)**

6.1 Origin/Sources of Project Risks

6.2 Methods of Describing Project Risks
- 6.2.1 Sensitivity Analysis
- 6.2.2 Breakeven Analysis
- 6.2.3 Scenario Analysis

6.3 Probability Concept of Economic Analysis

6.4 Decision Tree and Sequential Investment Decisions

7. Depreciation and Corporate Income Taxes **(6 hours)**

7.1 Concept and Terminology of Depreciation

7.2 Basic Methods of Depreciation
- 7.2.1 Straight line method
- 7.2.2 Declining Balance Method
- 7.2.3 Sinking Fund Method
- 7.2.4 Sum of the Year Digit Method
- 7.2.5 Modified Accelerated Cost Recovery System (MACRS)

7.3 Introduction to Corporate Income Tax

7.4 After Tax Cash Flow Estimate

7.5 General Procedure for Making after Tax Economic Analysis

8. Inflation and its Impact on Project Cash Flows **(4 hours)**

8.1 Concept of Inflation
8.2 Measuring Inflation
8.3 Equivalence Calculation Under Inflation
8.4 Impact of Inflation on Economic Evaluation

Tutorial:

1. Assignments
2. Quizzes and Case study

References:

1. Chan S.Park,"Contemporary Engineering Economics",,Prentice Hall, Inc.
2. E. Paul De Garmo, William G. Sullivan and James A. Bontadelli, "Engineering Economy", Mc Milan Publishing Company.
3. James L. Riggs, David D. Bedworth and Sabah U. Randhawa, "Engineering Economics", Tata McGraw Hill Education Private Limited.

DATABASE MANAGEMENT SYSTEMS
CT 652

Lecture : 3 **Year : III**
Tutorial : 1 **Part : I**
Practical : 3

Course Objectives:

To provide fundamental concept, theory and practices in design and implementation of Database Management System

1. Introduction **(3 hours)**

1.1 Concepts and Applications
1.2 Objective and Evolution
1.3 Data Abstraction and Data Independence
1.4 Schema and Instances
1.5 Concepts of DDL, DML and DCL

2. Data Models **(7 hours)**

2.1 Logical, Physical and Conceptual
2.2 E-R Model
2.3 Entities and Entities sets
2.4 Relationship and Relationship sets
2.5 Strong and Weak Entity Sets
2.6 Attributes and Keys
2.7 E-R Diagram
2.8 Alternate Data Model (hierarchical, network, graph)

3. Relational Languages and Relational Model **(7 hours)**

3.1 Introduction to SQL
3.2 Features of SQL
3.3 Queries and Sub-Queries
3.4 Set Operations
3.5 Relations (Joined, Derived)
3.6 Queries under DDL and DML Commands
3.7 Embedded SQL
3.8 Views
3.9 Relational Algebra
3.10 Database Modification
3.11 QBE and domain relational calculus

4. Database Constraints and Normalization **(6 hours)**

4.1 Integrity Constraints and Domain Constraints
4.2 Assertions and Triggering
4.3 Functional Dependencies
4.4 Multi-valued and Joined Dependencies

4.5 Different Normal Forms (1st, 2nd, 3rd, BCNF, DKNF)

5. Query Processing and Optimization **(4 hours)**

5.1 Query Cost Estimation
5.2 Query Operations
5.3 Evaluation of Expressions
5.4 Query Optimization
5.5 Query Decomposition
5.6 Performance Tuning

6. File Structure and Hashing **(4 hours)**

6.1 Records Organizations
6.2 Disks and Storage
6.3 Remote Backup System
6.4 Hashing Concepts, Static and Dynamic Hashing
6.5 Order Indices
6.6 B+ tree index

7. Transactions processing and Concurrency Control **(6 hours)**

7.1 ACID properties
7.2 Concurrent Executions
7.3 Serializability Concept
7.4 Lock based Protocols
7.5 Deadlock handling and Prevention

8. Crash Recovery **(4 hours)**

8.1 Failure Classification
8.2 Recovery and Atomicity
8.3 Log-based Recovery
8.4 Shadow paging
8.5 Advanced Recovery Techniques

9. Advanced database Concepts **(4 hours)**

9.1 Concept of Objet-Oriented and Distributed Database Model
9.2 Properties of Parallel and Distributed Databases
9.3 Concept of Data warehouse Database
9.4 Concept of Spatial Database

Practical:

1: Introduction and operations of MS-Access or MySQL or any suitable DBMS
2: Database Server Installation and Configuration (MS-SQLServer, Oracle)
3: DB Client Installation and Connection to DB Server. Introduction and practice with SELECT Command with the existing DB.
4, 5: Further Practice with DML Commands
6, 7: Practice with DDL Commands. (Create Database and Tables).
8: Practice of Procedure/Trigger and DB Administration & other DBs (MySQL,

PG-SQL, DB2.)
9, 10, 11: Group Project Development.
12: Project Presentation and Viva

References

1. H. F. Korth and A. Silberschatz, "*Database system concepts*", McGraw Hill.
2. A. K. Majumdar and P. Bhattacharaya, "*Database Management Systems*", Tata McGraw Hill, India.

COMPUTER NETWORKS

CT ~~702~~ 657

Lecture : 3
Tutorial : 1
Practical : 3

Year : III
Part : I

Course Objective:

To understand the concepts of computer networking, functions of different layers and protocols, and know the idea of IPV6 and security

1. Introduction to Computer Network **(5 hours)**

1.1 Uses of Computer Network
1.2 Networking model client/server, p2p, active network
1.3 Protocols and Standards
1.4 OSI model and TCP/IP model
1.5 Comparison of OSI and TCP/IP model
1.6 Example network: The Internet, X.25, Frame Relay, Ethernet, VoIP, NGN and MPLS, xDSL.

2. Physical Layer **(5 hours)**

2.1 Network monitoring: delay, latency, throughput
2.2 Transmission media: Twisted pair, Coaxial, Fiber optic, Line-of-site, Satellite
2.3 Multiplexing, Circuit switching, Packet switching, VC Switching, Telecommunication switching system (Networking of Telephone exchanges)
2.4 ISDN: Architecture, Interface, and Signaling

3. Data Link Layer **(5 hours)**

3.1 Functions of Data link layer
3.2 Framing
3.3 Error Detection and Corrections,
3.4 Flow Control
3.5 Examples of Data Link Protocol, HDLC, PPP
3.6 The Medium Access Sub-layer
3.7 The channel allocation problem
3.8 Multiple Access Protocols
3.9 Ethernet,
3.10 Networks: FDDI, ALOHA, VLAN, CSMA/CD, IEEE 802.3, 802.4, 802.5, and 802.11.

4. Network Layer **(9 hours)**

4.1 Internetworking &devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway
4.2 Addressing: Internet address, classful address

4.3 Subnetting
4.4 Routing: techniques, static vs. dynamic routing , routing table for classful address
4.5 Routing Protocols: RIP, OSPF, BGP, Unicast and multicast routing protocols
4.6 Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Protocols: ARP, RARP, IP, ICMP

5. Transport Layer **(5 hours)**

5.1 The transport service: Services provided to the upper layers
5.2 Transport protocols: UDP, TCP
5.3 Port and Socket
5.4 Connection establishment, Connection release
5.5 Flow control & buffering
5.6 Multiplexing & de-multiplexing
5.7 Congestion control algorithm: Token Bucket and Leaky Bucket

6. Application Layer **(5 hours)**

6.1 Web: HTTP & HTTPS
6.2 File Transfer: FTP, PuTTY, WinSCP
6.3 Electronic Mail: SMTP, POP3, IMAP
6.4 DNS
6.5 P2PApplications
6.6 Socket Programming
6.7 Application server concept: proxy caching, Web/Mail/DNS server optimization
6.8 Concept of traffic analyzer: MRTG, PRTG, SNMP, Packet tracer, Wireshark.

7. Introduction to IPV6 **(4 hours)**

7.1 IPv6- Advantages
7.2 Packet formats
7.3 Extension headers
7.4 Transition from IPv4 to IPv6: Dual stack, Tunneling, Header Translation
7.5 Multicasting

8. Network Security **(7 hours)**

8.1 Properties of secure communication
8.2 Principles of cryptography: Symmetric Key and Public Key
8.3 RSA Algorithm,
8.4 Digital Signatures
8.5 Securing e-mail (PGP)
8.6 Securing TCP connections (SSL)
8.7 Network layer security (IPsec, VPN)
8.8 Securing wireless LANs (WEP)
8.9 Firewalls: Application Gateway and Packet Filtering, and IDS

Practical:

1. Network wiring and LAN setup
2. Router Basic Configuration
3. Static and Dynamic Routing
4. Creating VLAN
5. Router access-list configuration
6. Basic Network setup on Linux
7. Setup of Web Server
8. DNS Server setup
9. Setup of DHCP Server
10. Virtualizations

References:

1. A.S. Tanenbaum, "Computer Networks", 3rd Edition, Prentice Hall India.
2. W. Stallings, "Data and Computer Communication", Macmillan Press.
3. Kurose Ross, "Computer Networking: A top down approach", Pearson Education
4. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers

COMPUTER ORGANIZATION AND ARCHITECTURE

CT 603

Lecture : 3 **Year : III**
Tutorial : 1 **Part : I**
Practical : 3/2

Course objectives:

To provide the organization, architecture and designing concept of computer system including processor architecture, computer arithmetic, memory system, I/O organization and multiprocessors

1. Introduction (3 hours)

1.1 Computer organization and architecture
1.2 Structure and function
1.3 Designing for performance
1.4 Computer components
1.5 Computer Function
1.6 Interconnection structures
1.7 Bus interconnection
1.8 PCI

2. Central processing Unit (10 hours)

2.1 CPU Structure and Function
2.2 Arithmetic and logic Unit
2.3 Instruction formats
2.4 Addressing modes
2.5 Data transfer and manipulation
2.6 RISC and CISC
2.7 64-Bit Processor

3. Control Unit (6 hours)

3.1 Control Memory
3.2 Addressing sequencing
3.3 Computer configuration
3.4 Microinstruction Format
3.5 Symbolic Microinstructions
3.6 Symbolic Micro program
3.7 Control Unit Operation
3.8 Design of control unit

4. Pipeline and Vector processing (5 hours)

4.1 Pipelining
4.2 Parallel processing
4.3 Arithmetic Pipeline
4.4 Instruction Pipeline

4.5 RISC pipeline
4.6 Vector processing
4.7 Array processing

5. Computer Arithmetic **(8 hours)**

5.1 Addition algorithm
5.2 Subtraction algorithm
5.3 Multiplication algorithm
5.4 Division algorithms
5.5 Logical operation

6. Memory system **(5 hours)**

6.1 Microcomputer Memory
6.2 Characteristics of memory systems
6.3 The Memory Hierarchy
6.4 Internal and External memory
6.5 Cache memory principles
6.6 Elements of Cache design
  6.6.1 Cache size
  6.6.2 Mapping function
  6.6.3 Replacement algorithm
  6.6.4 Write policy
  6.6.5 Number of caches

7. Input-Output organization **(6 hours)**

7.1 Peripheral devices
7.2 I/O modules
7.3 Input-output interface
7.4 Modes of transfer
  7.4.1 Programmed I/O
  7.4.2 Interrupt-driven I/O
  7.4.3 Direct Memory access
7.5 I/O processor
7.6 Data Communication processor

8. Multiprocessors **(2 hours)**

8.1 Characteristics of multiprocessors
8.2 Interconnection Structures
8.3 Interprocessor Communication and synchronization

Practical:

1. Add of two unsigned Integer binary number
2. Multiplication of two unsigned Integer Binary numbers by Partial-Product Method
3. Subtraction of two unsigned integer binary number
4. Division using Restoring

5. Division using non- restoring methods
6. To simulate a direct mapping cache

References:

1. M. Morris Mano, "Computer System Architecture"
2. William Stalling, "Computer organization and architecture"
3. John P. Hayes, "Computer Architecture and Organization"
4. V.P. Heuring, H.F. Jordan, "Computer System design and architecture"
5. S. Shakya, "Lab Manual on Computer Architecture and design"

OPERATING SYSTEM

CT 656

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : III
Part : I

Course Objective:

To be familiar with the different aspects of operating system and use the idea in designing operating system

1. Introduction **(5 hours)**

- 1.1 Operating System and Function
- 1.2 Evolution of Operating System
- 1.3 Type of Operating System: Batch, Interactive, Multiprocessing, Time Sharing and Real Time System
- 1.4 Operating System Components
- 1.5 Operating System Structure: Monolithic, Layered, Micro-Kernel, Client-Server, Virtual Machine
- 1.6 Operating System Services
  - 1.6.1 System calls
  - 1.6.2 Shell commands
  - 1.6.3 Shell programming
- 1.7 Examples of O. S.: UNIX, Linux, MS-Windows, Handheld OS.

2. Process Management **(6 hours)**

- 2.1 Introduction to Process
  - 2.1.1 Process description
  - 2.1.2 Process states
  - 2.1.3 Process control
- 2.2 Threads
- 2.3 Processes and Threads
- 2.4 Scheduling
  - 2.4.1 Types of scheduling
  - 2.4.2 Scheduling in batch system
  - 2.4.3 Scheduling in Interactive System
  - 2.4.4 Scheduling in Real Time System
  - 2.4.5 Thread Scheduling
- 2.5 Multiprocessor Scheduling concept

3. Process Communication and Synchronization **(5 hours)**

- 3.1 Principles of Concurrency

3.2 Critical Region
3.3 Race Condition
3.4 Mutual Exclusion
3.5 Semaphores and Mutex
3.6 Message Passing
3.7 Monitors
3.8 Classical Problems of Synchronization: Readers-Writers Problem, Producer Consumer Problem, Dining Philosopher problem

4. Memory Management **(6 hours)**

4.1 Memory address, Swapping and Managing Free Memory Space
4.2 Resident Monitor
4.3 Multiprogramming with Fixed Partition
4.4 Multiprogramming With Variable Partition
4.5 Multiple Base Register
4.6 Virtual Memory Management
  4.6.1 Paging
  4.6.2 Segmentation
  4.6.3 Paged Segmentation
4.7 Demand Paging
4.8 Performance
4.9 Page Replacement Algorithms
4.10 Allocation of Frames
4.11 Thrashing

5. File Systems **(6 hours)**

5.1 File: Name, Structure, Types, Access, Attribute, Operations
5.2 Directory and File Paths
5.3 File System Implementation
  5.3.1 Selecting Block Size
  5.3.2 Impact of Block Size Selection
  5.3.3 Implementing File: Contiguous Allocation, Link List Allocation, Link List Allocation with Table, Inode
  5.3.4 Implementing Directory
5.4 Impact of Allocation Policy on Fragmentation
5.5 Mapping File Blocks on The Disk Platter
5.6 File System Performance
5.7 Example File Systems: CD ROM file system, MS-DOS file system, Unix File system

6. I/O Management & Disk Scheduling **(4 hours)**

6.1 Principles of I/O Hardware
6.2 Principles of I/O software

6.3 I/O software Layer
6.4 Disk
  6.4.1 Hardware
  6.4.2 Formatting
  6.4.3 Arm scheduling
  6.4.4 Error handling
  6.4.5 Stable Storage

7. Deadlock **(5 hours)**

7.1 Principles of deadlock
7.2 Deadlock Prevention
7.3 Deadlock Avoidance
7.4 Deadlock Detection
7.5 Recovery from deadlock
7.6 An Integrated Deadlock Strategies
7.7 Other Issues: Two phase locking, Communication Deadlock, Livelock, Starvation

8. Security **(4 hours)**

8.1 Security breaches
8.2 Types of Attacks
8.3 Security Policy and Access Control
8.4 Basics of Cryptography
8.5 Protection Mechanisms
8.6 Authentication
8.7 OS Design Considerations For Security
8.8 Access Control Lists And OS Support

9. System administration **(4 hours)**

9.1 Administration Tasks
9.2 User Account Management
9.3 Start And Shutdown Procedures
9.4 Setting up Operational Environment for a New User
9.5 AWK tool, Search, Sort tools, Shell scripts, Make tool

Practical:

1. Shell commands, shell programming: write simple functions, basic tests, loops, patterns, expansions, substitutions
2. Programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Programs using the I/O system calls of UNIX operating system
4. Implement the Producer – Consumer problem using semaphores.
5. Implement some memory management schemes

Reference Books:

1. Andrew S. Tanenbaum, "Modern Operating Systems", PHI
2. Stalling William, "Operating Systems", Pearson Education
3. Silbcrschatz A.,Galvin P., Gagne G., "Operating System Concepts", John Wiley and Sons,
4. Milan Milenkovic, "Operating Systems Concepts and Design", TMGH
5. Das Sumitabha, "Unix Concepts and Applications", Tata McGraw Hill.
6. M. J. Bach, "The Design of The Unix Operating System", PHI.
7. Charles Crowley, "Operating Systems: A Design-oriented Approach", TMH.

FILTER DESIGN
EX 704

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : III
Part : I

Course Objective:

To familiarize student with the concept of analog filter design: passive filters, RC active filters and switched-capacitor filters

1. Introduction **(4 hours)**

- 1.1 Filter and its importance in communication
- 1.2 Kinds of filters in terms of frequency response
- 1.3 Ideal response and response of practical filters
- 1.4 Normalization and denormalization in filter design
- 1.5 Impedance (magnitude) scaling and frequency scaling
- 1.6 History of filter design and available filter technologies

2. Approximation Methods **(8 hours)**

- 2.1 Approximation and its importance in filter design
- 2.2 Lowpass approximations methods
- 2.3 Butterworth response, Butterworth pole locations, Butterworth filter design from specifications
- 2.4 Chebyshev and inverse Chebyshev characteristics, network functions and pole zero locations
- 2.5 Characteristics of Cauer (elliptic) response
- 2.6 Bessel-Thomson approximation of constant delay
- 2.7 Delay Equalization

3. Frequency transformation **(2 hours)**

- 3.1 Frequency transformation and its importance in filter design
- 3.2 Lowpass to highpass transformation
- 3.3 Lowpass to bandpass transformation and
- 3.4 Lowpass to bandstop transformation

4. Properties and Synthesis of Passive Networks **(7 hours)**

- 4.1 One-port passive circuits
  - 4.1.1 Properties of passive circuits, positive real functions
  - 4.1.2 Properties of lossless circuits
  - 4.1.3 Synthesis of LC one-port circuits, Foster and Cauer circuits
  - 4.1.4 Properties and synthesis of RC one-port circuits
- 4.2 Two-port Passive Circuits
  - 4.2.1 Properties of passive two-port circuits, residue condition, transmission zeros

4.2.2 Synthesis of two-port LC and RC ladder circuits based on zero-shifting by partial pole removal

5. Design of Resistively-Terminated Lossless Filter (4 hours)

5.1 Properties of resistively-terminated lossless ladder circuits, transmission and reflection coefficients
5.2 Synthesis of LC ladder circuits to realize all-pole lowpass functions
5.3 Synthesis of LC ladder circuits to realize functions with finite transmission zeros

6. Active Filter (7 hours)

6.1 Fundamentals of Active Filter Circuits
- 6.1.1 Active filter and passive filter
- 6.1.2 Ideal and real operational amplifiers, gain-bandwidth product
- 6.1.3 Active building blocks: amplifiers, summers, integrators
- 6.1.4 First order passive sections and active sections using inverting and non-inverting op-amp configuration

6.2 Second order active sections (biquads)
- 6.2.1 Tow-Thomas biquad circuit, design of active filter using Tow-Thomas biquad
- 6.2.2 Sallen-Key biquad circuit and Multiple-feedback biquad (MFB) circuit
- 6.2.3 Gain reduction and gain enhancement
- 6.2.4 RC-CR transformation

7. Sensitivity (3 hours)

7.1 Sensitivity and importance of sensitivity analysis
7.2 Definition of single parameter sensitivity
7.3 Centre frequency and Q-factor sensitivity
7.4 Sensitivity properties of biquads
7.5 Sensitivity of passive circuits

8. Design of High-Order Active Filters (6 hours)

8.1 Cascade of biquads
- 8.1.1 Sequencing of filter blocks, center frequency, Q-factor and gain

8.2 Active simulation of passive filters
- 8.2.1 Ladder design with simulated inductors
- 8.2.2 Ladder design with frequency-dependent negative resistors (FDNR)
- 8.2.3 Leapfrog simulation of ladders

9. Switched-Capacitor Filters (4 hours)

9.1 The MOS switch and switched capacitor
9.2 Simulation of resistor by switched capacitor

9.3 Switched-capacitor circuits for analog operations: addition, subtraction, multiplication and integration
9.4 First-order and second-order switched-capacitor circuits

Practical:

The laboratory experiments consist computer simulation as well hardware realization for analysis and design of passive and active filters which include.

- Analysis and design of passive & active filter circuits using computer simulation
- Design of active filters using biquad circuits
- Design of higher order active filters using inductor simulation
- Design of higher order active filters using functional simulation

References:

1. Rolf Schaumann, Mac E. Van Valkenburg, " Design of Analog Filters"
2. Wai-Kai Chen, " Passive and Active Filters (Theory and Implementations)",
3. Kendal L Su, "Analog Filter",

COMMUNICATION ENGLISH
SH 601

Lecture : 3 **Year : III**
Tutorial : 1 **Part : I**
Practical : 2

Course Introduction

This course is designed for the students of engineering with the objective of developing all four skills of communication applicable in professional field.

Course Objectives

After completion of this course students will be able to:

a. comprehend reading materials both technical and semi-technical in nature
b. develop grammatical competence
c. write notice, agenda, minutes
d. write proposals
e. write reports
f. write research articles
g. listen and follow instruction, description and conversation in native speakers' accent
h. do discussion in group, deliver talk and present brief oral reports

Unit I: Reading **(15 hours)**

1. Intensive Reading **(8 hours)**

1.1 Comprehension
1.2 Note-taking
1.3 Summary writing
1.4 Contextual questions based on facts and imagination
1.5 Interpreting text

2. Extensive Reading **(5 hours)**

2.1 Title/Topic Speculation
2.2 Finding theme
2.3 Sketching character

3. Contextual Grammar **(2 hours)**

3.1 Sequence of tense
3.2 Voice
3.3 Subject-Verb agreement
3.4 Conditional Sentences
3.5 Preposition

Unit II: Introduction to technical writing process and meeting **(4 hours)**

1. Editing, MLA/APA **(2 hours)**

1.1 Composing and editing strategies
1.2 MLA and APA comparison

2. Writing notices with agenda and minutes **(2 hours)**

2.1 Introduction
2.2 Purpose
2.3 Process

Unit III: Writing Proposal **(6 hours)**

1. Introduction

1.1 Parts of the proposal
- 1.1.1 Title page
- 1.1.2 Abstract/Summary
- 1.1.3 Statement of Problem
- 1.1.4 Rationale
- 1.1.5 Objectives
- 1.1.6 Procedure/Methodology
- 1.1.7 Cost estimate or Budget
- 1.1.8 Time management/Schedule
- 1.1.9 Summary
- 1.1.10 Conclusion
- 1.1.11 Evaluation or follow-up
- 1.1.12 Works cited

Unit IV: Reports **(18hours)**

1. Informal Reports **(6 hours)**

1.1 Memo Report
- 1.1.1 Introduction
- 1.1.2 Parts

1.2 Letter Report
- 1.2.1 Introduction
- 1.2.2 Parts

1.3 Project/Field Report (3 hours)
- 1.3.1 Introduction
- 1.3.2 Parts

1.4 Formal report (9 hours)
- 1.4.1 Introduction
- 1.4.2 Types of Formal Reports
  - 1.4.2.1 Progress Report
  - 1.4.2.1 Feasibility Report
  - 1.4.2.1 Empirical/ Research Report
  - 1.4.2.1 Technical Report

1.4.3 Parts and Components of Formal Report
- 1.4.3.1 Preliminary section
  - 1.4.3.1.1 Cover page
  - 1.4.3.1.2 Letter of transmittal/Preface
  - 1.4.3.1.3 Title page
  - 1.4.3.1.4 Acknowledgements
  - 1.4.3.1.5 Table of Contents
  - 1.4.3.1.6 List of figures and tables
  - 1.4.3.1.7 Abstract/Executive summary
- 1.4.3.2 Main Section
  - 1.4.3.2.1 Introduction
  - 1.4.3.2.2 Discussion/Body
  - 1.4.3.2.3 Summary/Conclusion
  - 1.4.3.2.4 Recommendations
- 1.4.3.3 Documentation
  - 1.4.3.3.1 Notes (Contextual/foot notes)
  - 1.4.3.3.2 Bibliography
  - 1.4.3.3.3 Appendix

Unit V: Writing Research Articles **(2 hours)**

1.1. Introduction
1.2. Procedures

Language lab		30 hours
Unit I: Listening		12 hours
Activity I	General instruction on effective listening, factors influencing listening, and note-taking to ensure ttention. (Equipment Required: Laptop, multimedia, laser pointer, overhead projector, power point, DVD, video set, screen)	2 hours
Activity II	Listening to recorded authentic instruction followed by exercises. (Equipment Required: Cassette player or laptop)	2 hours
Activity III	Listening to recorded authentic description followed by exercises. (Equipment Required: Cassette player or laptop)	4 hours
Activity IV	Listening to recorded authentic conversation followed by exercises (Equipment Required: Cassette player or laptop)	4 hours
Unit II: Speaking		18 hours
Activity I	General instruction on effective speaking ensuring audience's attention, comprehension and efficient use of Audio-visual aids. (Equipment Required: Laptop, multimedia, laser pointer, DVD, video, overhead projector, power point, screen)	2 hours
Activity II	Making students express their individual views on the assigned topics (Equipment Required: Microphone, movie camera)	2 hours
Activity III	Getting students to participate in group discussion on the assigned topics	4 hours

Activity IV	Making students deliver talk either individually or in group on the assigned topics (Equipment Required: Overhead projector, microphone, power point, laser pointer multimedia, video camera, screen)	8 hours
Activity V	Getting students to present their brief oral reports individually on the topics of their choice. (Equipment Required: Overhead projector, microphone, power point, laser pointer multimedia, video camera, screen)	2 hours

Evaluation Scheme

Units	Testing Items	No. of Questions	Type of Questions	Marks Distribution	Total Marks	Remarks
I	Reading	3	For grammar = objective and for the rest = short	2 Short questions 5+5 Interpretation of text 5 Note + Summary 5+5 Grammar 5	30	For short questions 2 to be done out of 3 from the seen passages, for interpretation an unseen paragraph of about 75 words to be given, for note + summary an unseen text of about 200to 250 to be given, for grammar 5 questions of fill up the gaps or transformation type to be given
II	Introduction to technical writing process and meeting	3	MLA/APA = objective, Editing and Meeting = short	MLA/APA = 4 Editing = 5 Meeting = 5	14	For APA/MLA 4 questions to be given to transform one from another or 4 questions asking to show citation according to APA/ MLA technique, For meeting minute alone or notice with agendas to be given
III	Proposal Writing	1	Long	10	10	A question asking to write a very brief proposal on any technical topic to be given
IV	Report writing	2	Informal report = short, Formal report = long	Informal report = 6 Formal report = 10	16	A question asking to write very brief informal report on technical topic to be given, for formal report a question asking to write in detail on any three elements of a formal report on technical topic to be given
V	Research article	1	Long	10	10	A question asking to write a brief research article on technical topic to be given

Evaluation Scheme for Lab

Units	Testing items	No. of Questions	Type of questions	Marks Distribution	Remarks
I	Listening ▫ instruction ▫ description ▫ conversation	2	objective	5+5	listening tape to be played on any two out of instruction, description and conversation followed by 10multiple choice type or fill in the gaps type questions

II	Speaking ▫ group/round table discussion ▫ presenting brief oral report ▫ delivering talk	2	subjective	Round table discussion 5, talk or brief oral report = 10	Different topics to be assigned in groups consisting of 8 members for group discussion and to be judged individually, individual presentation to be judged through either by talk on assigned topics or by brief oral reports based on their previous project, study and field visit.

Prescribed books

1. Adhikari, Usha, Yadav, Rajkumar, Yadav, Bijaya, ; " A Course book of Communicative English", Trinity Publication, 2012.
2. Adhikari, Usha, Yadav, Rajkumar, Shrestha, Rup Narayan ; "Technical Communication in English", Trinity Publication, 2012.

   (Note: 50 marks excluding reading to be covered on the basis of first book and reading part (i.e. 30 marks) to be covered on the basis of second book)

3. Khanal, Ramnath, "Need-based Language Teaching (Analysis in Relation to Teaching of English for Profession Oriented Learners)", Kathmandu: D, Khanal.
4. Konar, Nira, "Communication Skills for Professional", PHI Learning Private Limited, New Delhi.
5. Kumar, Ranjit, "Research Methodology", Pearson Education.
6. Laxminarayan, K.R, "English for Technical Communication", Chennai; Scitech publications (India) Pvt. Ltd.
7. Mishra, Sunita et. al. , "Communication Skills for Engineers", Pearson Education First Indian print.
8. Prasad, P. et. al , "The functional Aspects of Communication Skills", S.K. Kataria & sons.
9. Rutherfoord, Andrea J. Ph.D, "Basic Communication Skills for Technology", Pearson Education Asia.
10. Rizvi, M. Ashraf), "Effective Technical Communication", Tata Mc Graw Hill.
11. Reinking A James et. al, "Strategies for Successful Writing: A rhetoric, research guide, reader and handbook", Prentice Hall Upper Saddle River, New Jersey.
12. Sharma R.C. et al., "Business Correspondence and Report Writing: A Practical Approach to Business and Technical communication", Tata Mc Graw Hill.
13. Sharma, Sangeeta et. al, "Communication skills for Engineers and Scientists", PHI Learning Private Limited, New Delhi.
14. Taylor, Shirley et. al., "Model Business letters, E-mails & other Business documents", Pearson Education.

PROJECT MANAGEMENT

CT 701

Lecture : 3
Tutorial : 1
Practical : 0

Year : III
Part : I

Course objectives:

To make the students able to plan monitor and control project and project related activities

1. **Introduction** **(2 hours)**

   Definition of project and project management, Project objectives, classification of projects, project life cycle

2. **Project Management Body of Knowledge** **(4 hours)**

   Understanding of project environment, general management skill, effective and ineffective project managers, essential interpersonal and managerial skills, energized and initiator, communication, influencing, leadership, motivator, negotiation, problem solver, perspective nature, result oriented, global illiteracies, problem solving using problem trees.

3. **Portfolio and Project Management Institutes' (PMI) Framework** **(2 hours)**

   Portfolio, project management office, drivers of project success, inhibitors of project success

4. **Project Management** **(4 hours)**

   Advantages of project management, project management context as per PMI, Characteristics of project life cycles, representative project life cycles, IT Product Development Life Cycle, Product Life Cycle and Project Life Cycle, System Development methodologies, role and responsibilities of key project members

5. **Project and Organizational structure** **(2 hours)**

   System view of project management, functional organization, matrix organization, organizational structure influences on projects

6. **Project Management Process Groups** **(2 hours)**

   Project management processes, Overlaps of process groups in a phase, mapping of project management process groups to area of knowledge

7. **Project Integration Management** **(4 hours)**

   Develop project charters Develop preliminary project scope statement, Develop project management plan, Direct and manage project execution, monitor and control project work, Integrated change control, close project, project scope management, Create Work Break Down Structure, Scope

verification, Scope control.

8. Project Time Management **(4 hours)**

Activity definition, decomposition of activities, activity attributes, Activity sequencing, precedence relationship, network diagram, precedence diagram method, arrow diagramming method, Activity resources estimating, determining resource requirements, Schedule development and control, principles of scheduling, milestones, forward pass, backward pass, critical path method, critical chain technique, gantt chart, schedule control.

9. Project Cost Management **(4 hours)**

Cost and project, cost management, Cost estimating, types of cost estimates, estimating process and accuracy, enterprise environmental factors, organizational process assets, cost estimating tools, Cost budgeting, cost aggregation, deriving budget from activity cost, Cost control process, cost control methods, earned value management, EVM benefits, variance analysis.

10. Project quality management **(3 hours)**

Quality theories, Quality planning, project quality requirements, cost of quality, quality management plan, Quality assurance, quality audit, approach to a quality audit, Quality control process, control chart, pareto charts, testing of IT system, the test life cycle.

11. Project Communication Management **(3 hours)**

Importance of communication management, Communications planning process, communication requirement analysis, organizing and conducting effective meeting, Information distribution process, Performance reporting process, integrated reporting system

12. Project Risk Management **(4 hours)**

Understanding Risk, project risk, Risk management planning process, risk management plan, Risk identification, risk identification techniques, Qualitative risk analysis process, Quantitative risk analysis process, modeling techniques, Risk response planning, resolution of risk, strategies for negative risks or threats, strategies for positive risks or opportunities, Risk monitoring and control process.

13. Project Procurement Management **(3 hours)**

Procurement management process flow, Plan purchases and acquisition process, enterprise environmental factor, organizational process assets, Plan contracting process, standard forms, evaluation criteria, Request seller response process, Select seller process, Contract administration process, Contract closure process

14. Developing Custom Processes for IT projects **(3 hours)**

Developing it project management methodology, Moving forward

with customized management processes, Certified associate in project management, Project management maturity, Promoting project Excellency through awards and assessment , Certification process flow, Code of ethics, Future trends.

15. Balanced scorecard and ICT project management **(1 hour)**

References:

1. M. C. Christensen and R.H. Thayer, "The Project Manager's Guide to Software Engineering's Best Practices", IEEE computer Society
2. Clifford F. Gray, Erik W. Larson, "Project Management: The Management Process", McGraw Hill
3. Nick Jenkins, "A Project Management Primer",
4. Trevor L Young, "A handbook of Project Management", Kogan Page India Private Ltd.
5. M. Gentle, "Balance Supply and Demand", Compuware
6. Kelkar, " IT project Management",

PROPAGATION AND ANTENNA

EX 653

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : III
Part : II

Course Objectives:

To provide the student with an understanding of antennas, EM wave propagation and optical fibre communications.

1. Radiation and Antenna Fundamentals **(5 hours)**

1.1 Retarded Potentials: EM wave generation with a conduction current, the short uniformcurrent dipole, the radiated electric and magnetic fields.

1.2 Radiation patterns and input impedance of the short uniform current dipole, the short Dipole and long dipole.

1.3 Antenna theorems: reciprocity, superposition, Thevenin, minimum power transfer, Compensation, equality of directional patterns, equivalence of receiving and Transmitting impedances.

2. Antenna Parameters and Arrays: **(5 hours)**

2.1 Basic antenna parameters

2.2 Pattern multiplication: Linear and two-dimensional antenna arrays, end fire and Broadside arrays.

3. Antennas classification: **(10 hours)**

3.1 Isotropic antenna

3.2 Omni directional antenna; Dipole

3.3 Directional antennas;

3.4 Travelling wave antennas – single wire, V and RhombusReflector antennas – large plane sheet, small plane sheet, linear, corner, parabolic,elliptical, hyperbolic and circular reflector.Aperture antenna - horn Array antennas – Yagi-Uda, Log PeriodicOther antennas – Monopole, Loop, Helical, Microstrip.

4. Propagation and Radio Frequency Spectrum **(7 hours)**

4.1 Ground or surface wave

4.2 Space wave; direct and ground reflected wave, duct propagation

4.3 Ionospheric or sky wave; critical frequency, MUF, Skip distance

4.4 Tropospheric wave

4.5 Radio frequency spectrum and its propagation characteristics

5. Propagation between Antennas: **(7 hours)**

5.1 Free space propagation: power density of the receiving antenna, path loss

5.2 Plane earth propagation: the ground reflection, effective antenna heights, the two ray
5.3 propagation model, path loss
5.4 Fresnel Zones and Knife edge diffraction

6. Optical fibres(Introductory) (11 hours)

6.1 Optical fibre communication system and its advantages and disadvantages overMetalled wire communication system
6.2 Types of optical fibre and its structural difference
6.3 Light propagation characteristics and Numerical Aperture (NA) in optical fibre
6.4 Losses
6.5 Light source and photo detector

Practical:

1. Two Experiments in properties of EM waves: refraction, diffraction, polarization
2. Two Experiments in radiation patters of various types of antennas
3. Two Experiments in measurements on optical fibre transmission systems

References:

1. J. D. Kraus, "Antenna" McGraw Hill
2. C. A. Balanis, " Antenna Theory Analysis and Design" John Wiley & Sons, Inc.
3. Collins, R. E., "Antenna and Radio Wave Propagation" McGraw Hill.
4. Gerd Kaiser "Optical Fibre Communications" McGraw Hill.
5. John Gowar" Optical Communication Systems" PHI Publications.

COMMUNICATION SYSTEMS

EX 656

Lecture: 4
Tutorial: 1
Practical: 3

Year: III
Part: II

Course Objectives:

To introduce the students to the principles and building blocks of analog and digital communication systems.

1. **Introduction** (2 hours)
   - 1.1. Analog and Digital communication sources, transmitters, transmission channels and receivers.
   - 1.2. Noise, distortion and interference. Fundamental limitations due to noise, distortion and interference.
   - 1.3 Types and reasons for modulation.

2. **Representation of signals and systems in communication** (4 hours)
   - 2.1. Review of signals (types, mathematical representation and applications)
   - 2.2. Linear/non-linear, time variant/invariant systems. Impulse response and transfer function of a system. Properties of LTI systems.
   - 2.3. Low pass and band pass signals and systems, bandwidth of the system, distortionless transmission, the Hilbert transform and its properties.
   - 2.4. Complex envelops rectangular (in-phase and quadrature components) and polar representation of band pass band limited signals.

3. **Spectral Analysis** (2 hours)
   - 3.1. Review of Fourier series and transform, energy and power, Parseval's theorem.
   - 3.2. Energy Density Spectrum, periodogram, power spectral density function (psdf).
   - 3.3. Power spectral density functions of harmonic signal and white noise.
   - 3.4. The autocorrelation (AC) function, relationship between psdf and AC function.

4. **Amplitude Modulation and Demodulation** (8 hours)
   - 4.1. Time domain expressions, frequency domain representation, modulation index, signal bandwidth of Amplitude Modulated (AM) signal.
   - 4.2. AM for a single tone message, carrier and side-band components, powers in carrier and side-band components, bandwidth and power efficiency
   - 4.3. Generation of Double Side Band- Full Carrier (DSB-FC) AM
   - 4.4. Double Side Band Suppressed Carrier AM (DSB-AM), time and frequency domain expressions, powers in side-bands, bandwidth and power efficiency
   - 4.5. Generation of DSB-AM (balanced, ring modulators)
   - 4.6. Single Side Band Modulation, time and frequency domain expressions, powers
   - 4.7. Generation of SSB (SSB filters and indirect method)
   - 4.8. Introduction to Vestigial Side Bands (VSB), Independent Side Bands (ISB) and Quadrature Amplitude Modulations (QAM)
   - 4.9. Demodulation of DSB-FC, DSB-SC and SSB using synchronous detection
   - 4.10. Square law and envelop detection of DSB-FC
   - 4.11. Demodulation of SSB using carrier reinsertion , carrier recovery circuits
   - 4.12. Phase Locked Loop (PLL), basic concept, definitions, equations and applications, demodulation of AM using PLL

5. **Angle Modulation and Demodulation** (6 hours)
   - 5.1. Basic definitions, time domain expressions for Frequency Modulation (FM) and Phase Modulation (FM)
   - 5.2. Time domain expression for single tone modulated FM signals, spectral representation, Bessel's function and properties.
   - 5.3. Bandwidth of FM , Carson's rule, narrow and wideband FM
   - 5.4. Generation of FM (direct and Armstrong's methods)
   - 5.5. Demodulation of FM and PM signals, synchronous (PLL) and non-synchronous (limiter-discriminator) demodulation
   - 5.6. Stereo FM, spectral details, encoder and decoder

5.7. Pre-emphasis and de-emphasis networks

5.8. The super-heterodyne radio receivers for AM and FM

6. **Source Coding and Sampling Theory** (4 hours)

6.1. Digital communication sources, transmitters, transmission channels and receivers

66.2. Source coding, coding efficiency, Shannon-Fano and Huffman codes, coding of continuous time signals (A/D conversion)

6.3. Nyquist-Kotelnikov sampling theorem for strictly band-limited continuous time signals, time domain and frequency domain analysis, spectrum of sampled signal, reconstruction of sampled signal

6.4. Ideal, flat-top and natural sampling processes, sampling of band-pass signals, sub-sampling theory

6.5. Practical considerations: non-ideal sampling pulses (aperture effect), non-ideal reconstruction filter and time-limitness of the signal to be sampled (aliasing effects)

7. **Pulse Modulation Systems** (6 hours)

7.1. Pulse Amplitude Modulation (PAM), generation, bandwidth requirements, spectrum, reconstruction methods

7.2. Pulse position and pulse width modulations, generation, bandwidth requirements

7.3. Pulse code modulation as the result of analog to digital conversion, uniform quantization.

7.4. Quantization noise, signal to quantization noise ratio in uniform quantization.

7.5. Non uniform quantization, improvement in average SQNR for signals with high crest factor, companding techniques (μ and A law companding).

7.6. Data rate and bandwidth of a PCM signal.

7.7. Differential PCM, encoder, decoder

7.8. Delta Modulation, encoder, decoder, noises in DM, SQNR. Comparison between PCM and DM

7.9. Parametric speech coding, vocoders

8. **Baseband Data Communication Systems** (6 hours)

8.1. Introduction to information theory, measure of information, entropy, symbol rates and data (bit) rates.

8.2. Shannon Hartley Channel capacity theorem.Implications of the theorem and theoretical limits.

8.3. Electrical representation of binary data (line codes), Unipolar NRZ, bipolar NRZ, unipolar RZ, bipolar RZ, Manchester (split phase), differential (binary RZ-alternate mark inversion) codes, properties, comparisons

8.4. Baseband data communication systems, Inter-symbol interference (ISI), pulse shaping (Nyquist, Raised-cosine) and bandwidth considerations

8.5. Correlative coding techniques, duobinary and modified duobinary encoders

8.6. M-ary signaling, comparison with binary signaling.

8.7. The eye diagram.

9. **Bandpass (modulated) data communication systems** (4 hours)

9.1. Binary digital modulations, ASK, FSK, PSK, DPSK, QPSK, GMPSK, implementation, properties and comparisons

9.2. M-ary data communication systems, quadrature amplitude modulation systems, four phase PSK systems

9.3. Demodulation of binary digital modulated signals (coherent and non-coherent)

9.4. Modems and its applications.

10. **Random signals and noise in communication systems** (6 hours)

10.1. Random variables and processes, random signals, statistical and time averaged moments, interpretation of time averaged moments of a random process stationary process, ergodic process, psdf and AC function of a ergodic random process

10.2. White noise, thermal noise, band-limited white noise, the psdf and AC function of white noise

10.3. Passage of wide-sense stationary random signals through a LTI

10.4. Ideal low-pass and RC filtering of white noise, noise equivalent bandwidth of a filter

10.5. Optimum detection of a pulse in additive white noise, the matched filter. Realization of matched filters (time co-relaters). The matched filter for a rectangular pulse, ideal LPF and RC filters as matched filters

10.6. Performance limitation of baseband data communications due to noise, error probabilities in binary and M-ary baseband data communication.

11. **Noise performance of band-pass (modulated) communication systems** (6 hours)

11.1. Effect of noise in envelop and synchronous demodulation of DSB-FC AM, expression for gain parameter (ratio of output SNR to input SNR), threshold effect in non-linear demodulation of AM

11.2. Gain parameter for demodulations of DSB-SC and SSB using synchronous demodulators

11.3. Effect of noise (gain parameter) for non-coherent (limiter discriminator-envelop detector) demodulation of FM, threshold effect in FM. Use of pre-emphasis and de-emphasis circuits in FM.

11.4. Comparison of AM (DSB-FC, DSB-SC, SSB) and FM (Narrow and wide bands) in terms power efficiency, channel bandwidth and complexity.

11.5. Noise performance of modulated digital systems. Error probabilities for ASK, FSK, PSK, DPSK with coherent and non-coherent demodulation.

11.6. Comparison of modulated digital systems in terms of bandwidth efficiency, power efficiency and complexity.

12. Multiplexing (2 hours)

12.1 Principle of frequency division multiplexing (FDM) , FDM in telephony, hierarchy

12.2. Frequency Division Multiple Access (FDMA) systems- SCPC, DAMA, SPADE etc.

12.3. Filter and oscillator requirements in FDM.

12.4. Time Division Multiplexing with PCM, data rate and bandwidth of a PCM signal.

12.5 The T1 and E1 TDM PCM telephone hierarchy

13. Error control coding techniques (4 hours)

13.1. Basic principles of error control coding, types, basic definitions (hamming weight, hamming distance, minimum weight), hamming distance and error control capabilities

13.2. Linear block codes (systematic and non-systematic), generation, capabilities, syndrome calculation

13.3. Binary cyclic codes (systematic and non-systematic), generation, capabilities, syndrome calculation.

13.4. Convolutional codes, implementation, code tree, trellis and decoding algorithms.

Suggested Experiments:

1. Demonstration of power spectrum of various signals using LF spectrum analyzer
2. Generation of DSB-SC, DSB-FC and SSB signals
3. Demodulation of AM signals (synchronous and non-synchronous methods)
4. Generation of FM signals
5. Demodulation of FM signal (limiter-discriminator)
6. Operation of PLL, PLL as demodulator of AM and FM signals.
7. Study of line codes
8. Study of PCM
9. Study of DPCM
10. Study of DM
11. Study of ASK, FSK and PSK
12. Study of eye diagram

References:

1. S. Haykin, Digital communication systems, latest editions
2. Leon Couch, Digital and analog communication systems, latest edition
3. B.P.Lathi, Analog and Digital communication systems, latest edition
4. J. Proakis, Digital communication systems, latest edition
5. D. Sharma, Course manuals "Communication Systems I " and "Communication Systems II".

Evaluation Scheme

Marks distribution for all the chapters in the syllabus is shown in the table below.

S.N.	Unit	Hours	Marks Distribution*
1	1, 2 and 4	2 +4+8	20%
2	3 and 5	2+6	10%
3	6 and 7	4 +6	10%
4	8, 9 and 10	6+4+6	20%
5	11, 12 and 13	6+2 +6	20%

*There may be minor variation in marks distribution

Object Oriented Software Engineering

Lecture: 3
Tutorial: 1
Practical: 3/2

CT 657

Year: III
Part: II

Course Objectives:
This course aims to give both theoretical and practical foundations on the software engineering and object oriented software engineering and also provide systematic approach planning, development, and managing of object oriented software engineering.

1. Introduction to software and software engineering (5 Hrs)
- 1.1 Introduction to software engineering
- 1.2 Software processes and software process models,
- 1.3 Agile software developments
- 1.4 Requirements engineering processes,
- 1.5 System modeling,
- 1.6 Software prototyping,
- 1.7 Object Oriented software development

2. Object Oriented Concepts and Modeling (8 Hrs)
- 2.1 Introduction to class, Object, inheritance, polymorphism
- 2.2 Object Oriented system development
  - 2.2.1 Object Oriented Modeling
  - 2.2.2 Object Oriented System
  - 2.2.3 Function/data Methods
  - 2.2.4 Object Oriented Analysis
  - 2.2 .5 Object Oriented Programming
  - 2.2.6 Object Oriented Construction
- 2.3 Identifying the elements of an object model
  - 2.3.1 Identifying classes and objects
  - 2.3.2 Specifying the attributes
  - 2.3.3 Defining operations
  - 2.3.4 Finalizing the object definition

3. Structural, Behavioral and architectural Modeling (8 Hrs)
- 3.1 Classes Relationship,
- 3.2 Conceptual Model of UML
- 3.3 Class diagram
- 3.4 Advanced classes
- 3.5 Advanced Relationship
- 3.6 Interface
- 3.7 Object Diagram
- 3.8 Interactions
- 3.9 Use cases
- 3.10 Use Case Diagram
- 3.11 Interaction Diagram,
- 3.12 Activity Diagram State chart Diagram
- 3.13 Component and Components Diagram
- 3.14 Deployment Diagram

4. Object Oriented Analysis (5 Hrs)
- 4.1 Iterative Development
- 4.2 Unified process & UP Phases
  - 4.2.1 Inception
  - 4.2.2 Elaboration
  - 4.2.3 Construction
  - 4.2.4 Transition
- 4.3 Understanding requirements
- 4.4 UP Disciplines
- 4.5 Agile UP

5.1 Components of OO Design model,
5.2 System Design process
5.3 Partitioning the analysis model
5.4 Concurrency and subsystem allocation
5.5 Task Management component
5.6 Object DBMS
5.7 Data Management components
5.8 Resource Management components
5.9 Inter sub-system communication
5.10 Object Design process

6. Object Oriented Testing (6 Hrs)

6.1 Overview of Testing and object oriented Testing,
6.2 Types of Testing,
  6.2.1 Unit testing,
  6.2.2 Integrating testing,
  6.2.3 System testing,
6.2 Object Oriented Testing strategies,
6.3 Test case design for OO software,
6.4 Inter class test Case design

7. Managing object oriented software engineering (5 Hrs)

7.1 Project selection and preparation,
7.2 Project development, organization and management,
7.3 Software project planning and scheduling and techniques,
7.4 COCOMO model,
7.5 Risk management process,
7.6 Software quality assurance,
7.7 Software metrics

Practical

The practical shall include projects on object oriented system development. Choice of project depend upon teacher and student, case studies shall be included too.

References:

1. Ivar Jacobson, Object Oriented Software Engineering, Prentice Hous.
2. Grady Booch, James Raumbaugh, Ivar Jacobson, The United Modeling Language User Guide, Prentice House.
3. Pressman, Software Engineering, MC Graw Hall Education.
4. Sommer ville, Software Engineering, Person.

MINOR PROJECT

CT 654

Lecture : 0
Tutorial : 0
Practical : 4

Year : III
Part : II

Objectives:

To carry out a small scale project to develop hands-on experience of working in a project. During the course, the student will also develop knowledge of application development platforms and tools (Java /C# dotnet / Visual C++/PHP or any platform of current trend). The students will learn working as a team and basic collaboration and project management skills. The student will also learn about formulating project documentations.

1. Project ideas and proposal guidance **(4 hours)**

2. Application development **(10 hours)**

- 2.1 Visual programming (object oriented)
  - 2.1.1 Language basics
  - 2.1.2 Frameworks and APIs
- 2.2 Programming basics and design patterns

3. Project management, team work and collaboration **(8 hours)**

- 3.1 Project management techniques
- 3.2 Collaborative development environment

4. Project guidance **(5 hours)**

5. Project work **(30 hours)**

6. Project documentation guidance **(3 hours)**

EMBEDDED SYSTEM

CT 655

Lecture : 3 **Year : III**
Tutorial : 1 **Part : II**
Practical : 3/2

Course Objective:
To introduce students to understand and familiarization on applied computing principles in emerging technologies and applications for embedded systems

1. Introduction to Embedded System **(3 Hours)**

1.1 Embedded Systems overview
1.2 Classification of Embedded Systems
1.3 Hardware and Software in a system
1.4 Purpose and Application of Embedded Systems

2. Hardware Design Issues **(4 Hours)**

2.1 Combination Logic
2.2 Sequential Logic
2.3 Custom Single-Purpose Processor Design
2.4 Optimizing Custom Single-Purpose Processors

3. Software Design Issues **(6 Hours)**

3.1 Basic Architecture
3.2 Operation
3.3 Programmer's View
3.4 Development Environment
3.5 Application-Specific Instruction-Set Processors
3.6 Selecting a Microprocessor
3.7 General-Purpose Processor Design

4. Memory **(5 Hours)**

4.1 Memory Write Ability and Storage Permanence
4.2 Types of Memory
4.3 Composing Memory
4.4 Memory Hierarchy and Cache

5. Interfacing **(6 Hours)**

5.1 Communication Basics
5.2 Microprocessor Interfacing: I/O Addressing, Interrupts, DMA
5.3 Arbitration
5.4 Multilevel Bus Architectures
5.5 Advanced Communication Principles

6. Real-Time Operating System (RTOS) **(8 Hours)**

6.1 Operating System Basics

6.2 Task, Process, and Threads
6.3 Multiprocessing and Multitasking
6.4 Task Scheduling
6.5 Task Synchronization
6.6 Device Drivers

7. Control System **(3 Hours)**

7.1 Open-loop and Close-Loop control System overview
7.2 Control System and PID Controllers
7.3 Software coding of a PID Controller
7.4 PID Tuning

8. IC Technology **(3 Hours)**

8.1 Full-Custom (VLSI) IC Technology
8.2 Semi-Custom (ASIC) IC Technology
8.3 Programming Logic Device (PLD) IC Technology

9. Microcontrollers in Embedded Systems **(3 Hours)**

9.1 Intel 8051 microcontroller family, its architecture and instruction sets
9.2 Programming in Assembly Language
9.3 A simple interfacing example with 7 segment display

10. VHDL **(4 Hours)**

10.1 VHDL overview
10.2 Finite state machine design with VHDL

Practical:

Student should be complete lab works and project work in practical classes.

Reference Books:

1. David E. Simon, "An Embedded Software Primer", Addison-Wesley
2. Muhammad Ali Mazidi, "8051 Microcontroller and Embedded Systems", Prentice Hall
3. Frank Vahid, Tony Givargis, "Embedded System Design", John Wiley & Sons
4. Douglas L. Perry, "VHDL Programming by example", McGraw Hill