B.E. DEGREE
IN
COMPUTER ENGINEERING

Year : I   Part : I

S. N.	Course Code	Course Title	Teaching Schedule				Examination Scheme						Total	Remark
							Theory			Practical				
			L	T	P	Total	Assesment Marks	Final Duaration hours	Final Marks	Assesment Marks	Final Duaration hours	Final Marks		
1	SH 401	Engineering Mathematics I	3	2		5	20	3	80				100	
2	CT 401	Computer Programming	3		3	6	20	3	80	50			150	
3	ME 401	Engineering Drawing I	1		3	4				60	3	40	100	
4	SH 402	Engineering Physics	4	1	2	7	20	3	80	20	3	30	150	
5	CE 401	Applied Mechanics	3	2		5	20	3	80				100	
6	EE 401	Basic Electrical Engineering	3	1	1.5	5.5	20	3	80	25			125	
		Total	17	6	9.5	32.5	100	15	400	155	6	70	725	

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
Tutorial   : 0
Practical : 3

Year : I
Part : I

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

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.

APPLIED MECHANICS
CE 401

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

Course Objective:

To provide concept and knowledge of engineering mechanics and help understand structural engineering stress analysis principles in later courses or to use basics of mechanics in their branch of engineering. Emphasis has been given to Statics.

1. Introduction (2 hours)

1.1 Definitions and scope of Applied Mechanics
1.2 Concept of Rigid and Deformed Bodies
1.3 Fundamental concepts and principles of mechanics: Newtonian Mechanics

2. Basic Concept in Statics and Static Equilibrium (4 hours)

2.1 Concept of Particles and Free Body Diagram
2.2 Physical meaning of Equilibrium and its essence in structural application
2.3 Equation of Equilibrium in Two Dimension

3. Forces Acting on Particle and Rigid Body (6 hours)

3.1 Different types of Forces: Point, Surface Traction and Body Forces -Translational Force and Rotational Force: Relevant Examples
3.2 Resolution and Composition of Forces: Relevant Examples
3.3 Principle of Transmissibility and Equivalent Forces: Relevant Examples
3.4 Moments and couples: Relevant Examples
3.5 Resolution of a Force into Forces and a Couple: Relevant Examples
3.6 Resultant of Force and Moment for a System of Force: Examples

4. Center of Gravity, Centroid and Moment of Inertia (6 hours)

4.1 Concepts and Calculation of Centre of Gravity and Centroid: Examples
4.2 Calculation of Second Moment of Area / Moment of Inertia and Radius of Gyration: And Relevant usages
4.3 Use of Parallel axis Theorem: Relevant Examples

5. Friction (2 hours)

5.1 Laws of Friction, Static and Dynamic Coefficient of Friction, Angle of Friction: Engineering Examples of usage of friction

5.2 Calculations involving friction in structures: Example as High Tension Friction Grip bolts and its free body diagram

6. Analysis of Beams and Frames (9 hours)

6.1 Introduction to Structures: Discrete and Continuum
6.2 Concept of Load Estimating and Support Idealizations: Examples and Standard symbols
6.3 Use of beams/frames in engineering: Concept of rigid joints/distribute loads in beams/frames.
6.4 Concept of Statically/Kinematically Determinate and Indeterminate Beams and Frames: Relevant Examples
6.5 Calculation of Axial Force, Shear Force and Bending Moment for Determinate Beams and Frames
6.6 Axial Force, Shear Force and Bending Moment Diagrams and Examples for drawing it.

7. Analysis of Plane Trusses (4 hours)

7.1 Use of trusses in engineering: Concept of pin joints/joint loads in trusses.
7.2 Calculation of Member Forces of Truss by method of joints: Simple Examples
7.3 Calculation of Member Forces of Truss by method of sections: Simple Examples

8. Kinematics of Particles and Rigid Body (7 hours)

8.1 Rectilinear Kinematics: Continuous Motion
8.2 Position, Velocity and Acceleration of a Particle and Rigid Body
8.3 Determination of Motion of Particle and Rigid Body
8.4 Uniform Rectilinear Motion of Particles
8.5 Uniformly Accelerated Rectilinear Motion of Particles
8.6 Curvilinear Motion: Rectangular Components with Examples of Particles

9. Kinetics of Particles and Rigid Body: Force and Acceleration (5 hours)

9.1 Newton's Second Law of Motion and momentum
9.2 Equation of Motion and Dynamic Equilibrium: Relevant Examples
9.3 Angular Momentum and Rate of Change
9.4 Equation of Motion-Rectilinear and Curvilinear
9.5 Rectangular: Tangential and Normal Components and Polar Coordinates: Radial and Transverse Components

Tutorial:

There shall be related tutorials exercised in class and given as regular homework exercises. Tutorials can be as following for each specified chapters.

1. Introduction (1 hour)

A. Theory; definition and concept type questions.

2. Basic Concept in Statics and Static Equilibrium (2 hours)

A. Theory; definition and concept type questions.

3. Concept of Force acting on structures (3 hours)

A. Practical examples; numerical examples and derivation types of questions.

B. There can be tutorials for each sub-section.

4. Center of Gravity, Centroid and Moment of Inertia (4 hours)

A. Concept type; numerical examples and practical examples type questions.

5. Friction (2 hours)

A. Definition type; Practical example type and numerical type questions.

6. Analysis of Beam and Frame (5 hours)

A. Concept type; definition type; numerical examples type with diagrams questions.

B. There can be tutorials for each sub-section.

7. Analysis of Plane Trusses (5 hours)

A. Concept type; definition type; numerical examples type questions.

B. There can be tutorials for each sub-section.

8. Kinematics of Particles and Rigid Body (4 hours)

A. Definition type; numerical examples type questions.

B. There can be tutorials for each sub-section.

9. Kinetics of Particles and Rigid Body: Force and Acceleration (4 hours)

A. Concept type; definition type; numerical examples type questions.

B. There can be tutorials for each sub-section.

References:

1. F.P. Beer and E.R.Johnston, Jr. ,"Mechanics of Engineers- Statics and Dynamics", Mc Graw-Hill.

2. R.C. Hibbeler, Ashok Gupta, "Engineering Mechanics-Statics and Dynamics", New Delhi, Pearson.
3. I.C. Jong and B.G. Rogers, "Engineering Mechanics- Statics and Dynamics",
4. D.K. Anand and P.F. Cunnif, "Engineering Mechanics- Statics and Dynamics",
5. R.S. Khurmi, "A Text Book of Engineering Mechanics",
6. R.S.Khurmi, "Applied Mechanics and Strength of Materials",
7. I.B.Prasad, "A Text Book of Applied Mechanics",
8. Shame, I.H., "Engineering Mechanics-Statics and Dynamics", Prentice Hall of India, New Delhi.

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   Krichhof'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.

B.E. DEGREE
IN
COMPUTER ENGINEERING

Year : I

S. N.	Course Code	Course Title	Teaching Schedule				Examination Scheme						Total	Remark
							Theory			Practical				
			L	T	P	Total	Assesment Marks	Final		Assesment Marks	Final			
								Duaration hours	Marks		Duaration hours	Marks		
1	SH 451	Engineering Mathematics -II	3	2		5	20	3	80				100	
2	ME 451	Engineering Drawing II	1		3	4				60	3	40	100	
3	EX 451	Basic Electronics Engineering	3	1	1.5	5.5	20	3	80	25			125	
4	SH 453	Enginering Chemistry	3	1	3	7	20	3	80	20	3	30	150	
5	ME 452	Fundamental of Thermodynamics and Heat Transfer	3	1	1.5	5.5	20	3	80	25			125	
6	ME 453	Workshop Technology	1		3	4	10			40			50	
		Total	14	5	12	31	90	12	320	170	6	70	650	

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

ENGINEERING DRAWING II
ME 451

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

Course Objective:

To make familiar with the conventional practices of sectional views. To develop basic concept and skill of pictorial drawing and working drawings. Also to make familiar with standard symbols of different engineering fields.

1. **Conventional Practices for Orthographic and Sectional Views**   **(12 hours)**
    1.1   Conventional Practices in Orthographic views: Half Views and Partial Views, Treatment of Unimportant Intersections, Aligned Views, Treatment for Radially Arranged Features, Representation of Fillets and Rounds
    1.2   Conventional Practices in Sectional views: Conventions for Ribs, Webs and Spokes in Sectional View, Broken Section, Removed Section, Revolved Section, Offset Section, Phantom Section and Auxiliary Sectional Views
    1.3   Simplified Representations of Standard Machine Elements

2. **Pictorial Drawings**   **(20 hours)**
    2.1   Classifications: Advantages and Disadvantages
    2.2   Axonometric Projection: Isometric Projection and Isometric Drawing
          2.2.1   Procedure for making an isometric drawing
          2.2.2   Isometric and Non-isometric Lines; Isometric and Non-isometric Surfaces
          2.2.3   Angles in Isometric Drawing
          2.2.4   Circles and Circular Arcs in Isometric Drawing
          2.2.5   Irregular Curves in Isometric Drawing
          2.2.6   Isometric sectional Views
    2.3   Oblique Projection and Oblique Drawing
          2.3.1   Procedure for making an Oblique drawing
          2.3.2   Rules for Placing Objects in Oblique drawing
          2.3.3   Angles, Circles and Circular Arcs in Oblique drawing
    2.4   Perspective Projection
          2.4.1   Terms used in Perspective Projection
          2.4.2   Parallel and Angular Perspective
          2.4.3   Selection of Station Point

3. **Familiarization with Different Components and Conventions**   **(8 hours)**
    3.1   Limit Dimensioning and Machining Symbols
          3.1.1   Limit, Fit and Tolerances
          3.1.2   Machining Symbols and Surface Finish

3.2 Threads, Bolts and Nuts

    3.2.1 Thread Terms and Nomenclature, Forms of Screw Threads

    3.2.2 Detailed and Simplified Representation of Internal and External Threads

    3.2.3 Thread Dimensioning

    3.2.4 Standard Bolts and Nuts: Hexagonal Head and Square Head

    3.2.5 Conventional Symbols for Bolts and Nuts

3.3 Welding and Riveting

    3.3.1 Types of Welded Joints and Types of Welds, Welding Symbols

    3.3.2 Forms and Proportions for Rivet Heads, Rivet Symbols, Types of Riveted Joints: Lap Joint, Butt Joint

3.4 Familiarization with Graphical Symbols and Conventions in Different Engineering Fields

    3.4.1 Standard Symbols for Civil, Structural and Agricultural Components

    3.4.2 Standard Symbols for Electrical, Mechanical and Industrial Components

    3.4.3 Standard Symbols for Electronics, Communication and Computer Components

    3.4.4 Topographical Symbols

3.5 Standard Piping Symbols and Piping Drawing

4. Detail and Assembly Drawings   (20 hours)

4.1 Introduction to Working Drawing

4.2 Components of Working Drawing: Drawing Layout, Bill of Materials, Drawing Numbers

4.3 Detail Drawing

4.4 Assembly Drawing

4.5 Practices of Detail and Assembly Drawing: V-block Clamp, Centering Cone, Couplings, Bearings, Antivibration Mounts, Stuffing Boxes, Screw Jacks, etc

Practical:

1. Conventional Practices for Orthographic and Sectional Views (Full and Half Section)
2. Conventional Practices for Orthographic and Sectional Views (Other Type Sections)
3. Isometric Drawing
4. Isometric Drawing (Consisting of Curved Surfaces and Sections)
5. Oblique Drawing
6. Perspective Projection
7. Familiarization with Graphical Symbols (Limit, Fit, Tolerances and Surface Roughness Symbols)
8. Familiarization with Graphical Symbols (Symbols for Different Engineering Fields)

9. Detail Drawing
10. Assembly Drawing I
11. Assembly Drawing II
12. Building Drawing

References:
1. W. J. Luzadder, " Fundamentals of Engineering Drawing", Prentice Hall.
2. T. E. French, C. J. Vierck, and R. J. Foster, "Engineering Drawing and Graphic Technology", Mc Graw Hill Publshing Co.
3. F. E. Giescke, A . Mitchell, H. C. Spencer and J. T. Dygdone, "Technical Drawing", Macmillan Publshing Co.
4. N. D. Bhatt, "Machine Drawing", Charotar Publshing House, India.
5. P. S. Gill, "Machine Drawing", S. K. Kataria and Sons, India.
6. R. K. Dhawan "Machine Drawing", S. Chand and Company Limited, India.

BASIC ELECTRONICS ENGINEERING
EX 451

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

Course Objectives:

To understand the electronics elements and their functionality, basic understanding of analog and digital systems and their applications

1. Basic Circuits Concepts (4 hours)

1.1 Passive components: Resistance, Inductance, Capacitance; series, parallel combinations; Kirchhoff's law: voltage, current; linearity

1.2 Signal sources: voltage and current sources; nonideal sources; representation under assumption of linearity; controlled sources: VCVS, CCVS, VCCS, CCCS; concept of gain, transconductance, transimpedance.

1.3 Superposition theorem; Thevenin's theorem; Norton's theorem

1.4 Introduction to filter

2. Diodes (6 hours)

2.1 Semiconductor diode characteristics

2.2 Modeling the semiconductor diode

2.3 Diode circuits: clipper; clamper circuits

2.4 Zener diode, LED, Photodiode, varacters diode, Tunnel diodes

2.5 DC power supply: rectifier-half wave, full wave (center tapped, bridge), Zener regulated power supply

3. Transistor (8 hours)

3.1 BJT configuration and biasing, small and large signal model

3.2 T and μ model

3.3 Concept of differential amplifier using BJT

3.4 BJT switch and logic circuits

3.5 Construction and working principle of MOSFET and CMOS

3.6 MOSFET as logic circuits

4. The Operational Amplifier and Oscillator (7 hours)

4.1 Basic model; virtual ground concept; inverting amplifier; non-inverting amplifier; integrator; differentiator, summing amplifier and their applications

4.2 Basic feedback theory; positive and negative feedback; concept of stability; oscillator

4.3 Waveform generator using op-amp for Square wave, Triangular wave Wien bridge oscillator for sinusoidal waveform

5. Communication System (4 hours)

5.1 Introduction
5.2 Wired and wireless communication system
5.3 EMW and propagation, antenna, broadcasting and communication
5.4 Internet / intranet
5.5 Optical fiber

6. Digital Electronics (11 hours)

6.1 Number systems, Binary arithmetic
6.2 Logic gates: OR, NOT, AND NOR, NAND, XOR, XNOR gate; Truth tables
6.3 Multiplexers; Demux, Encoder, Decoder
6.4 Logic function representation
6.5 Combinational circuits: SOP, POS form; K-map;
6.6 Latch, flip-flop: S-R flip-flop; JK master slave flip-flop; D-flip flop
6.7 Sequential circuits: Generic block diagram; sift registers; counters

7. Application of Electronic System (5 hours)

7.1 Instrumentation system: Transducer, strain gauge, DMM, Oscilloscope
7.2 Regulated power supply
7.3 Remote control, character display, clock, counter, measurements, date logging, audio video system

Practical:

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

References

1. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" PHI
2. Thomas L. Floyd, "Electronic Devices" Pearson Education, Inc.
3. A.S. Sedra and K.C. Smith, "Microelectronic Circuits", Oxford University Press.

ENGINEERING CHEMISTRY
SH 453

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

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

FUNDAMENTALS OF THERMODYNAMICS AND HEAT TRANSFER
ME 452

Lectures : 3
Tutorial   : 1
Practical : 3/2

Year : I
Part : II

Course Objective:

To develop basic concepts, laws of thermodynamics and heat transfer and their applications.

1. **Introduction** (3 hours)
   1.1   Definition and Scope of Engineering Thermodynamics
   1.2   Value of energy to society
   1.3   Microscopic versus Macroscopic Viewpoint
   1.4   Concepts and Definitions
       1.4.1   System, Surroundings, Boundary and Universe; Closed Systems, Open Systems, and Isolated Systems
       1.4.2   Thermodynamic Properties: Intensive, Extensive and Specific Properties
       1.4.3   Thermodynamic Equilibrium
       1.4.4   Thermodynamic State
       1.4.5   Thermodynamic Process, Cyclic Process, Quasi-equilibrium Process, Reversible and Irreversible Process
   1.5   Common Properties: Pressure, Specific Volume, Temperature
   1.6   Zeroth Law of Thermodynamics, Equality of Temperature

2. **Energy and Energy Transfer** (3 hours)
   2.1   Energy and its Meaning
   2.2   Stored Energy and Transient Energy; Total Energy
   2.3   Energy Transfer
       2.3.1   Heat Transfer
       2.3.2   Work Transfer
   2.4   Expressions for displacement work transfer
   2.5   Power

3. **Properties of Common Substances** (6 hours)
   3.1   Pure Substance and State Postulate
   3.2   Ideal Gas and Ideal Gas Relations
   3.3   Two Phase (Liquid and Vapor) Systems: Phase Change; Subcooled Liquid, Saturated Liquid, Wet Mixture, Critical Point, Quality, Moisture Content, Saturated Vapor and Superheated Vapor
   3.4   Properties of Two Phase Mixtures

3.5 Other Thermodynamic Properties: Internal Energy, Enthalpy, and Specific Heats

3.6 Development of Property Data: Graphical Data Presentation and Tabular Data Presentation

4. First Law of Thermodynamics (9 hours)

4.1 First Law of Thermodynamics for Control Mass; First Law of Thermodynamics for Control Mass Undergoing Cyclic Process

4.2 First Law of Thermodynamics for Control Volume

4.3 Control Volume Analysis: Steady State Analysis and Unsteady State Analysis

4.4 Control Volume Application: Steady and Unsteady Work Applications and Steady and Unsteady Flow Applications

4.5 Other Statements of the First Law

5. Second Law of Thermodynamics (9 hours)

5.1 Necessity of Formulation of Second Law

5.2 Entropy and Second Law of Thermodynamics for an Isolated System

5.3 Reversible and Irreversible Processes

5.4 Entropy and Process Relation for an Ideal Gases and Incompressible Substances

5.5 Control Mass Formulation of Second Law

5.6 Control Volume Formulation of Second Law

5.7 Isentropic Process for an Ideal Gas and for an Incompressible Substances

5.8 Carnot Cycle, Heat Engine, Heat Pump and Refrigerator

5.9 Kelvin-Planck and Clausius Statements of the Second Law of Thermodynamics and their Equivalence

6. Thermodynamic Cycles (9 hours)

6.1 Classification of Cycles

6.2 Air Standard Brayton Cycle

6.3 Rankine Cycle

6.4 Internal Combustion Cycles

    6.4.1 Air standard Analysis

    6.4.2 Air Standard Otto Cycle

    6.4.3 Air Standard Diesel Cycle

6.5 Vapor Compression Refrigeration Cycle

7. Introduction to Heat Transfer (6 hours)

7.1 Basic Concepts and Modes of Heat Transfer

7.2 One dimensional steady state heat conduction through a plane wall

7.3 Radial steady state heat conduction through a hollow cylinder

7.4 Heat flow through composite structures

    7.4.1 Composite Plane Wall

    7.4.2 Multilayer tubes

7.5   Electrical Analogy for thermal resistance
7.6   Combined Heat Transfer and Overall Heat Transfer Coefficient for Plane Wall and Tube
7.7   Nature of Convection; Free and Forced Convection
7.8   Heat Radiation, Stefan's Law, Absorptivity, Reflectivity and Transmissivity; Black Body, White Body and Gray Body

Practical:

1.   Temperature Measurements
2.   Experiment related to first law
3.   Heat Pump
4.   Heat Conduction
5.   Heat Radiation

References:

1.   M. C. Luintel, "Fundamentals of Thermodynamics and Heat Transfer", Athrai Publication (P) Limited.
2.   R. Gurung, A. Kunwar & T. R. Bajracharya, "Fundamentals of Engineering Thermodynamics and Heat Transfer", Asmita   Books Publishers and Distributors (P) Limited.
3.   J. R. Howell & R. O. Buckius, "Fundamentals of Engineering Thermodynamics", McGraw Hill Publishers
4.   V. Wylen, Sonntag & Borgnakke, "Fundamentals of Thermodynamics", John Wiley & Sons, Inc.
5.   M. J. Moran & H. N. Shapiro, "Fundamentals of Engineering Thermodynamics", John Wiley & Sons, Inc.
6.   Y. A. Cengel & M.A. Boles, "Thermodynamics: An Engineering Approach", McGraw-Hill.
7.   J. P. Holman, "Heat Transfer", McGraw-Hill
8.   Y. A. Cengel, "Heat Transfer: A Practical Approach", McGraw-Hill.

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

9. Grinding Machines
10. Sheet Metal works
11. Foundry Practice
12. Forging Practice
13. Electric Arc Welding
14. Gas Welding

References:

1. Anderson and E. E. Tatro, "Shop Theory", JMcGraw – Hill.
2. O. D. Lascoe, C. A. Nelson and H. W. Porter, "Machine shop operations and setups", American Technical society.
3. "Machine shop Practice – Vol. I" , Industrial Press, New York.
4. "Machine shop Practice – Vol. I" , Industrial Press, New York.
5. Ryerson, " Technology of Machine Tools", Mc Graw Hill.
6. Oberg, Jones and Horton, "Machinery's Handbook", Industrial Press, New York.
7. S. K. Hajra Choudhury and A. K. Hajra Choudhury, "Elements of Workshop Technology - Vol. I (Manufacturing Processes)", Media Promoters and Publishers Pvt. Ltd. , Bombay, INDIA.
8. S. K. Hajra Choudhury, S. K. Bose and A. K. Hajra Choudhury , "Elements of Workshop Technology - Vol. II: (Machine Tools)" , Media Promoters and Publishers Pvt. Ltd. , Bombay, INDIA.
9. Prof. B. S. Raghuwanshi, "A Course in Workshop Technology - Vol. I" , Dhanpat Rai and Co. (P) Ltd, Delhi, INDIA.
10. Prof. B. S. Raghuwanshi, "A Course in Workshop Technology - Vol. II" , Dhanpat Rai and Co. (P) Ltd, Delhi, INDIA.
11. H. S. Bawa, "Workshop Technology - Vol. I", Tata Mc – Graw Hill publishing company Limited, New Delhi, INDIA,
12. H. S. Bawa, "Workshop Technology - Vol. II" , Tata Mc – Graw Hill publishing company Limited, New Delhi, INDIA,
13. R. S. Khurmi and J. K. Gupta, "A text book of Workshop Technology", S. Chand and Company Ltd, New Delhi. INDIA

B.E. DEGREE
IN
COMPUTER ENGINEERING

Year : II

S. N.	Course Code	Course Title	Teaching Schedule				Examination Scheme						Total	Remark
							Theory			Practical				
			L	T	P	Total	Assesment Marks	Final		Assesment Marks	Final			
								Duaration hours	Marks		Duaration hours	Marks		
1	SH 501	Engineering Mathematics III	3	2		5	20	3	80				100	
2	CT 501	Object Oriented Programming	3		3	6	20	3	80	50			150	
3	CT 502	Theory of Computation	3	1		4	20	3	80				100	
4	EE 501	Electric Circuit Theory	3	1	1.5	5.5	20	3	80	25			125	
5	EX 501	Electronic Devices & Circuits	3	1	1.5	5.5	20	3	80	25			125	
6	EX 502	Digital Logic	3		3	6	20	3	80	50			150	
7	EX 503	Electromagnetics	3	1	1.5	5.5	20	3	80	25			125	
		Total	21	6	10.5	37.5	140	21	560	175			875	

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.

OBJECT ORIENTED PROGRAMMING
CT 501

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

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

THEORY OF COMPUTATION
CT 502

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

Course Objectives:
To provide basic understanding of theory of automata, formal languages, turing machines and computational complexity

1. **Introduction**   **(4 hours)**
    1.1   Set, relation, function, Proof techniques.
    1.2   Alphabets, language, regular expression.

2. **Finite Automata**   **(12 hours)**
    2.1   Deterministic Finite Automata.
    2.2   Non-Deterministic Finite Automata.
    2.3   Equivalence of regular language and finite automata.
    2.4   Regular language, properties of regular language.
    2.5   Pumping lemma for regular language.
    2.6   Decision algorithms for regular languages.

3. **Context free language**   **(12 hours)**
    3.1   Context free grammar.
    3.2   Derivative trees, simplification of context free grammar.
    3.3   Chomsky normal form.
    3.4   Push down automata.
    3.5   Equivalence of context free language and push down automata.
    3.6   Pumping lemma for context free language.
    3.7   Properties of context free language.
    3.8   Decision algorithms for context free language.

4. **Turing machine**   **(10 hours)**
    4.1   Definition of Turing machine, notation for Turing machine.
    4.2   Computing with Turing machine.
    4.3   Extensions of Turing machine.
    4.4   Unrestricted grammar.
    4.5   Recursive function theory.

5. **Undecidability**   **(5 hours)**
    5.1   The Church-Turing thesis.
    5.2   Halting Problem, Universal Turing machine.
    5.3   Undecidable problems about Turing machines, grammars.
    5.4   Properties of Recursive, Recursively enumerable languages.

6.   Computational Complexity   **(2 hours)**
6.1   Class P, Class NP, NP-complete problems.

References
1.   H. R. Lewis, C. H. Papadimitriou, "Elements of theory of computation", Pearson Education.
2.   Michael Sipser, "Introduction to the Theory of Computation", Thomson Course Technology.

ELECTRIC CIRCUIT THEORY
EE 501

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

Course Objectives:

To continue work in Basic Electrical Engineering including the use of the Laplace Transform to determine the time and frequency domain responses of electric circuits.

1. **Network Analysis of AC circuit & dependent sources**   **(8 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
        3.5.1   DC excitation
        3.5.2   Exponential excitation
        3.5.3   Sinusoidal excitation
    3.6   Response of R-C circuit with
        3.6.1   DC excitation
        3.6.2   Exponential excitation
        3.6.3   Sinusoidal excitation
    3.7   Response of series R-L-C circuit with
        3.7.1   DC excitation
        3.7.2   Exponential excitation
        3.7.3   Sinusoidal excitation
    3.8   Response of parallel R-L-C circuit with DC excitation

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
    4.6.1 DC excitation
    4.6.2 Exponential excitation
    4.6.3 Sinusoidal excitation
4.7 Response of R-C circuit with
    4.7.1 DC excitation
    4.7.2 Exponential excitation
    4.7.3 Sinusoidal excitation
4.8 Response of series R-L-C circuit with
    4.8.1 DC excitation
    4.8.2 Exponential excitation
    4.8.3 Sinusoidal excitation
4.9 Response of parallel R-L-C circuit with exponential excitation
4.10 Transfer functions Poles and Zeros of Networks

5. Frequency Response of Network (6 hours)

5.1 Introduction
5.2 Magnitude and phase response
5.3 Bode diagrams
5.4 Band width of Series & parallel Resonance circuits
5.5 Basic concept of filters, high pass, low pass, band pass and band stop filters

6. Fourier Series and transform (5 hours)

6.1 Basic concept of Fourier series and analysis
6.2 Evaluation of Fourier coefficients for periodic non-sinusoidal waveforms in electric networks
6.3 Introduction of Fourier transforms

7. Two-port Parameter of Networks (6 Hours)

7.1 Definition of two-port networks
7.2 Short circuit admittance parameters
7.3 Open circuits impedance parameters
7.4 Transmission Short circuit admittance parameters
7.5 Hybrid parameters
7.6 Relationship and transformations between sets of parameters
7.7 Application to filters
7.8 Applications to transmission lines
7.9 Interconnection of two-port network (Cascade, series, parallel)

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. Frequency Response of first order passive circuits
-    measure amplitude and phase response and plot bode diagrams for RL, RC and RLC circuits
-    relate Bode diagrams to transfer functions and pole zero configuration circuit

5. Frequency Response of second order passive circuits
-    measure amplitude and phase response and plot bode diagrams for RL, RC and RLC circuits
-    relate Bode diagrams to transfer functions and pole zero configuration circuit

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.

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

DIGITAL LOGIC
EX 502

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

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"

ELECTROMAGNETICS
EX 503

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : II
Part : I

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   Impedance 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.

B.E. DEGREE
IN
COMPUTER ENGINEERING

Year : II   Part : II

S. N.	Course Code	Course Title	Teaching Schedule				Examination Scheme						Total	Remark
			L	T	P	Total	Theory			Practical				
							Assesment Marks	Final		Assesment Marks	Final			
								Duaration hours	Marks		Duaration hours	Marks		
1	SH 551	Applied Mathematics	3	1		4	20	3	80				100	
2	SH 553	Numerical Methods	3	1	3	7	20	3	80	50			150	
3	EE 552	Instrumentation I	3	1	1.5	5.5	20	3	80	25			125	
4	EE 554	Electrical Machines	3	1	1.5	5.5	20	3	80	25			125	
5	CT 551	Discrete Structure	3			3	20	3	80				100	
6	CT 552	Data Structure and Algorithm	3		3	6	20	3	80	50			150	
7	EX 551	Microprocessor	3	1	3	7	20	3	80	50			150	
		Total	21	5	12	38	140	21	560	200			900	

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.

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

INSTRUMENTATION I
EE 552

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

Course Objectives:

To provide comprehensive treatment of methods and instrument for a wide range of measurement problems

1. Instrumentations Systems   **(2 hours)**
   1.1   Functions of components of instrumentation system introduction, signal   processing , Signal transmission ,output indication
   1.2   Need for electrical, electronics, pneumatic and hydraulic working media systems and conversion devices
   1.3   Analog and digital systems

2. Theory of measurement   **(10 hours)**
   2.1   Static performance parameters - accuracy, precision, sensitivity, resolution and linearity
   2.2   Dynamic performance parameters - response time, frequency response and bandwidth
   2.3   Error in measurement
   2.4   Statistical analysis of error in measurement
   2.5   Measurement of voltage & current (moving coil & moving iron instruments)
   2.6   Measurement of low, high & medium resistances
   2.7   AC bridge & measurement of inductance and capacitance

3. Transducer   **(8 hours)**
   3.1   Introduction
   3.2   Classification
   3.3   Application
       3.3.1   Measurement of mechanical variables, displacement, strain. velocity. acceleration and vibration
       3.3.2   Measurement of process variables - temperature pressure, level, fluid flow, chemical constituents in gases or liquids, pH and humidity.
       3.3.3   Measurement of bio-physical variables blood pressure and myoelectric potentials

4. Electrical Signal Processing and transmission   **(6 hours)**
   4.1   Basic Op-amp characteristics
   4.2   Instrumentation amplifier

4.3 Signal amplification, attenuation, integration, differentiation, network isolation, wave shaping
4.4 Effect of noise, analog filtering, digital filtering
4.5 Optical communication, fibre optics, electro-optic conversion devices

5. **Analog - Digital and Digital - Analog Conversion** (6 hours)
5.1 Analog signal and digital signal
5.2 Digital to analog convertors - weighted resistor type, R-2R ladder type, DAC Errors
5.3 Analog to digital convertors - successive approximation type, ramp type, dual ramp type, flash type, ADC errors

6. **Digital Instrumentation** (5 hours)
6.1 Sample data system, sample and hold circuit
6.2 Components of data acquisition system
6.3 Interfacing to the computer

7. **Electrical equipment** (8 hours)
7.1 Wattmeter
   7.1.1 Types
   7.1.2 Working principles
7.2 Energy meter
   7.2.1 Types
   7.2.2 Working principles
7.3 Frequency meter
   7.3.1 Types
   7.3.2 Working principles
7.4 Power factor meter
7.5 Instrument transformers

Practical:
1. Accuracy test in analog meters
2. Operational Amplifiers in Circuits
   - Use of Op amp as a summer, inverter, integrator and differentiator
3. Use resistive, inductive and capacitive transducers to measure displacement
   - Use strain gauge transducers to measure force
4. Study of Various transducers for measurement of Angular displacement, Angular Velocity, Pressure and Flow
   - Use optical, Hall effect and inductive transducer to measure angular displacement
   - Use tacho - generator to measure angular velocity
   - Use RTD transducers to measure pressure and flow
5. Digital to Analog Conversion
   - Perform static testing of D/A converter
6. Analog to Digital Conversion
   - Perform static testing of A/D converter

References:

1. D.M Considine "Process Instruments and Controls Handbook" McGraw Hill.

2. S. Wolf and R.F.M. Smith "Students Reference Manual for Electronics Instrumentation Laboratories", Prentice Hall.

3. E.O Deobelin "Measurement System, Application and Design" McGraw Hill.

4. A.K Sawhney "A Course in Electronic Measurement and Instrumentation " DhanpatRai and Sons.

5. C.S. Rangan, G.R Sharma and V.S.V. Mani, "Instrumentation Devices and Systems" Tata McGraw Hill publishing Company Limited New Delhi.

6. J.B. Gupta. "A Course in Electrical & Electronics Measurement & Instrumentation, Kataria& Sons.

ELECTRICAL MACHINES
EE 554

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

Course Objectives:
To impart knowledge on constructional details, operating principle and performance of Transformers, DC Machines, 1-phase and 3-phase Induction Machines, 3-phase Synchronous Machines and Fractional Kilowatt Motors.

1. Magnetic Circuits and Induction   **(4hours)**
    1.1   Magnetic Circuits
    1.2   Ohm's Law for Magnetic Circuits
    1.3   Series and Parallel magnetic circuits
    1.4   Core with air gap
    1.5   B-H relationship (Magnetization Characteristics)
    1.6   Hysteresis with DC and AC excitation
    1.7   Hysteresis Loss and Eddy Current Loss
    1.8   Faraday's Law of Electromagnetic Induction, Statically and Dynamically Induced EMF
    1.9   Force on Current Carrying Conductor

2. Transformer   **(8 hours)**
    2.1   Constructional Details, recent trends
    2.2   Working principle and EMF equation
    2.3   Ideal Transformer
    2.4   No load and load Operation
    2.5   Operation of Transformer with load
    2.6   Equivalent Circuits and Phasor Diagram
    2.7   Tests: Polarity Test, Open Circuit test, Short Circuit test and Equivalent Circuit Parameters
    2.8   Voltage Regulation
    2.9   Losses in a transformer
    2.10 Efficiency, condition for maximum efficiency and all day efficiency
    2.11 Instrument Transformers: Potential Transformer (PT) and Current Transformer (CT)
    2.12 Auto transformer: construction, working principle and Cu saving
    2.13 Three phase Transformers

3. DC Generator   **(6 hours)**
    3.1   Constructional Details and Armature Winding
    3.2   Working principle and Commutator Action
    3.3   EMF equation

3.4 Method of excitation: separately and self excited, Types of DC Generator
3.5 Characteristics of series, shunt and compound generator
3.6 Losses in DC generators
3.7 Efficiency and Voltage Regulation

4. DC Motor (6 hours)
4.1 Working principle and Torque equation
4.2 Back EMF
4.3 Method of excitation, Types of DC motor
4.4 Performance Characteristics of D.C. motors
4.5 Starting of D.C. Motors: 3 point and 4 point starters
4.6 Speed control of D.C. motors: Field Control, Armature Control
4.7 Losses and Efficiency

5. Three Phase Induction Machines (7 hours)
5.1 Three Phase Induction Motor
    5.1.1 Constructional Details and Types
    5.1.2 Operating Principle, Rotating Magnetic Field, Synchronous Speed, Slip, Induced EMF, Rotor Current and its frequency, Torque Equation
    5.1.3 Torque-Slip characteristics
5.2 Three Phase Induction Generator
    5.2.1 Working Principle, voltage build up in an Induction Generator
    5.2.2 Power Stages

6. Three Phase Synchronous Machines (8 hours)
6.1 Three Phase Synchronous Generator
    6.1.1 Constructional Details, Armature Windings, Types of Rotor, Exciter
    6.1.2 Working Principle
    6.1.3 EMF equation, distribution factor, pitch factor
    6.1.4 Armature Reaction and its effects
    6.1.5 Alternator with load and its phasor diagram
6.2 Three Phase Synchronous Motor
    6.2.1 Principle of operation
    6.2.2 Starting methods
    6.2.3 No load and Load operation, Phasor Diagram
    6.2.4 Effect of Excitation and power factor control

7. Fractional Kilowatt Motors (6 hours)
7.1 Single phase Induction Motors: Construction and Characteristics
7.2 Double Field Revolving Theory
7.3 Split phase Induction Motor
    7.3.1 Capacitors start and run motor
    7.3.2 Reluctance start motor

7.4   Alternating Current Series motor and Universal motor

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

Practical:

1.   Magnetic Circuits
-     To draw B-H curve for two different sample of Iron Core
-     Compare their relative permeability

2.   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

3.   DC Generator
-     To draw open circuit characteristic (OCC) of a DC shunt generator
-     To draw load characteristic of shunt generator

4.   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.

5.   3-phase Machines
-     To draw torque-speed characteristics and to observe the effect of rotor resistance on torque-speed characteristics of a 3-phase Induction Motor
-     To study load characteristics of synchronous generator with (a) resistive load (b) inductive load and (c) capacitive load

6.   Fractional Kilowatt 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.   I.J. Nagrath & D.P.Kothari," Electrical Machines", Tata McGraw Hill

2.   S. K. Bhattacharya, "Electrical Machines", Tata McGraw Hill

3.   B. L. Theraja and A. K. Theraja, "Electrical Technology (Vol-II)", S. Chand

4.   Husain Ashfaq ," Electrical Machines", DhanpatRai& Sons

5.   A.E. Fitzgerald, C.KingsleyJr and Stephen D. Umans,"Electric Machinery", Tata McGraw Hill

6.   B.R. Gupta &VandanaSinghal, "Fundamentals of Electrical Machines, New Age International

7.   P. S. Bhimbra, "Electrical Machines"' Khanna Publishers

8. Irving L.Kosow, "Electric Machine and Tranformers", Prentice Hall of India.

9. M.G. Say, "The Performance and Design of AC machines", Pit man & Sons.

10. Bhag S. Guru and Huseyin R. Hizirogulu, "Electric Machinery and Transformers" Oxford University Press.

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

MICROPROCESSORS
EX 551

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

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

B.E. DEGREE
IN
COMPUTER ENGINEERING

Year : III   Part : I

S. N.	Course Code	Course Title	Teaching Schedule				Examination Scheme						Total	Remark
							Theory			Practical				
			L	T	P	Total	Assesment Marks	Final		Assesment Marks	Final			
								Duaration hours	Marks		Duaration hours	Marks		
1	SH 601	Communication English	3	1	2	6	20	3	80	25			125	
2	SH 602	Probability and Statistics	3	1		4	20	3	80				100	
3	CT 601	Software Engineering	3	1	1.5	5.5	20	3	80	25			125	
4	CT 602	Data Communication	3	1	1.5	5.5	20	3	80	25			125	
3	CT 603	Computer Organization & Architecture	3	1	1.5	5.5	20	3	80	25			125	
6	EX 602	Instrumentation II	3	1	1.5	5.5	20	3	80	25			125	
7	EX 603	Computer Graphics	3	1	3	7	20	3	80	50			150	
		Total	21	7	11	39	140	21	560	175			875	

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.

PROBABILITY AND STATISTICS
SH 602

Lecture   : 3   Year : III
Tutorial   : 1   Part : I
Practical : 0

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.

SOFTWARE ENGINEERING
CT 601

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

Course Objectives:

To provide a systematic approach towards planning, development, implementation and maintenance of system, also help developing software projects

1. Software Process and requirements   (12 hours)
  1.1   Software crisis
  1.2   Software characteristics
  1.3   Software quality attributes
  1.4   Software process model
  1.5   Process iteration
  1.6   process activities
  1.7   Computer-aided software engineering
  1.8   Functional and non –functional requirements
  1.9   User requirements
  1.10 System requirement
  1.11 Interface specification
  1.12 The software requirements documents
  1.13 Feasibility study
  1.14 Requirements elicitation and analysis
  1.15 Requirements validation and management

2. System models   (3 hours)
  2.1   Context models
  2.2   Behavioural models
  2.3   Data and object models
  2.4   Structured methods

3. Architectural design   (6 hours)
  3.1   Architectural design decisions
  3.2   System organization
  3.3   Modular decomposition styles
  3.4   Control styles
  3.5   Reference architectures
  3.6   Multiprocessor architecture
  3.7   Client –server architectures
  3.8   Distributed object architectures
  3.9   Inter-organizational distributed computing

4. **Real –time software design** (3 hours)
   - 4.1 System design
   - 4.2 Real-time operating systems
   - 4.3 Monitoring and control systems
   - 4.4 Data acquisition systems

5. **Software Reuse** (3 hours)
   - 5.1 The reuse landscape
   - 5.2 Design patterns
   - 5.3 Generator –based reuse
   - 5.4 Application frameworks
   - 5.5 Application system reuse

6. **Component-based software engineering** (2 hours)
   - 6.1 Components and components models
   - 6.2 The CBSE process
   - 6.3 Component composition

7. **Verification and validation** (4 hours)
   - 7.1 Planning verification and validation
   - 7.2 Software inspections
   - 7.3 Verification and formal methods
   - 7.4 Critical System verification and validation

8. **Software Testing and cost Estimation** (5 hours)
   - 8.1 System testing
   - 8.2 Component testing
   - 8.3 Test case design
   - 8.4 Test automation
   - 8.5 Metrics for testing
   - 8.6 Software productivity
   - 8.7 Estimation techniques
   - 8.8 Algorithmic cost modeling
   - 8.9 Project duration and staffing

9. **Quality management** (5 hours)
   - 9.1 Quality concepts
   - 9.2 Software quality assurance
   - 9.3 Software reviews
   - 9.4 Formal technical reviews
   - 9.5 Formal approaches to SQA
   - 9.6 Statistical software quality assurance
   - 9.7 Software reliability
   - 9.8 A framework for software metrics

9.9   Matrices for analysis and design model
9.10   ISO standards
9.11   CMMI
9.12   SQA plan
9.13   Software certification

10. Configuration Management   **(2 hours)**
10.1   Configuration management planning
10.2   Change management
10.3   Version and release management
10.4   System building
10.5   CASE tools for configuration management

Practical

The laboratory exercises shall include projects on requirements, analysis and designing of software system. Choice of project depend upon teacher and student, case studies shall be included too.

Guest lecture from software industry in the practical session.

References:

1.   Ian Sommerville, Software Engineering
2.   Roger S. Pressman, Software Engineering –A Practitioner's Approach
3.   Pankaj Jalote, Software Engineering-A precise approach
4.   Rajib Mall, Fundamental of Software Engineering

DATA COMMUNICATION
CT 602

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

Course Objective:
To familiarize student with the concept of data communication, communication signals and their characteristics, transmission media and their characteristics, basics of multiplexing and switching

1. Introduction [4 hours]
1.1 Data and Signal
1.2 Analog and Digital Signal
1.3 Data Representation
1.4 Analog and Digital Data Communication System
1.5 Transmission Impairments (Attenuation, Noise, Distortion)

2. Signals and Systems [4 hours]
2.1 Signal and Classification of Signals: Periodic and Non-periodic Signals, Deterministic and Random Signals, Energy and Power Signals, Continuous Time and Discrete Time Signals
2.2 System and Basic Properties of Systems: System with and without memory, Linearity, Time Invariance, Invertibility, Casuality, Stability

3. Signal Analysis [6 hours]
3.1 Unit Impulse Function and Unit Step Function
3.2 LTI System and Impulse Response
3.3 Fourier Series Representation of Continuous Time Signal
3.4 Fourier Transform of Continuous Time Signal
3.5 Spectral Analysis of a Signal, Signal Bandwidth

4. Transmission Media [4 hours]
4.1 Electromagnetic Spectrum for Communication and Type of Propagation
4.2 Guided Transmission Media: Copper Media (Twisted pair and Co-axial) and Fiber Optics
4.3 Unguided Communication Bands and Antennas
4.4 Unguided Transmission Media: Terrestrial Microwaves, Satellite Communication and Cellular System
4.5 Data Rate Limits: Nyquist Bit Rate for Noiseless Channel, Shannon Capacity for Noisy Channel
4.6 Performance of Channel: Bandwidth, Throughput, Latency, Jitter, Bit Error Rate (BER)

5. Data Encoding and Modulation   **[10 hours]**

5.1   Baseband Communication (Analog/Digital)
5.2   Data Encoding and Modulation
5.3   Types of Analog Modulation: Amplitude Modulation, Frequency Modulation and Phase Modulation
5.4   Pulse Modulation System: Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM)
5.5   Encoding Analog Data as Digital Signal: Pulse Code Modulation (PCM)
5.6   Encoding Digital Data as Digital Signals
5.7   Line Coding Schemes: NRZ, RZ, Manchester, AMI
5.8   Block Coding, Scrambling
5.9   Digital Modulation: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Quadrature Amplitude Modulation (QAM)

6. Multiplexing and Spreading   **[6 hours]**

6.1   Multiplexing and Application
6.2   Frequency Division Multiplexing (FDM), Wavelength-Division Multiplexing (WDM)
6.3   Time Division Multiplexing (TDM)
6.4   Spread Spectrum
6.5   Code-Division Multiple Access (CDMA)

7. Switching   **[3 hours]**

7.1   Switching and Application
7.2   Circuit Switching and Packet Switching
7.3   Datagram Switching and Virtual Circuit Switching
7.4   X.25, Frame Relay, ATM

8. Information Theory and Coding   **[8 hours]**

8.1   Introduction to Information Theory, Average Information
8.2   Source Coding – Huffman Coding
8.3   Error Detection and Correction Codes
8.4   Hamming Distance
8.5   Linear Block Coding
8.6   Cyclic Codes, CRC
8.7   Convolution Codes

Practical:
1.   Signal analysis using MATLAB
2.   Bandwidth analysis of different signals using spectrum analyzer
3.   Analog Modulation Generation and Reconstruction
4.   Pulse Modulation Generation and Reconstruction
5.   Conversion of given binary sequence into different line coding
6.   Digital Modulation (ASK, FSK, PSK) Generation and Reconstruction

References:
1. William Stallings, "Data and Computer Communications"
2. Behrouz A Forouzan, "Data Communications and Networking"
3. A. V. Oppenheim, "Signals and Systems"
4. A. S. Tanenbaum, "Computer Networks"

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"

INSTRUMENTATION II
EX 602

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

Course Objective:

To introduce and apply the knowledge of microprocessor, A/D, D/A converter to design Instrumentation system and to provide the concept of interfacing with microprocessor based system and circuit design techniques

1. Microprocessor Based Instrumentation System   **(4 hours)**

   1.1   Basic Features of Microprocessor Based System
   1.2   Open Loop and Closed Loop Microprocessor Based System
   1.3   Benefits of Microprocessor Based System
   1.4   Microcomputer on Instrumentation Design
   1.5   Interfacing With Microprocessor
      1.5.1   PC Interfacing Techniques
      1.5.2   Review of Address Decoding
      1.5.3   Memory Interfacing
      1.5.4   Programmed I/O, Interrupt Driven I/O and Direct   Memory Access (DMA)

2. Parallel Interfacing With Microprocessor Based System   **(4 hours)**

   2.1   Methods of Parallel Data Transfer : Simple Input and Output, Strobe I/O, Single Handshake I/O, & Double Handshake I/O
   2.2   8255 as General Purpose Programmable I/O Device and its interfacing examples
   2.3   Parallel Interfacing with ISA and PCI bus

3. Serial Interfacing With Microprocessor Based System   **(6 hours)**

   3.1   Advantages of Serial Data Transfer Over Parallel
   3.2   Synchronous and Asynchronous Data Transfer
   3.3   Errors in Serial Data Transfer
   3.4   Simplex, Half Duplex and Full Duplex Data Communication
   3.5   Parity and Baud Rates
   3.6   Introduction Serial Standards RS232, RS423, RS422
   3.7   Universal Serial Bus
      3.7.1   The Standards: - USB 1.1 and USB 2.0
      3.7.2   Signals, Throughput & Protocol
      3.7.3   Devices, Hosts And On-The-Go
      3.7.4   Interface Chips:- USB Device And USB Host

4. Interfacing A/D And D/A Converters   **(4 hours)**

   4.1   Introduction

4.2 General Terms Involved in A/D and D/A Converters

4.3 Examples of A/D and D/A Interfacing

4.4 Selection of A/D and D/A Converters Based on Design Requirements

5. Data Acquisition And Transmission (5 hours)

5.1 Analog and Digital Transmission

5.2 Transmission Schemes

    5.2.1 Fiber Optics

    5.2.2 Satellite

    5.2.3 Bluetooth Devices

5.3 Data Acquisition System

    5.3.1 Data Loggers

    5.3.2 Data Archiving and Storage

6. Grounding And Shielding (3 hours)

6.1 Outline for Grounding and Shielding

6.2 Noise, Noise Coupling Mechanism and Prevention

6.3 Single Point Grounding and Ground Loop

6.4 Filtering and Smoothing

6.5 Decoupling Capacitors and Ferrite Beads

6.6 Line Filters, Isolators and Transient Suppressors

6.7 Different Kinds of Shielding Mechanism

6.8 Protecting Against Electrostatic Discharge

6.9 General Rules For Design

7. Circuit Design (3 hours)

7.1 Converting Requirements into Design

7.2 Reliability and Fault Tolerance

7.3 High Speed Design

7.4 Bandwidth, Decoupling, Ground Bounce, Crosstalk, Impedance Matching, and Timing

7.5 Low Power Design

7.6 Reset and Power Failure Detection and interface Unit

8. Circuit Layout (3 hours)

8.1 Circuits Boards and PCBs

8.2 Component Placement

8.3 Routing Signal Tracks

8.4 Trace Density, Common Impedance, Distribution of Signals and Return, Transmission Line Concerns, Trace Impedance and Matching, and Avoiding Crosstalk.

8.5 Ground ,Returns and Shields

8.6 Cables and Connectors

8.7 Testing and Maintenance

9. Software For Instrumentation And Control Applications **(4 hours)**

9.1 Types of Software, Selection and Purchase
9.2 Software Models and Their Limitations
9.3 Software Reliability
9.4 Fault Tolerance
9.5 Software Bugs and Testing
9.6 Good Programming Practice
9.7 User Interface
9.8 Embedded and Real Time Software

10. Case Study **(9 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:

a) Instrumentation for a power station including all electrical and non-electrical parameters.
b) Instrumentation for a wire and cable manufacturing and bottling plant.
c) Instrumentation for a beverage manufacturing and bottling plant.
d) Instrumentation for a complete textile plant; for example, a cotton mill from raw cotton through to finished dyed fabric.
e) Instrumentation for a process; for example, an oil seed processing plant from raw seeds through to packaged edible oil product.
f) Instruments required for a biomedical application such as a medical clinic or hospital.
g) Other industries can be selected with the consent of the Subject teacher.

Practical:

The laboratory exercises deal interfacing techniques using microprocessor or microcontrollers. There will be about six lab sessions which should cover at least following:

1. Simple and Handshake data transfer using PPI.
2. Basic I/O device interfacing like keyboard, seven segments, motors etc
3. Analog to Digital interfacing
4. Digital to Analog interfacing
5. Design exercise (small group project)

Study in detail the instrumentation requirements of a particular proposed or existing industrial plant and design an instrumentation and data collection system for that particular industrial plant. The final report should present the instrumentation requirements in terms of engineering specifications, the hardware solution suggested, a listing of the particular devices chosen to satisfy the requirements, appropriate system flow diagrams, wiring diagrams, etc. to show how the system would be connected and operated.

References:

1. D. V. Hall, "Microprocessor and Interfacing, Programming and Hardware" Tata McGraw Hill

2. K.R. Fowler, "Electronic Instrument Design: Architecting for the Life Cycle", Oxford University Press

3. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Application with 8085", Prentice Hall

4. A.K. Ray & K.M. Bhurchandi, "Advanced Microprocessors And Peripherals", Tata McGraw Hill

5. E.O. Duebelin, "Measurement System Application And Design", Tata McGraw Hills

6. John Hyde, "USB Design By Example", Intel Press

7. PCI bus, USB, 8255,Bluetooth datasheets

8. D. M. Consodine, "Process Instruments and Controls Handbook", McGraw-Hill,New York.

9. S. Wolf and R. F. Smith, "Student Reference Manual for Electronic Instrumentation Laboratories", Prentice Hall, Englewood Cliffs, New Jersey.

10. S. E. Derenzo, "Interfacing: A Laboratory Approach Using the Microcomputer for Instrumentation, Data Analysis, and Control", Prentice Hall, Englewood Cliffs, New Jersey.

COMPUTER GRAPHICS
EX 603

Lecture : 3   Year : III
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"

ENGINEERING ECONOMICS
CE 655

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

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.

OBJECT ORIENTED ANALYSIS AND DESIGN
CT 651

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

Course Objectives:

To introduce basic concepts of object-oriented analysis and design and to study the main features of the software development process in an object-oriented framework. To provide exposure to Visual Object Oriented Modeling languages, specifically Unified Modeling Language (UML)

1. Object Oriented Fundamentals   **(10 hours)**

   1.1   Introduction,
   1.2   Object Oriented Analysis and Design,
   1.3   Defining Models,
   1.4   Case Study,
   1.5   Requirement Process,
   1.6   Use Cases,
   1.7   Object Oriented Development Cycle,
   1.8   Overview of the Unified Modeling Language: UML Fundamentals and Notations.

2. Object Oriented Analysis   **(8 hours)**

   2.1   Building Conceptual Model,
   2.2   Adding Associations and Attributes,
   2.3   Representation of System Behavior.

3. Object Oriented Design   **(12 hours)**

   3.1   Analysis to Design,
   3.2   Describing and Elaborating Use Cases,
   3.3   Collaboration Diagram,
   3.4   Objects and Patterns,
   3.5   Determining Visibility,
   3.6   Class Diagram.

4. Implementation   **(15 hours)**

   4.1   Programming and Development Process,
   4.2   Mapping Design to Code,
   4.3   Creating Class Definitions from Design Class Diagrams,
   4.4   Creating Methods from Collaboration Diagram,
   4.5   Updating Class Definitions,
   4.6   Classes in Code,
   4.7   Exception and Error Handling.

Practical:

Laboratory Exercise will include handling a object oriented design and modeling activity in a ACSE Environment. UML pattern design and modeling will be taken up with the help of *UML Software*.

Reference Books:

1.   Larman, C., Applying UML and Patterns, Pearson Education Asia.

2.   Stevens, P., Pooley, R., Using UML: Software Engineering with Objects and Components, Addision-Wesley.

3.   Fowler, M., Scott, K., UML Distilled: Applying the Standard Object Modeling Language, Addison-Wesley.

4.   Booch, G., Jacobson, I., Rumbaugh, J., The Unified Software Development Process, Addison-Wesely.

5.   Booch, G., Jacobson, I., Rumbaugh, J., The Unified Modeling Language User Guide, Addison-Wesely.

6.   Jacobson I., Object-Oriented Software Engineering – A Use Case Driven Approach, Addison-Wesely.

DATABASE MANAGEMENT SYSTEMS
CT 652

Lecture   : 3   Year : III
Tutorial : 1   Part : II
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.

ARTIFICIAL INTELLIGENCE
CT 653

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

Course Objectives:

- To provide basic knowledge of Artificial Intelligence
- To familiarize students with different search techniques
- To acquaint students with the fields related to AI and the applications of AI

1. Introduction (4 hours)

1.1 Definition of Artificial Intelligence
1.2 Importance of Artificial Intelligence
1.3 AI and related fields
1.4 Brief history of Artificial Intelligence
1.5 Applications of Artificial Intelligence
1.6 Definition and importance of Knowledge, and learning.

2. Problem solving (4 hours)

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

3. Search techniques (5 hours)

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

4. Knowledge representation, inference and reasoning (8 hours)

4.1 Formal logic-connectives, truth tables, syntax, semantics, tautology, validity, well-formed-formula,
4.2 Propositional logic, predicate logic, FOPL, interpretation, quantification, horn clauses,

4.3 Rules of inference, unification, resolution refutation system (RRS), answer extraction from RRS, rule based deduction system,

4.4 Statistical Reasoning-Probability and Bayes' theorem and causal networks, reasoning in belief network

5. Structured knowledge representation (4 hours)

5.1 Representations and Mappings,

5.2 Approaches to Knowledge Representation,

5.3 Issues in Knowledge Representation,

5.4 Semantic nets, frames,

5.5 Conceptual dependencies and scripts

6. Machine learning (6 hours)

6.1 Concepts of learning,

6.2 Learning by analogy, Inductive learning, Explanation based learning

6.3 Neural networks,

6.4 Genetic algorithm

6.5 Fuzzy learning

6.6 Boltzmann Machines

7. Applications of AI (14 hours)

7.1 Neural networks

    7.1.1 Network structure

    7.1.2 Adaline network

    7.1.3 Perceptron

    7.1.4 Multilayer Perceptron, Back Propagation

    7.1.5 Hopfield network

    7.1.6 Kohonen network

7.2 Expert System

    7.2.1 Architecture of an expert system

    7.2.2 Knowledge acquisition, induction

    7.2.3 Knowledge representation, Declarative knowledge, Procedural knowledge

    7.2.4 Development of expert systems

7.3 Natural Language Processing and Machine Vision

    7.3.1 Levels of analysis: Phonetic, Syntactic, Semantic, Pragmatic

    7.3.2 Introduction to Machine Vision

Practical:

Laboratory exercises should be conducted in either LISP or PROLOG. Laboratory exercises must cover the fundamental search techniques, simple question answering, inference and reasoning.

References:

1. E. Rich and Knight, "Artificial Intelligence", McGraw Hill.

2. D. W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall.

3. P. H. Winston, "Artificial Intelligence", Addison Wesley.

4. Stuart Russel and Peter Norvig, "Artificial Intelligence A Modern Approach", Pearson.

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

OPERATING SYSTEM
CT 656

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

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.

MINOR PROJECT
CT 654

Lecture : 0   Year : III
Tutorial : 0   Part : II
Practical : 4

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)**

ENGINEERING ECONOMICS
CE 655

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

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.

OBJECT ORIENTED ANALYSIS AND DESIGN
CT 651

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

Course Objectives:
To introduce basic concepts of object-oriented analysis and design and to study the main features of the software development process in an object-oriented framework. To provide exposure to Visual Object Oriented Modeling languages, specifically Unified Modeling Language (UML)

1. Object Oriented Fundamentals   **(10 hours)**
- 1.1 Introduction,
- 1.2 Object Oriented Analysis and Design,
- 1.3 Defining Models,
- 1.4 Case Study,
- 1.5 Requirement Process,
- 1.6 Use Cases,
- 1.7 Object Oriented Development Cycle,
- 1.8 Overview of the Unified Modeling Language: UML Fundamentals and Notations.

2. Object Oriented Analysis   **(8 hours)**
- 2.1 Building Conceptual Model,
- 2.2 Adding Associations and Attributes,
- 2.3 Representation of System Behavior.

3. Object Oriented Design   **(12 hours)**
- 3.1 Analysis to Design,
- 3.2 Describing and Elaborating Use Cases,
- 3.3 Collaboration Diagram,
- 3.4 Objects and Patterns,
- 3.5 Determining Visibility,
- 3.6 Class Diagram.

4. Implementation   **(15 hours)**
- 4.1 Programming and Development Process,
- 4.2 Mapping Design to Code,
- 4.3 Creating Class Definitions from Design Class Diagrams,
- 4.4 Creating Methods from Collaboration Diagram,
- 4.5 Updating Class Definitions,
- 4.6 Classes in Code,
- 4.7 Exception and Error Handling.

Practical:

Laboratory Exercise will include handling a object oriented design and modeling activity in a ACSE Environment. UML pattern design and modeling will be taken up with the help of *UML Software*.

Reference Books:

1. Larman, C., Applying UML and Patterns, Pearson Education Asia.
2. Stevens, P., Pooley, R., Using UML: Software Engineering with Objects and Components, Addision-Wesley.
3. Fowler, M., Scott, K., UML Distilled: Applying the Standard Object Modeling Language, Addison-Wesley.
4. Booch, G., Jacobson, I., Rumbaugh, J., The Unified Software Development Process, Addison-Wesely.
5. Booch, G., Jacobson, I., Rumbaugh, J., The Unified Modeling Language User Guide, Addison-Wesely.
6. Jacobson I., Object-Oriented Software Engineering – A Use Case Driven Approach, Addison-Wesely.

DATABASE MANAGEMENT SYSTEMS
CT 652

Lecture   : 3   Year : III
Tutorial : 1   Part : II
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.

ARTIFICIAL INTELLIGENCE
CT 653

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

Course Objectives:

- To provide basic knowledge of Artificial Intelligence
- To familiarize students with different search techniques
- To acquaint students with the fields related to AI and the applications of AI

1.   Introduction   **(4 hours)**

1.1   Definition of Artificial Intelligence
1.2   Importance of Artificial Intelligence
1.3   AI and related fields
1.4   Brief history of Artificial Intelligence
1.5   Applications of Artificial Intelligence
1.6   Definition and importance of Knowledge, and learning.

2.   Problem solving   **(4 hours)**

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

3.   Search techniques   **(5 hours)**

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

4.   Knowledge representation, inference and reasoning   **(8 hours)**

4.1   Formal logic-connectives, truth tables, syntax, semantics, tautology, validity, well-formed-formula,
4.2   Propositional logic, predicate logic, FOPL, interpretation, quantification, horn clauses,

    4.3   Rules of inference, unification, resolution refutation system (RRS), answer extraction from RRS, rule based deduction system,

    4.4   Statistical Reasoning-Probability and Bayes' theorem and causal networks, reasoning in belief network

5. Structured knowledge representation   (4 hours)

    5.1   Representations and Mappings,

    5.2   Approaches to Knowledge Representation,

    5.3   Issues in Knowledge Representation,

    5.4   Semantic nets, frames,

    5.5   Conceptual dependencies and scripts

6. Machine learning   (6 hours)

    6.1   Concepts of learning,

    6.2   Learning by analogy, Inductive learning, Explanation based learning

    6.3   Neural networks,

    6.4   Genetic algorithm

    6.5   Fuzzy learning

    6.6   Boltzmann Machines

7. Applications of AI   (14 hours)

    7.1   Neural networks

        7.1.1   Network structure

        7.1.2   Adaline network

        7.1.3   Perceptron

        7.1.4   Multilayer Perceptron, Back Propagation

        7.1.5   Hopfield network

        7.1.6   Kohonen network

    7.2   Expert System

        7.2.1   Architecture of an expert system

        7.2.2   Knowledge acquisition, induction

        7.2.3   Knowledge representation, Declarative knowledge, Procedural knowledge

        7.2.4   Development of expert systems

    7.3   Natural Language Processing and Machine Vision

        7.3.1   Levels of analysis: Phonetic, Syntactic, Semantic, Pragmatic

        7.3.2   Introduction to Machine Vision

Practical:

Laboratory exercises should be conducted in either LISP or PROLOG. Laboratory exercises must cover the fundamental search techniques, simple question answering, inference and reasoning.

References:

1. E. Rich and Knight, "Artificial Intelligence", McGraw Hill.

2. D. W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall.

3. P. H. Winston, "Artificial Intelligence", Addison Wesley.

4. Stuart Russel and Peter Norvig, "Artificial Intelligence A Modern Approach", Pearson.

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

OPERATING SYSTEM
CT 656

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

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.

MINOR PROJECT
CT 654

Lecture : 0   Year : III
Tutorial : 0   Part : II
Practical : 4

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)

B.E. DEGREE
IN
COMPUTER ENGINEERING

Year : IV

Part : I

S. N.	Course Code	Course Title	Teaching Schedule				Examination Scheme						Total	Remark
							Theory			Practical				
			L	T	P	Total	Assesment Marks	Final		Assesment Marks	Final			
								Duaration hours	Marks		Duaration hours	Marks		
1	ME 708	Organization and Management	3	1		4	20	3	80				100	
2	EX 701	Energy Enviroment and Society	2			2	10	1.5	40				50	
3	CT 701	Project Management	3	1		4	20	3	80				100	
4	CT 702	Computer Network	3	1	1.5	5.5	20	3	80	50			150	
5	CT 703	Distributed System	3	1	1.5	5.5	20	3	80	25			125	
6	CT 704	Digital Signal Analysis and Processing	3	1	1.5	5.5	20	3	80	25			125	
7	CT 725	Elective I	3	1	1.5	5.5	20	3	80	25			125	
8	CT 707	Project (Part A)			3	3				50			50	
		Total	20	6	9	35	130	19.5	520	175			825	

ORGANIZATION AND MANAGEMENT
ME 708

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

Course Objective:
To give knowledge about organizational management and internal organization of companies required for managing an enterprise. Also to make familiar with personnel management, case study, management information system motivation and leadership for developing managerial skills.

1. Introduction (20 hours)

1.1 Organization (2 hours)
    1.1.1 System approach applied to Organization
    1.1.2 Necessity of Organization
    1.1.3 Principles of Organization
    1.1.4 Formal and Informal Organizations

1.2 Management (4 hours)
    1.2.1 Functions of Management
    1.2.2 Levels of Management
    1.2.3 Managerial Skills
    1.2.4 Importance of Management
    1.2.5 Models of Management

1.3 Theory of Management (6 hours)
    1.3.1 Scientific Management Approach
    1.3.2 Administrative Management Approach
    1.3.3 Behavioral Management Approach
    1.3.4 Modern Management Theories

1.4 Forms of Ownership (2 hours)
    1.4.1 Single Ownership – Advantages and limitations
    1.4.2 Partnership – Types of Partners – Advantages and limitations
    1.4.3 Joint Stock Company – Formation of Joint Stock Company – Advantages and limitations
    1.4.4 Co – operative Societies – Types of Co – operatives – Advantages and limitations
    1.4.5 Public Corporations – Advantages and limitations

1.5 Organizational Structure (2 hours)
    1.5.1 Line Organization – Advantages and disadvantages
    1.5.2 Functional Organization – Advantages and disadvantages
    1.5.3 Line and Staff Organization – Advantages and disadvantages
    1.5.4 Committee Organization – Advantages and disadvantages

1.6 Purchasing and Marketing Management (4 hours)
    1.6.1 Purchasing – Introduction

1.6.2   Functions of Purchasing Department
1.6.3   Methods of Purchasing
1.6.4   Marketing – Introduction
1.6.5   Functions of Marketing
1.6.6   Advertising

2.   Personal Management   **(8 hours)**

2.1   Introduction
2.2   Functions of Personal Management
2.3   Development of Personal Policy
2.4   Manpower Planning
2.5   Recruitment and Selection of manpower – Scientific selection
2.6   Training and Development of manpower
2.7   Job Analysis, Job Evaluation and Merit Rating
2.8   Wages and Incentives

3.   Motivation, Leadership and Entrepreneurship   **(10 hours)**

3.1   Motivation   (6 hours)
    3.1.1   Human needs
    3.1.2   Maslow's Hierarchy of needs
    3.1.3   Motivation – Introduction
    3.1.4   Types of Motivation
    3.1.5   Attitude Motivation; Group Motivation; Executive Motivation
    3.1.6   Techniques of Motivation
    3.1.7   Motivation Theories
        3.1.7.1   McGregor's Theory X - Y
        3.1.7.2   Fear and Punishment Theory
        3.1.7.3   Alderfer's ERG Theory
        3.1.7.4   MacClelland's Theory of learned needs
        3.1.7.5   Herzberg's Hygiene Maintenance Theory
        3.1.7.6   Vroom's Expectancy/ Valency Theory
3.2   Leadership - Introduction   (2hours)
    3.2.1   Qualities of a good Leader
    3.2.2   Leadership Style
    3.2.3   Blakes and Mouton's Managerial Grid
    3.2.4   Leadership Approach
    3.2.5   Leadership Theories
3.3   Entrepreneurship – Introduction   (2 hours)
    3.3.1   Entrepreneurship Development
    3.3.2   Entrepreneurial Characteristics
    3.3.3   Need for Promotion of Entrepreneurship
    3.3.4   Steps for establishing small scale unit

4.   Case Studies   **(2 hours)**

4.1   Introduction
4.2   Objectives of case study
4.3   Phases of case study

4.4   Steps of case study
4.5   Types of case studies

5.   Management Information System   (5 hours)
5.1   Data and Information
5.2   Need, function and Importance of MIS
5.3   Evolution of MIS
5.4   Organizational Structure and MIS
5.5   Computers and MIS
5.6   Classification of Information Systems
5.7   Information Support for functional areas of management
5.8   Organizing Information Systems

Note: Students have to submit a case study report after visiting an industrial organization.

Reference:

1.   H. B. Maynard, "Industrial Engineering Handbook" , Editor – in – Chief, McGraw Hill.
2.   E. S. Buffa and R. K. Sarin "Modern Production / Operations Management", 8th Edition, Wiley.
3.   H. J. Arnold and D. C. Feldman "Organizational Behavior" , McGraw – Hill.
4.   J. A. Senn, "Information Systems in Management " , Wadsworth Inc.
5.   P. Hershey and K. H. Blanchard, "Management of Organizational Behavior – Utilizing Human Resources ", Prentice – Hall Inc.
6.   M. Mahajan, "Industrial Engineering and production Management" ,Dhanpat Rai and Co. (P) Ltd. , Delhi.
7.   S. Sadagopan, "Management Information System", Prentice Hall of India Pvt Ltd.
8.   C. B. Mamoria "Personnel Management", Himalaya Publishing House..
9.   O. P. Khanna, "Industrial Engineering and Management", Dhanpat Rai Publications (P) Ltd.
10. S. K. Joshi, "Organization and Management", IOE, Pulchowk Campus.

ENERGY, ENVIRONMENT AND SOCIETY
EX 701

Lecture : 2   Year : IV
Tutorial   : 0   Part : I
Practical : 0

Course Objective:
To understand the various types of energy sources and their environmental impact. To know the role of engineers for creating better and responsible society.

1. Technology and Development   **(3 hours)**
1.1   Introduction to Technology
1.2   Appropriate Technology
1.3   Role of Appropriate Technology in Transformation of Society
1.4   Importance of Technology Transfer
1.5   Impact of technology on Society

2. Energy Basics   **(4 hours)**
2.1   Importance of Energy in achieving Maslow's hierarchy of Needs, Human Development Index and Energy Consumption
2.2   Current Energy Trends, Demand and Supply of Energy in World and Nepal
2.3   Introduction to Global warming, Clean Development Mechanism, and Sustainability Issues
2.4   Conventional and Non-Conventional/Renewable Energy Sources
2.5   Conventional Energy Sources: Fossil fuel, Nuclear Energy

3. Renewable Energy Sources   **(14 hours)**
3.1   Solar Energy
       3.1.1   Solar radiation
       3.1.2   Solar thermal energy
       3.1.3   Solar Cell (Photovoltaic Technology)
3.2   Hydropower
       3.2.1   Water sources and power
       3.2.2   Water turbines and hydroelectric plants
       3.2.3   Hydro Power Plant Classification (pico, micro, small, medium, large)
3.3   Wind Energy
       3.3.1   Availability of Wind Energy sources
       3.3.2   Wind turbines, wind parks and power control
3.4   Geothermal Energy
       3.4.1   Sources of Geothermal Energy
       3.4.2   Uses of Geothermal Energy
3.5   Bio-mass and Bio-energy
       3.5.1   Synthetic fuels from the biomass

      3.5.2   Thermo-chemical,   physio-chemical   and   bio-chemical conversion

      3.5.3   Bio-fuel cells

  3.6   Hydrogen Energy and Fuel Cell

      3.6.1   Basics of electrochemistry

      3.6.2   Polymer membrane electrolyte (PEM) fuel cells

      3.6.3   Solid oxide fuel cells (SOFCs)

      3.6.4   Hydrogen production and storage

      3.6.5   Coal-fired plants and integrated gassifier fuel cell (IGFC) systems

4.   Environmental Impact of Energy sources   **(4 hours)**

  4.1   Emission hazard

  4.2   Battery hazard

  4.3   Nuclear hazard

5.   Energy Storage   **(3 hours)**

  5.1   Forms of energy storage

  5.2   Hybrid vehicles

  5.3   Smart grid systems

  5.4   Batteries

  5.5   Super-capacitors

6.   Relevant International/national case studies   **(2 hours)**

References:

1.   Godfrey Boyle, "Renewable Energy, Power for a sustainable future", Oxford University Press, latest edition

2.   Aldo V. da Rosa, "Fundamentals of Renewable Energy Processes"

PROJECT MANAGEMENT
CT 701

Lecture : 3   Year : IV
Tutorial : 1   Part :I
Practical : 0

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",

COMPUTER NETWORKS
CT 702

Lecture   : 3   Year : IV
Tutorial : 1   Part : I
Practical : 3

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

DISTRIBUTED SYSTEMS
CT 703

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

Course Objective:
To be familiar with different aspect of the distributed system, middleware, system level support and different issues in designing distributed algorithms

1. Introduction   **(4 hours)**
    1.1   Introduction to Distributed Systems
    1.2   Examples of Distributed Systems
    1.3   Main Characteristics
    1.4   Advantages and Disadvantages of Distributed System
    1.5   Design Goals
    1.6   Main Problems
    1.7   Models of Distributed System
    1.8   Resource Sharing and the Web Challenges
    1.9   Types of Distributed System: Grid, Cluster, Cloud

2. Distributed Objects and File System   **(7 hours)**
    2.1   Introduction
    2.2   Communication between distributed objects
    2.3   Remote Procedure Call
    2.4   Events And Notifications
    2.5   Java RMI Case Study
    2.6   Introduction to DFS
    2.7   File Service Architecture
    2.8   Sun Network File System
    2.9   Introduction to Name Services
    2.10 Name Services and DNS
    2.11 Directory and Discovery Services
    2.12 Comparison of Different Distributed File Systems

3. Operating System Support   **(3 hours)**
    3.1   The operating system layer
    3.2   Protection
    3.3   Process and threads
    3.4   Communication and invocation
    3.5   Operating system architecture

4. Distributed Heterogeneous Applications and CORBA   **(3 hours)**
    4.1   Heterogeneity in Distributed Systems
    4.2   Middleware

4.3   Objects in Distributed Systems
4.4   The CORBA approach
4.5   CORBA services

5.   Time and State in Distributed Systems   (5 hours)

5.1   Time in Distributed Systems,
       5.1.1   Physical Clocks
       5.1.2   Logical Clocks
       5.1.3   Vector Clocks
       5.1.4   Clock Synchronization
5.2   Causal Ordering of Messages
5.3   Global State and State Recording
5.4   Distributed debugging

6.   Coordination and Agreement   (4 hours)

6.1   Mutual Exclusion in Distributed Systems
6.2   Algorithms for Mutual Exclusion
6.3   Distributed Elections
6.4   Multicast communication
6.5   Consensus

7.   Replication   (4 hours)

7.1   Reasons for Replication
7.2   Object Replication
7.3   Replication as Scaling Technique
7.4   Fault Tolerant Services
7.5   High Available Services
7.6   Transaction with Replicated Data

8.   Transaction and Concurrency Control   (6 hours)

8.1   Transactions
8.2   Nested Transaction
8.3   Locks
8.4   Optimistic Concurrency Control
8.5   Timestamp Ordering
8.6   Comparison of Methods For Concurrency Control
8.7   Introduction to Distributed Transactions
8.8   Flat and Nested Distributed Transactions
8.9   Atomic Commit Protocols
8.10   Concurrency Control in Distributed Transactions
8.11   Distributed Deadlocks
8.12   Transaction Recovery

9.   Fault Tolerance   (4 hours)

9.1   Introduction to Fault Tolerance
9.2   Process Resilience

9.3   Reliable Client Server Communication
9.4   Distributed Commit
9.5   Recovery

10. Case Studies   **(5 hours)**
   10.1   CORBA
   10.2   Mach
   10.3   JINI
   10.4   TIB/Rendezvous

Practical:

1.   Implementation of Election Algorithm.
2.   Simulation for Clock Synchronization in Distributed System using Lamport's Algorithm.
3.   Implementation of Banker's Algorithm for avoiding Deadlock
4.   Experiment on DFS
5.   Case Study – CORBA,JINI, Mach, TIB/Rendezvous

Reference:

1.   George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems Concepts and   Design", Third Edition, Pearson Education.
2.   A.S. Tanenbaum, M. VanSteen, "Distributed Systems", Pearson Education.
3.   MukeshSinghal, "Advanced Concepts in Operating Systems", McGraw-Hill Series in Computer Science.

DIGITAL SIGNAL ANALYSIS AND PROCESSING
CT 704

Lecture   : 3   year : IV
Tutorial   : 1   Part : I
Practical : 3/2

Course Objectives:
To introduce digital signal processing techniques and algorithms

1. **Discrete time signals and systems**   **(8 hours)**
   1.1   Discrete time signal, basic signal types
   1.2   Energy signal, power signal
   1.3   Periodicity of discrete time signal
   1.4   Transformation of independent variable
   1.5   Discrete time Fourier series and properties
   1.6   Discrete time Fourier transform and properties
   1.7   Discrete time system properties
   1.8   Linear time invariant (LTI) system convolution sum, properties of LTI system
   1.9   Frequency response of LTI system
   1.10 Sampling of continuous time signal, spectral properties of sampled signal.

2. **Z-transform**   **(4 hours)**
   2.1   Defintion, convergence of Z-transform and region of convergence
   2.2   Properties of Z-transform (linearity, time shift, multiplication by exponential sequence, differentiation, time reversal, convolution, multiplication)
   2.3   Inverse z-transform by long division and partial fraction expansion.

3. **Analysis of LTI system in frequency domain**   **(6 hours)**
   3.1   Frequency response of LTI system, response to complex exponential
   3.2   Linear constant co-efficient difference equation and corresponding system function
   3.3   Relationship of frequency response to pole-zero of system
   3.4   Linear phase of LTI system and its relationship to causality.

4. **Discrete filter structures**   **(8 hours)**
   4.1   FIR filter, Structures for FIR filter (direct form, cascade, frequency sampling, lattice)
   4.2   IIR filter, structures for IIR filter (direct form I, direct form II, cascade, lattice, lattice ladder)
   4.3   Quantization effect (truncation, rounding), limit cycles and scaling.

5. **FIR filter design**   **(6 hours)**
   5.1   Filter design by window method, commonly used windows (rectangular

window, Hanning window, Hamming window)
5.2   Filter design by Kaiser window
5.3   Filter design by frequency sampling method
5.4   Filter design using optimum approximation, Remez exchange
      algorithm.

6.   IIR filter design   (6 hours)

6.1   Filter design by impulse invariance method
6.2   Filter design using bilinear transformation
6.3   Design of digital low pass Butterworth filter
6.4   Properties of Chebyshev filter, properties of elliptic filter, properties of
      Bessel filter, Spectral transformation.

7.   Discrete Fourier transform   (7 hours)

7.1   Discrete Fourier transform (DFT) representation, properties of DFT
      (linearity, time shift, frequency shift, conjugation and conjugate
      symmetry, duality, convolution, multiplication), circular convolution
7.2   Fast Fourier Transform (FFT) algorithm (decimation in time algorithm,
      decimation in frequency algorithm)
7.3   Computational complexity of FFT algorithm.

Practical:

1.   Introduction to DSP tools.
2.   Signal generation and manipulation
3.   Convolution
4.   Cascade of second order systems
5.   IIR filter
6.   FIR filter

References

1.   Alan V. Oppenheim, Ronald W. Schafer, John R. Buck, "Discrete-Time Signal
     Processing", Pearson Education.
2.   John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Prentice
     Hall.

PROJECT-I
CT 707

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

Course Objectives:

The objective of this project work is to develop hands-on experience of working in a project. During the course, students have to design and complete a functional project which should require integration of various course concepts. Students will develop various skills related to project management like team work, resource management, documentation and time management.

1. Group formation (Not exceeding 4 persons per group)

2. Project concept development (software engineering concept must include for computer engineering and hardware / software elements include electronics & communication engineering)

3. Proposal preparation (proposal content: title, objective, scope of project, methodology, expected outcome, hardware/software element, list of equipment, and historical background and reviewed should be clearly reflected)

4. Project documentation (follow the project documentation guideline)

Evaluation Scheme:

Project (Part A): Internal Evaluation is done on the basis of Project Proposal, Regular activities, Progress Report and Presentation.

ELECTIVE I

ADVANCED JAVA PROGRAMMING
CT 725 01

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

Course Objective:

To provide programming knowledge for both single system software distribution and across networks/devices and to focus on the advanced topics that a Java programmer will need to know so that they will be in a position to do commercial Java development both for single services and also for distributed processes across multiple devices. To provide an in depth coverage of object serialization, Java Beans, XML, Servlets, JSP's, networking, remote objects (RMI), distributed computing, and Java database Connectivity.

1. **Introduction**   (2 hours)
   1.1   Overview
   1.2   Java Programming Review

2. **GUI Programming and Components**   (4 hours)
   2.1   Swing Introduction
   2.2   Frame Creation/Positioning
   2.3   Working with Shape, Color, Text, Images
   2.4   Basics of Event Handling
   2.5   AWT Event Hierarchy
   2.6   Low Level Event Types
   2.7   User Interface Components
   2.8   Layout Management
   2.9   Text Input/Choice Components/Menu/Dialog Box

3. **Applets and Application Deployment**   (4 hours)
   3.1   Applet Basics
   3.2   Applet HTML Tags & Attribute
   3.3   Multimedia, URL Encapsulation
   3.4   JAR files
   3.5   Application Packaging
   3.6   Storage of Application Preferences

4. **Streams and File Handling**   (4 hours)
   4.1   Streams
   4.2   Text Input and Output
   4.3   Working with Binary Data
   4.4   Object Streams & Serialization
   4.5   File Management, Buffer , Lock etc.

5. XML Programming (3 hours)

5.1 Introducing XML
5.2 Parsing an XML Documents
5.3 Validating XML Documents
5.4 XPath, SAX Parsers, XSL Transformations

6. Network Programming (4 hours)

6.1 Server Connection
6.2 Implementing Servers
6.3 Socket Timeouts / Interruptible Sockets
6.4 Sending E-mail
6.5 URL Connection Establishment
6.6 Posting Form Data

7. Database Programming (6 hours)

7.1 The design of JDBC and types
7.2 The Structured Query Language (SQL)
7.3 JDBC Configuration
7.4 Executing SQL Statements
7.5 Query execution
7.6 Scrollable and Updateable result sets
7.7 Row sets /Cached row sets
7.8 Metadata
7.9 Transactions
7.10 Enterprise Application and Connection management in Web
7.11 LDAP / LDAP Server configuration and accessing LDAP

8. Distributed Objects (4 hours)

8.1 Client – Server model
8.2 RMI Programming model
8.3 Parameters and return values in remote methods
8.4 Remote Object Activation
8.5 Web services and JAX-WS

9. Advanced Swing and advanced AWT (5 hours)

9.1 Swing: Lists, Tables, Trees, Text Components
9.2 Swing : Progress Indicators, Component Organizers, Split/tabbed Panes
9.3 AWT : Rendering, Shapes, Areas, Strokes, Coordinate Transformations
9.4 AWT : Clipping and Image manipulation, Printing, The Clipboard

10. Java Beans Components (5 hours)

10.1 Introducing Beans
10.2 Using Beans in Application Building
10.3 Packaging Beans in JAR files
10.4 Naming Patterns for Beans

10.5   Bean property types

10.6   JavaBeans Persistence

11. Miscellaneous   (4 hours)

11.1   Security : Bytecode verification, User Authentication, Encryption, Digital Signature

11.2   Scripting : Scripting Engine, Script Binding, Script compilation

11.3   Other recent trends

Practicals:

There should be substantial program design and implementation assignments related to every chapter of the syllabus content.

References:

1.   Car S. Horstmann, "Core Java Volume I and II – Advanced Features", Prentice Hall.

2.   Y. Daniel Liang, "Introduction to Java Programming", Pearson/ Prentice Hall.

3.   H. Deitel, P. Deitel, "Java How To Program" , Prentice Hall.

DATA MINING
CT 725 02

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

Course Objective:
To introduce the fundamental principles, algorithms and applications of intelligent data processing and analysis and to provide an in depth understanding of various concepts and popular techniques used in the field of data mining

1. **Introduction**   (2 hours)
    1.1   Data Mining Origin
    1.2   Data Mining & Data Warehousing basics

2. **Data Preprocessing**   (6 hours)
    2.1   Data Types and Attributes
    2.2   Data Pre-processing
    2.3   OLAP & Multidimensional Data Analysis
    2.4   Various Similarity Measures

3. **Classification**   (12 hours)
    3.1   Basics and Algorithms
    3.2   Decision Tree Classifier
    3.3   Rule Based Classifier
    3.4   Nearest Neighbor Classifier
    3.5   Bayesian Classifier
    3.6   Artificial Neural Network Classifier
    3.7   Issues : Overfitting, Validation, Model Comparison

4. **Association Analysis**   (10 hours)
    4.1   Basics and Algorithms
    4.2   Frequent Itemset Pattern & *Apriori* Principle
    4.3   FP-Growth, FP-Tree
    4.4   Handling Categorical Attributes
    4.5   Sequential, Subgraph, and Infrequent Patterns

5. **Cluster Analysis**   (9 hours)
    5.1   Basics and Algorithms
    5.2   K-means Clustering
    5.3   Hierarchical Clustering
    5.4   DBSCAN Clustering
    5.5   Issues : Evaluation, Scalability, Comparison

6. Anomaly / Fraud Detection   (3 hours)

7. Advanced Applications   (3 hours)
  7.1 Mining Object and Multimedia
  7.2 Web-mining
  7.3 Time-series data mining

Practical:

Using either MATLAB or any other DataMining tools (such as WEKA), students should practice enough on real-world data intensive problems like IRIS or Wiki dataset.

References:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, *Introduction to Data Mining*, 2005, Addison-Wesley.
2. Jiawei Han and Micheline Kamber, *Data Mining: Concepts and Techniques*, 2nd Edition, 2006, Morgan Kaufmann.

EMBEDDED SYSTEMS DESIGN USING ARM TECHNOLOGY
CT 725 03

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

Course Objectives:

To provide fundamentals concepts and insights for understanding of the ARM based Processors architecture and programming embedded system based on ARM powered MCU for application in control, consumer, multimedia signal processing and mobile and wireless communications systems.

1. **ARM Embedded Systems**   (3 hours)
    1.1 Introduction to Embedded Systems
    1.2 The RISC Design Philosophy
    1.3 The ARM Design Philosophy
    1.4 Embedded System Hardware
    1.5 Embedded System Software

2. **ARM Processor Fundamentals**   (3 hours)
    2.1 The Acron RISC Machine
    2.2 The ARM programmer's model
    2.3 Current Program Status Register
    2.4 Exceptions, Interrupts, and the Vector Table
    2.5 ARM Processor Families

3. **ARM Organization and Peripherals**   (6 hours)
    3.1 3-stage pipeline ARM organization
    3.2 5-stage pipeline ARM organization
    3.3 ARM instruction execution
    3.4 Peripherals: GPIO, UART, I2C, SPI, ADC/DAC, Timers, Displays, Interrupts and DMA.

4. **Efficient C Programming for ARM**   (3 hours)
    4.1 Data types, Expressions and Conditional statements
    4.2 Loops, Functions and procedures
    4.3 Use of memory
    4.4 Pointer Aliasing
    4.5 Bit-Field

5. **ARM Assembly Language Programming**   (3 hours)
    5.1 Data processing instructions
    5.2 Data transfer instructions

5.3   Control flow instructions
5.4   Writing simple assembly language programs

6.   ARM Instruction Set   **(6 hours)**
6.1   Data Processing Instructions
6.2   Branch Instructions
6.3   Load-Store Instructions
6.4   Software Interrupt Instruction
6.5   Program Status Register Instructions
6.6   Loading Constants
6.7   Conditional Execution

7.   Thumb Instruction Set   **(3 hours)**
7.1   The Thumb bit in the CPSR
7.2   The Thumb programmer's model
7.3   Thumb branch instructions
7.4   Thumb software interrupt instruction
7.5   Thumb data processing instructions
7.6   Thumb single register data transfer instructions
7.7   Thumb multiple register data transfer instructions
7.8   Thumb breakpoint instruction
7.9   Thumb implementation
7.10   Thumb applications

8.   Architectural Support for System Development   **(6 hours)**
8.1   The ARM memory interface
8.2   The Advanced Microcontroller Bus Architecture (AMBA)
8.3   The ARM reference peripheral specification
8.4   Hardware system prototyping tools
8.5   The ARMulator
8.6   The JTAG boundary scan test architecture
8.7   The ARM debug architecture
8.8   Embedded Trace

9.   Firmware and Embedded Operating Systems   **(6 hours)**
9.1   Firmware and Bootloader
9.2   Fundamental components of embedded operating systems
9.3   Embedded Linux
9.4   Android Operating Systems

10. Signal Processing and Communication Application using ARM Cortex Processors   **(6 hours)**
10.1   ARM Cortex-M4 Processors for Multimedia Signal Processing
10.2   Hardware and software development aspects for Cortex-M series applications
10.3   ARM Cortex-R processors for mobile and wireless communication

10.4 Hardware and software development aspects for Cortex-R series applications

Practicals:

1. Introduction to NXP LPC2148 MCU, Development Board and Development Tools
2. Programming in C & Assembly (KEIL and PROTEUS)
3. GPIO Programming (LED, LCD, Keypad, Buzzer)
4. Serial Protocols Programming (UART0, I2C0, SPI)
5. Timer Programming (Timer/Counter, PWM, WDT, RTC)
6. LPC2148 Interface for ADC/DAC

References:

1. Andrew N. Sloss, Dominic Symes, Chris Wright "ARM System Developer's Guide", Morgan Kaufmann
2. Steve Furber, "ARM System-on-Chip Architecture," Second Edition, Addison Weley
3. Joseph Yiu, " The Definitive Guide to the ARM Cortex-M3," Newnes
4. William Hold, "ARM Assembly Language: Fundamentals and Techniques," CRC Press
5. David Seal, "Free ARMv7-AR, ARMv7-M, ARMv6-M and ARMv5 Architecture Reference Manual Downloads," Addison-Wesley
6. Warwick A.Smith, "C Programming for Embedded Microcontrollers"

IMAGE PROCESSING AND PATTERN RECOGNITION
CT 725 04

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

Course Objectives:

To be familiar with processing of images, pattern recognition and their applications.

1. Introduction to digital image processing (4 hours)
1.1 Digital image representation
1.2 Digital image processing: Problems and applications
1.3 Elements of visual perception
1.4 Sampling and quantization, relationships between pixels

2. Two-dimensional systems (5 hours)
2.1 Fourier transform and Fast Fourier Transform
2.2 Other image transforms and their properties: Cosine transform, Sine transform, Hadamard transform, Haar transform

3. Image enhancement and restoration (8 hours)
3.1 Point operations, contrast stretching, clipping and thresholding, digital negative, intensity level slicing, bit extraction
3.2 Histogram modeling: Equalization, Modification, Specification
3.3 Spatial operations: Averaging, directional smoothing, median, filtering, spatial low pass, high pass and band pass filtering, magnification by replication and interpolation

4. Image coding and compression (4 hours)
4.1 Pixel coding: run length, bit plane coding, Huffman coding
4.2 Predictive and inter-frame coding

5. Introduction to pattern recognition in images (3 hours)

6. Recognition and classification (5 hours)
6.1 Recognition and classification
6.2 Feature extraction
6.3 Models
6.4 Division of sample space

7. Grey level features edges and lines (6 hours)
7.1 Similarity and correlation
7.2 Template matching
7.3 Edge detection using templates
7.4 Edge detection using gradient models, model fitting

7.5   Line detection, problems with feature detectors

8. Segmentation   **(3 hours)**
   8.1   Segmentation by thresholding
   8.2   Regions based Segmentation, edges, line and curve detection

9. Frequency approach and transform domain   **(3 hours]**

10. Advanced Topics   **(4 hours)**
   10.1   Neural networks and their application to pattern recognition
   10.2   Hopfield nets
   10.3   Hamming nets, perceptron

Practical:

Laboratory exercises using image processing and pattern recognition packages.

References:

1.   R. C. Gonzalez and P. Wintz, "Digital Image Processing", Second Edition, Addison-Wesley Publishing.
2.   K. Castlemann. "Digital Image Processing", Prentice Hall of India Ltd.
3.   A. K. Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India Pvt. Ltd..
4.   Sing Tze Bow, M. Dekker, "Pattern Recognition and Image Processing",
5.   M. James, "Pattern Recognition", BSP professional books.
6.   P. Monique and M. Dekker, "Fundamentals of Pattern Recognition".

WEB TECHNOLOGIES AND APPLICATIONS
CT 725 05

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

Course Objectives:
To introduce the key foundations of the Web, essential technologies and knowledge needed for web application development, and to highlight the recent developments on the dynamic area of the Web.

1. **Introduction**   (3 hours)
   1.1   History
   1.2   Internet and the Web
   1.3   Client/server computing paradigm

2. **Web basics**   (5 hours)
   2.1   Web documents and browsers
   2.2   HTML, XHTML, forms, CSS
   2.3   Crawling and information retrieval on the web

3. **Server-side programming**   (7 hours)
   3.1   Server-side scripting languages- PHP, JSP, Java servlets, ASP.NET etc.
   3.2   Backend database programming
   3.3   Multi-tier architecture

4. **Client-side scripting**   (4 hours)
   4.1   JavaScript basics
   4.2   JavaScript DOM

5. **Web applications**   (6 hours)
   5.1   Content management systems
   5.2   Web application frameworks
   5.3   Online information systems and solutions

6. **Web 2.0**   (6 hours)
   6.1   Introduction
   6.2   Blogs, wikis, social networking and collective intelligence
   6.3   Tagging - folksonomies
   6.4   AJAX

7. **Information representation and sharing – XML**   (5 hours)
   7.1   XML documents, DTD
   7.2   Stylesheets and transformation - XSLT
   7.3   Information syndication - RSS

8. Web services   **(4 hours)**

    8.1 Service-oriented architecture

    8.2 SOAP, WSDL, REST

9. The Semantic Web   **(5 hours)**

    9.1 Introduction

    9.2 RDF and Ontologies

    9.3 Linked Open Data

    9.4 Applications and Web 3.0

Practical:

Regular lab sessions can be conducted related to web design, server-side programming, client-side scripting, working with application frameworks and tools, etc.

A number of practical assignments can be given for hands-on experience on web application development.

References:

1. Slides and handouts
2. Jeffrey C. Jackson, "Web technologies: a computer science perspective",
3. P. J. Deitel and H. M. Deitel, "Internet and World Wide Web: How to Program",.
4. G. McComb, "Web Programming Languages", John Wiley & Sons, Inc.
5. Marty Hall, "Core Web Programming", Prentice Hall PTR, Upper Saddle River, NJ 07458.

OPERATING SYSTEM
CT 725 06

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

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. SilbcrschatzA.,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.

RADAR TECHNOLOGY
EX 725 01

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

Course Objectives:
- To enable the student to become familiar with Radar technology
- To get an overview of Radar and the Radar equation
- To study about different types of radars and their operations
- To study about Radar transmitters, receivers, duplexers, displays and antennas
- To get a knowledge about the detection of Radar signals in noise

1. Introduction to Radar   (2 hours)
    1.1   Introduction
    1.2   Radar block diagram and operation
    1.3   Applications of Radar
    1.4   Radar frequencies

2. The Radar equation   (8 hours)
    2.1   Simple form of Radar Equation
    2.2   Prediction of range performance
    2.3   Minimum detectable signal
    2.4   Receiver noise
    2.5   Signal to Noise ratio
    2.6   Integration of Radar Pulses
    2.7   Radar Cross Section of Targets (simple targets - sphere, cone-sphere)
    2.8   Transmitter Power
    2.9   Pulse repetition frequency and range ambiguities
    2.10 System losses
    2.11 Propagation effects

3. CW and Frequency Modulated Radar   (4 hours)
    3.1   The Doppler effect
    3.2   CW Radar
    3.3   FM-CW Radar
    3.4   Multiple Frequency CW Radar

4. MTI andPulse Doppler Radar   (8 hours)
    4.1   Moving Target indicator Radar
    4.2   Delay Line and Cancellers
    4.3   Staggered Pulse Repetition Frequencies
    4.4   Range Gated Doppler Filters,
    4.5   Other MTI delay line,
    4.6   Limitations of MTI performance,

4.7 Non-Coherent MTI
4.8 Pulse Doppler Radar
4.9 MTI from a moving platform
4.10 Limitations of MTI performance
4.11 MTI versus Pulse Doppler Radar

5. Tracking Radar   **(6 hours)**
  5.1 Tracking with Radar
  5.2 Sequential Lobbing
  5.3 Conical Scan
  5.4 Monopulse Tracking Radar
  5.5 Tracking in range
  5.6 Acquisition
  5.7 Comparison of Trackers

6. Radar Transmitters, Receivers, Duplexers, Displays and Antennas **(10 hours)**
  6.1 Radar Transmitters
    6.1.1 Introduction
    6.1.2 Solid state transmitters
    6.1.3 Introduction to Radar Modulators
  6.2 Radar Receivers
    6.2.1 Introduction
    6.2.2 Super Heterodyne Receiver
    6.2.3 Receiver Noise Figure
  6.3 Duplexers
    6.3.1 Introduction
    6.3.2 Branch type and Balanced type
  6.4 Displays
    6.4.1 Introduction and types
  6.5 Antennas
  6.6 Introduction
  6.7 Parameters of Radar Antenna
  6.8 Phased Array Antenna
    6.8.1 Basic Concepts
    6.8.2 Radiation Pattern
    6.8.3 Applications, Advantages and Limitations

7. Detection of Radar Signals in Noise   **(5 hours)**
  7.1 Introduction,
  7.2 Matched Filter Receiver
    7.2.1 Response Characteristics and Derivation
  7.3 Correlation Detection
    7.3.1 Correlation Function and Cross-correlation Receiver

8. Image Analysis and Applications   **(2 hours)**

Practical:
1. Field trip to Airport for the introduction of Air Traffic Control (ATC) Radar.
2. Radar Cross Section Simulation and Analysis
3. Case Study

References:

1. Merrill I. Skolnik, "Introduction to Radar Systems", MacGraw Hill
2. MerrillI.Skolnik, "Radar Handbook", McGraw Hill Publishers
3. J. C. Toomay and Paul J. Hannen, "Radar Principles for the Non-Specialist", by J. C. Toomay, Paul Hannen, SciTech Publishing
4. David Knox Barton, A. I. Leonov, Sergey A. Leonov, I. A. Morozov and Paul C. Hamilton, "Radar Technology Encyclopedia", Artech House.
5. Dr. Eli Brookner (Editor), "Radar Technology", Artech House.
6. M. R. Richards, J. A. Scheer, W. A. Holm, Editors "Principles of Modern Radar, Basic Principles", SciTech Publishing.

SATELLITE COMMUNICATION
EX 725 02

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

Course Objectives:

• To enable the student to become familiar with satellites and satellite services
• To get an overview of satellite systems in relation to other terrestrial systems
• To study about satellite orbits, launching, link design, multiple access techniques, propagation effects and their impact on satellite-earth links
• To study about VSAT systems, Satellite TV, radio and GPS

1. Overview of satellite communication   **(2 hours)**

   1.1 Introduction
   1.2 Frequency Allocations for Satellite Services
   1.3 Intelsat
   1.4 U.S.Domsats
   1.5 Polar Orbiting Satellites

2. Orbital mechanics and launchers   **(10 hours)**

   2.1 Kepler's laws
   2.2 Newton's law
   2.3 Orbital parameters
   2.4 Orbital Mechanics
   2.5 Look Angle Determination
   2.6 Orbital perturbations
   2.7 Orbit Control system
   2.8 Geo stationary orbit
   2.9 Telemetry, tracking, Command and monitoring
   2.10 Power systems
   2.11 Communication subsystems
   2.12 Transponders
   2.13 Satellite Antennas
   2.14 Equipment reliability and space qualification.

3. Satellite link design   **(9 hours)**

   3.1 Basic transmission Theory,
   3.2 System noise temperature and G/T ratio,
   3.3 Design of downlinks,
   3.4 Satellite systems using small earth stations Uplink design,
   3.5 Design for C/N:Combining C/N and C/I values in satellite links,
   3.6 System design examples

4. Multiple access techniques for satellite links (4 hours)

4.1 Multiple access
4.2 Frequency Division Multiple Access
4.3 Time Division Multiple Access
4.4 On board processing
4.5 Demand access Multiple Access
4.6 Random access
4.7 Code division Multiple Access

5. Propagation effects and their impact on satellite-earth links (3 hours)

5.1 Quantifying attenuation and depolarization
5.2 Propagation effects that are not associated with hydrometers
5.3 Rain and ice effects
5.4 Prediction of rain attenuation
5.5 Prediction of XPD
5.6 Propagation impairment Countermeasures

6. VSAT systems (4 hours)

6.1 Network architectures
6.2 Access control protocol
6.3 Basic techniques
6.4 SAT earth station engineering
6.5 Calculation of link margins for VSAT star network
6.6 System design procedures

7. Low Earth Orbit and Non-Geostationary Satellite systems (4 hours)

7.1 Orbit considerations
7.2 Coverage and frequency considerations
7.3 Delay and throughput considerations
7.4 Operational NGSO constellation design
7.5 Introduction to Satellite mobile network
7.6 Meteorological Satellites System

8. Direct broadcast Satellite TV and radio (4 hours)

8.1 C-Band and Ku band home satellite TV
8.2 Digital DBS–TV
8.3 DBS–TV system design
8.4 DBS–TV link budget
8.5 Error control in digital DBS TV
8.6 DBS –TV link budget
8.7 Master control station and uplink
8.8 Establishment of DBS–TV antennas Satellite radio broadcasting

9. Satellite Navigation and Global Positioning System: (5 hours)

9.1 Radio and Satellite navigation
9.2 GPS position location principles

9.3 GPS receivers and Codes
9.4 Satellite signal acquisition
9.5 GPS navigation message
9.6 GPS signal levels
9.7 Timing accuracy
9.8 GPS receiver operation

Practical/ Field visits

Field visits to Satellite Stations.

References:

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt, "Satellite Communications", John Willy & Sons (Asia) Pvt. Ltd.
2. Dennis Roddy, "Satellite Communications", McGraw-Hill Publication.
3. James Martyn, "Communication Satellite systems", Prentice Hall.
4. Wilbur L. Pritchard, Hendri G. Suyderhoud and Robert A. Nelson, "SatelliteCommunication Systems Engineering", Prentice Hall/Pearson.
5. M.Richharia, "SatelliteCommunicationSystems-DesignPrinciples",Macmillan.
6. Emanuel Fthenakis, "Manual of Satellite Communications", McGraw Hill Book Co.

BIOMEDICAL INSTRUMENTATION
EX 725 03

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

Course Objectives:

To provide specific engineering and instrumentation methods and principles to acquire basic knowledge of design, its application and maintenance of different biomedical instruments.

1. Fundamental of Medical Instrumentation: **(4 hours)**
   1.1 Biomedical Engineering and Areas of Engineering Contribution
   1.2 Biometrics and Design Consideration Factors for Medical Instruments
   1.3 Man Instrument System and their Objectives
   1.4 Components of Man Instrument System

2. Bioelectric Signals and Electrodes: **(4 hours)**
   2.1 Body System and Bioelectric Phenomenon
   2.2 Sources of Bioelectric Signals
   2.3 Resting and Action Potentials
   2.4 Electrode Theory and their Equivalent Circuits
   2.5 Types of Biopotential Electrodes
   2.6 Application of electrodes in medical instrumentation

3. Physiological Transducers: **(4 hours)**
   3.1 Classification of Transducers
   3.2 Performance Characteristics of Transducers
   3.3 Active Transducers and their Application in Medical Instruments
   3.4 Passive Transducers and their Types used in Medical Instruments

4. Bioelectric Signals Measurement and Recording System **(10 hours)**
   4.1 Aspects of Bioelectric Signals
   4.2 Electrocardiography (ECG)
      4.2.1 Normal Characteristics of Electrocardiogram
      4.2.2 ECG Lead Configuration and Recording Techniques
      4.2.3 Computer –Aided Electrocardiograph Analysis
   4.3 Electroencephalography (EEG)
      4.3.1 Electroencephalogram and Evoked Potential
      4.3.2 EEG Pre amplifier Design
      4.3.3 EEG Electrode Configuration and Recording Techniques
      4.3.4 Practical Details of EEG
   4.4 Electromyography (EMG)
      4.4.1 Electromyography Recording Technique
      4.4.2 Applications of EMG

5.   Non- Invasive Diagnostic Instruments   (12 hours)

    5.1   Blood Flow Measurement
        5.1.1   Magnetic Blood Flow meter
        5.1.2   Ultrasonic Blood Flow meter
        5.1.3   Blood Flow Measurement by Thermal Convection
        5.1.4   Blood Flow Measurement by Radiographic Method
    5.2   Diagnostic Medical Imaging System
        5.2.1   Radiographic Imaging System
            5.2.1.1   Principle of generation of X-rays and its medical properties
            5.2.1.1   Functional X-ray Machine
            5.2.1.1   Biological Effects of X-rays
        5.2.2   Ultrasonography Imaging System
        5.2.3   Computer Tomography (CT-Scan) System
        5.2.4   Magnetic Resonance Imaging System (MRI)
        5.2.5   Nuclear Medicine Machine

6.   Therapeutic Instruments   (4 hours)

    6.1   Function of Kidneys
    6.2   Principle of Artificial Kidneys
    6.3   Heamodialysis Machine
    6.4   Types of Dialyzers
    6.5   Lithotripsy and its principle
    6.6   Lithotripter Machine
    6.7   Defibrillator Machine

7.   Biomedical Telemetry and Telemedicine   (3 hours)

    7.1   Wireless Telemetry
    7.2   Single Channel Telemetry System
    7.3   Multi channel Telemetry
    7.4   Telemedicine Using Mobile Communication Equipments

8.   Electrical Safety of Medical Equipment   (4 hours)

    8.1   Physiological Effects of Electricity
    8.2   Leakage Currents and Methods of Accident Prevention
    8.3   Micro shocks and Macro shocks Hazards
    8.4   Electrical Safety Codes and Standards
    8.5   Special Safety Measures for Electrical Susceptible Patients
    8.6   Power Distribution and Protection System of the Hospital

Practicals:

1.   Three practical exercises based on availability of the portable medical and clinical based equipments.
2.   Field Visit to Medical Institution
3.   Field Visit Report and Viva Voce.

References:

1. Leslie Cromwell, et Al, " Biomedical Instrumentation and Measurements", Prentice Hall, India
2. R S Khandpur, "A Hand Book of Biomedical Instrumentation", Tata McGraw Hill

AERONAUTICAL TELECOMMUNICATION
EX725 04

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

Course Objectives:
To give the basic understanding of aviation related ground based electronics equipment used for Communication, Navigation and Surveillance and their theory of operation.

1. **Introduction to Aviation** (4 hours)
   History of Aviation, Aircraft, Airport, Airspace, Air Traffic Control and Air Traffic Management

2. **Aeronautical Communication** (5 hours)
   Aviation Band , ICAO and ITU , VHF Air to Ground communication, HF Ground to Ground communication, Interference, Data link, AFTN/ATN/ AMHS

3. **Aeronautical Navigation** (9 hours)
   3.1 Introduction
       Introduction to Navigation, Piloting, Dead Reckoning, Radio Navigation, Ground Based Navigation System

   3.2 Non Directional Radio Beacon (NDB)
       NDB as a navigational aid, working principle, Uses of NBD, Advantages of NBD, Limitations of NDB , Sitting Requirements, Antenna System, Types of Antennas, Factors affecting NDB Antenna, Role of Top, loading, Transmitting equipment, Monitoring and Calibration.

   3.3 VHF Omni Directional Radio Range (VOR)
       VOR as a navigational aid, Frequency band, general principal of operation, basic VOR transmission techniques, rotation of cardioids, VOR errors, sitting requirements, Doppler VOR (DVOR), principal of operations of DVOR and its types, advantages of DVOR over conventional VOR, airborne VOR receiver, antenna system, conventional and Doppler VOR antenna, Transmitting techniques (i) conventional VOR (ii) Doppler VOR, monitoring and calibration.

4. **Aeronautical Equipment** (9 hours)
   4.1 Distance Measuring Equipment (DME)
       DME as a navigational aid, principal of operation, applications, Gaussian pulse, DME errors and echo suppression techniques, Airborne Interrogator, Sitting requirements, antenna system, monitoring and calibrations

4.2   Instrument Landing System (ILS)

ILS as a landing aid, co-location of DME with ILS, coverage of an ILS, Marker Beacons, siting requirements, general transmitting techniques, generation of DDM, localizer and glide slope equipment and antenna system.

5.   Aeronautical Surveillance   **(8 hours)**

History of Radar, Types of Airport Surveillance Radar, Theory of Primary and Secondary Surveillance Radar, Monopulse SSR and Mode-S, Radar Data Processing System, Introduction to Automatic Dependence Surveillance and Multi Lateration system.

6.   Aeronautical Mobile Satellite System (AMSS) and Global NavigationSatellite system (GNSS)   **(4 hours)**

International maritime satellite System (Inmarsat), International Telecommunication Satellite System (Intelsat), Global Positioning System (GPS), Global Orbiting Navigation Satellite System (GLONASS).

7.   Basics of Aircraft Avionics Equipment   **(6 hours)**

Aircraft HF, VHF and Satellite Communication equipment, Radio compass, Radio Magnetic Indicator (RMI), Horizontal Situation Indicator, Automatic Direction Finder, SSR Tansponder, Flight Data and Voice Recorders.

Practical

1.   Field visits to Avionics Communication Stations and Centers.
2.   Reports writing on various Surveillance/Navigation/Other Instruments which are specific to avionics communication

References

1.   H.V Sudarsan, "Seamless Sky", Ashgate Publishing limited, England".
2.   Donald J. Clausing "Aviator's Guide to Navigation"
3.   J.S. Chitode "Principles of communication"
4.   Dale Stacey "Aeronautical Radio Communication system and Networks"
5.   International Civil Aviation Organization, Global Air Navigation Plan for
6.   CNS/ATM systems (Doc9750)

RF AND MICROWAVE ENGINEERING
EX 725 05

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

Course Objectives:

To understand the fundamentals of Radio Frequency (RF) and Microwave (M/W) theory and applications, design and analysis practices, and measurement techniques.

1. Introduction   **(3 hours)**
    1.1   Standard frequency bands
    1.2   Behaviour of circuits at conventional and RF/microwave bands
    1.3   Microwave applications

2. RF and M/W Transmission Lines   **(6 hours)**
    2.1   Types of transmission lines
    2.2   Transmission line theory
    2.3   Smith Chart analysis
    2.4   Impedance transformations and matching analysis

3. RF an M/W Network Theory and Analysis   **(4 hours)**
    3.1   Scattering matrix and its properties
    3.2   S-Parameter derivation and analysis

4. RF/Microwave Components and Devices   **(8 hours)**
    4.1   Coupling probes
    4.2   Coupling loops
    4.3   Waveguide
    4.4   Termination, E-plane Tee, H-plane Tee, Magic Tee
    4.5   Phase-Shifter
    4.6   Attenuators
    4.7   Directional coupler
    4.8   Gunn diode
    4.9   Microwave transistor
    4.10 MASER
    4.11 Resonator and circulators

5. Microwave Generators   **(5 hours)**
    5.1   Transit-time effect
    5.2   Limitations of conventional tubes

5.3 Two-cavity and multi-cavity klystrons
5.4 Reflex klystron
5.5 TWT and magnetrons

6. RF Design Practices (10 hours)

6.1 RF Low pass filter
    6.1.1 Insertion loss
    6.1.2 Frequency scaling
    6.1.3 Microstrip implementation
6.2 RF Amplifier
    6.2.1 Amplifier theory
    6.2.2 Design and real world consideration
6.3 Oscillator and mixer
    6.3.1 Oscillator and super mixing theory
    6.3.2 Design and real world consideration

7. Microwave Antennas and Propagation (3 hours)

7.1 Antenna types
7.2 Propagation characteristics of microwave antennas
7.3 RF an M/W radiation, safety practices and standards

8. RF/Microwave Measurements (6 hours)

8.1 Power measurement
8.2 Calorimeter method
8.3 Bolometer bridge method
8.4 Thermocouples
8.5 Impedance measurement
8.6 RF frequency measurement and spectrum analysis
8.7 Measurement of unknown loads
8.8 Measurement of reflection coefficient
8.9 VSWR and Noise

Practicals:

1. Illustration of Smith Chart and load analysis

2. Introduction to RF and M/W signal and circuits, measuring techniques, instrumentations, and practices

3. Designing and analysis of simple strip-line and two-port circuits using network and spectrum analysers

4. Software-based (ADS-like) RF signal & circuit simulation practices

References:

1. Herbert J. Reich and et al., Van Nostard Reinhold, " Microwave Principles",
2. K.C. Gupta, "Microwave Electronics", Tata McGraw Hill.
3. A. K. Gautam, "Microwave Engineering" , S. K. Kataria & Sons.
4. D.C. Agrawal, "Microwave Techniques" , Tata McGraw Hill.
5. R. Chatterjee, "Elements of Microwave Engineering" ,Tata McGraw Hill.
6. Samuel Y. Liao, "Microwave Devices & Circuits", PHI.
7. David M. Pozar, "Microwave Engineering", John Wiley & Sons.
8. Newington "ARRL UHF/Microwave Experimenter's Manual", CT.
9. W. H. Hayt, "Engineering Electromagnetics" , McGraw-Hill Book Company.
10. A. Das, "Microwave Engineering", Tata McGraw Hill.
11. William Sinnema, "Electronic Transmission Technology: Lines, Waves, and Antennas", Prentice Hall.

B.E. DEGREE
IN
COMPUTER ENGINEERING

Year : IV

S. N.	Course Code	Course Title	Teaching Schedule				Examination Scheme						Total	Remark
							Theory			Practical				
			L	T	P	Total	Assesment Marks	Final		Assesment Marks	Final			
								Duaration hours	Marks		Duaration hours	Marks		
1	CE 752	Professional Practice	2			2	10	1.5	40				50	
2	CT 751	Information Systems	3	1		4	20	3	80				100	
3	CT 753	Simulation and Modelling	3	1	1.5	5.5	20		80	25			125	
4	CT 754	Internet and Intranet	3	1	1.5	5.5	20	3	80	25			125	
5	CT 765	Elective II	3	1	1.5	5.5	20	3	80	25			125	
6	CT 785	Elective III	3	1	1.5	5.5	20	3	80	25			125	
7	CT 755	Project (Part B)			6	6				50		50	100	
		Total	17	5	12	34	110	13.5	440	150		50	750	

ENGINEERING PROFESSIONAL PRACTICE
CE 752

Lecture : 2   Year : IV
Tutorial : 0   Part : II
Practical : 0

Course Objective:
To familiarize the students with their roles in the society, ethical and legal environment in which engineering is practiced, contract administration, regulatory environment and contemporary issues in Engineering.

1. History of Engineering Practices   (3 hours)

    1.1   Man and Society
    1.2   Technology and Society
    1.3   History of Engineering Practice in Eastern Society
    1.4   History of Engineering Practice in Western society
    1.5   Engineering Practices in Nepal

2. Profession and Ethics   (6 hours)

    2.1   Profession: Definition and Characteristics
    2.2   Professional Institutions
    2.3   Relation of an Engineer with Client, Contractor and Fellow Engineers
    2.4   Ethics, Code of Ethics and Engineering Ethics
    2.5   Moral Dilemma and Ethical Decision Making
    2.6   Detailed Duties of an Engineer and Architect
    2.7   Liability and Negligence

3. Professional Practices in Nepal   (3 hours)

    3.1   Public Sector practices
    3.2   Private Sector Practices
    3.3   General Job Descriptions of Fresh Graduates in both Public and Private Sector

4. Contract Management   (6 hours)

    4.1   Methods of work execution/contracting
    4.2   Types of Contracts
    4.3   Tendering Procedure
    4.4   Contract agreement

5. Regulatory Environment   (5 hours)

    5.1   Nepal Engineering Council Act
    5.2   Labor Law
    5.3   Intellectual Property Right
    5.4   Building Codes and Bylaws
    5.5   Company Registration

6. Contemporary Issues in Engineering (3 hours)
   6.1 Globalization and Cross Cultural Issues
   6.2 Public Private Partnership
   6.3 Safety, Risk and Benefit Analysis
   6.4 Development and Environment
   6.5 Conflict and Dispute Management

7. Case Studies based on Engineering Practices (4 hours)

References:

1. Carson Morrison and Philip Hughes "Professional engineering Practice – Ethical Aspects", McGraw-Hill Ryerson Ltd.' Toronto.
2. Dr Rajendra Adhikari, "Engineering Professional Practice – Nepalese and international Perspectives" Pashupati Publishing House, Kathmandu Nepal.
3. M. Govindarajan; S Natarajan and V.S. Senthikumar., " Engineering Ethics" – PHI Learning Pvt. Ltd. New Delhi.
4. Nepal Engineering Council Act
5. Contract Act
6. Labor Act
7. Company Act
8. Copyright Act
9. Public Procurement Act
10. Building By-Laws

INFORMATION SYSTEMS
CT 751

Lecture : 3   Year : IV
Tutorial : 0   Part : II
Practical : 3/2

Course Objectives:
To introduce and apply the knowledge of computer based information systems. It also provides the concept to the student in designing and setting up complex information system

1. Information system   **(3 hours)**
  1.1   Classification and evolution of IS
  1.2   IS in functional area.
  1.3   Information system architecture
  1.4   Qualities of information systems
  1.5   Managing Information System resources
  1.6   Balanced Scorecard – case studies

2. Control, Audit and Security of Information system   **(5 hours)**
  2.1   Control of information system
  2.2   Audit of information system
  2.3   Security of information system
  2.4   Consumer layered security strategy
  2.5   Enterprise layered security strategy
  2.6   Extended validation and SSL certificates
  2.7   Remote access authentication
  2.8   Content control and policy based encryption
  2.9   Example of security in e-commerce transaction

3. Enterprise Management Systems   **(4 hours)**
  3.1   Enterprise management systems (EMS)
  3.2   Enterprise Software: ERP/SCM/CRM
  3.3   Information Management and Technology of Enterprise Software
  3.4   Role of IS and IT in Enterprise Management
  3.5   Enterprise engineering, Electronic organism, Loose integration vs. full integration, Process alignment, Frame work to manage integrated change, future trends.

4. Decision support and Intelligent systems   **(7 hours)**
  4.1   DSS, operations research models
  4.2   Group decision support systems
  4.3   Enterprise and executive decision support systems
  4.4   Knowledge Management, Knowledge based Expert system
  4.5   AI, Neural Networks, Virtual reality, Intelligent Agents

4.6   Data mining, Data ware Housing, OLAP, OLTP

4.7   Anomaly and fraud detection

5. Planning for IS   (3 hours)

5.1   Strategic information system

5.2   Tactical information system

5.3   Operational information systems

6. Implementations of Information Systems   (7 hours)

6.1   Change Management

6.2   Critical Success Factors

6.3   Next generation Balanced scorecard

7. Web based information system and navigation   (8 hours)

7.1   The structure of the web

7.2   Link Analysis

7.3   Searching the web

7.4   Navigating the web

7.5   Web uses mining

7.6   Collaborative filtering

7.7   Recommender systems

7.8   Collective intelligence

8. Scalable and Emerging Information System techniques   (8 hours)

8.1   Techniques for voluminous data

8.2   Cloud computing technologies and their types

8.3   MapReduce and Hadoop systems

8.4   Data management in the cloud

8.5   Information retrieval in the cloud

8.6   Link analysis in cloud setup

8.7   Case studies of voluminous data environment

Practicals:

The practical exercise shall include following three types of projects on designing of information system

1.   E-commerce based information system for online transaction processing

2.   web uses mining or collaborative filtering based processing system

3.   scalable and emerging information system

4.   Balanced scorecard, Strategy Map

References:

1.   Leonard Jessup and Joseph Valacich, "Information Systems Today" Prentice hall.

2.   J.Kanter, "Managing With Information System", PHI

3. M. Levene, "An Introduction to Search Engines and Web Navigation", Pearson Education

4. Jimmy Lin and Chris Dyer, "Data-Intensive Text Processing with MapReduce", Morgan and Claypool.

5. Jothy Rosenberg and Arthur Mateos, "The Cloud at Your Service, Manning",

6. Robert S. Kaplan,David P. Norton, "Balanced scorecard"

7. Robert S. Kaplan,David P. Norton, "Strategy Maps : Converting   intangible assets into tangible outcomes"

8. Robert S. Kaplan,David P. Norton, "Strategy Focused organization"

SIMULATION AND MODELING
CT 753

Lecture   : 3   Year : IV
Tutorial : 1   Part : II
Practical : 3/2

Course objectives:

To provide the knowledge of discrete and continuous system, random numbers generation, queuing system and computer system simulation

1.   Introduction to Simulation   **(4 hours)**

   1.1   System, model and simulation
   1.2   Discrete and continuous systems
   1.3   Model of a system
   1.4   Types of models
   1.5   Steps in simulation study
   1.6   Model development life cycle
   1.7   Advantage and disadvantage of simulation
   1.8   Limitations of the simulation techniques
   1.9   Areas of application

2.   Physical and Mathematical models   **(4 hours)**

   2.1   Static physical model
   2.2   Dynamic physical model
   2.3   Static mathematical models
   2.4   Dynamic mathematical models

3.   Continuous system simulation   **(5 hours)**

   3.1   Differential and partial differential equations
   3.2   Continuous system models
   3.3   Analog computer
   3.4   Analog Methods
   3.5   Hybrid simulation
   3.6   Digital-Analog simulators
   3.7   Continuous System simulation languages(CSSLs)
   3.8   Feedback systems

4.   Queuing system   **(6 hours)**

   4.1   Elements of queuing system
   4.2   Characteristics of queuing systems
   4.3   Model of queuing system
   4.4   Types of queuing system
   4.5   Queuing notation
   4.6   Measurement of system performance

4.7   Network of queues

4.8   Applications of queuing system

5.   Markov chains   (3 hours)

5.1   Key features of Markov chains

5.2   Markov process with example

5.3   Application of Markov chain

6.   Random Number   (10 hours)

6.1   Properties of Random Numbers

6.2   Generation of Pseudo-Random numbers

6.3   Random Number generation methods

6.4   Test for random numbers

6.5   Generating discrete distribution

6.6   Inversion, rejection , composition and Convolution

7.   Verification and validation of simulation models   (3 hours)

7.1   Verification and validation

7.2   Verification of simulation models

7.3   Calibration and validation of models

8.   Analysis of simulation output   (4 hours)

8.1   Estimation methods

8.2   Simulation run statistics

8.3   Replication of runs

8.4   Elimination of Initial bias

9.   Simulation software   (3 hours)

9.1   simulation in Java

9.2   simulation in GPSS

9.3   Simulation in SSF

9.4   Other simulation software

10.   Simulation of computer systems   (3 hours)

10.1   Simulation tools

10.2   High Level computer –system simulation

10.3   CPU simulation

10.4   Memory Simulation

Practicals:

1.   Simulation of continuous system

2.   Simulation of the R-C amplifier circuit

3.   Generation of Random number

4.   Simulation mass spring damper system

5.   Simulation of National econometric system

References:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, Devid M. Nicol, P. Shahabudeen, "Discrete-Event System Simulation"
2. Geoffrey Gordon, "System Simulation"
3. A.M. Law and W.D. Kelton, " Simulation and Modeling and Analysis"
4. R. Y. Rubinstein, B. Melamed, "Modern Simulation and Modeling"
5. S. Shakya, "Lab Manual on Simulation and Modeling"

INTERNET AND INTRANET
CT 754

Lecture   : 3   Year : IV
Tutorial : 1   Part : II
Practical : 3/2

Course Objectives:

To provide the basic knowledge on practical applications of internetworking technologies to private intranets for information management and public internets for electronic commerce, which includes theoretical details, strategies for designing sites, techniques for creating their technical infrastructures, methods for developing content, and techniques for site deployment and management

1. **Introduction** (5 hours)
   1.1   History and Development of Internets and Intranets
   1.2   IANA, RIR/NIR/LIR and ISPs for internet number management
   1.3   Internet Domain and Domain Name System
   1.4   Internet Access Overview
   1.5   Internet Backbone Networks: Optical Backbone, Marine Cables, Teleports, Satellite and Terrestrial Links

2. **Internet Protocol Overview** (6 hours)
   2.1   TCP/IP and the IP Layer overview
   2.2   IPv4 and IPv6 Address Types and Formats
   2.3   IPv4 and IPv6 Header Structure
   2.4   InternetRFCs

3. **Protocols and Client/Server Applications** (6 hours)
   3.1   Standard protocols: SMTP, E-mail Message (RFC22),PGP, POP, IMAP, HTTP, FTP
   3.2   N-Tiered Client/Server Architecture
   3.3   Universal Internet Browsing
   3.4   Multiprotocol Support

4. **HTTP and the Web Services** (8 hours)
   4.1   HTTP, Web Servers and Web Access
   4.2   Universal naming with URLs
   4.3   WWW Technology: HTML, DHTML, WML, XML
   4.4   Tools: WYSWYG Authoring Tools
   4.5   Helper applications: CGI; PERL, JAVA, JAVA SRIPTS, PHP, ASP, .NET Applications

4.6   Introduction to AJAX (Programming)

4.7   browser as a rendering engine: text, HTML, gif and jpeg

5.   Designing Internet Systems and Servers   (8 hours)

5.1   Designing of Internet System Network Architecture

5.2   Choice of platforms

5.3   Server Concepts: WEB, Proxy, RADIUS, MAIL

5.4   Cookies

5.5   Load Balancing: Proxy Arrays

5.6   Server Setup and Configuration Guidelines

5.7   Security and System Administration Issues, Firewalls and Content Filtering

6.   Internet and Intranet Systems Development   (6 hours)

6.1   Introductions

6.2   Benefits and drawbacks of intranets

6.3   Protocols, Structure and Scope of Networks

6.4   Intranets Resource Assessments: Network Infrastructure, Clients and Server Resources

6.5   Intranet Implementation Guidelines

6.6   Content Design, Development, Publishing and Management

6.7   Intranet Design with Open source Tools: DRUPAL, JUMLA

6.8   Tunneling Protocols: VPN

7.   Internet and Intranet Applications   (6 hours)

7.1   General Applications: Email, WWW, Gopher, Online Systems

7.2   Multimedia and Digital Video/Audio Broadcasting: Video/Audio Conferencing, Internet Relay Chat (IRC)

7.3   Broadband Communications, Policy, xDSL and Cable Internet

7.4   VoIP, FoIP and IP Interconnection

7.5   Datacenters and Data warehousing, packet clearing house

7.6   Unified Messaging Systems

7.7   Fundamental of e-Commerce

7.8   Concept of Grid and Cloud Computing

Practicals

1.   Web programming Skill (HTML, PHP, ASP..) and WEB development Tools.

2.   Web Programming with DB Connection and Ajax programming.

3.   nternet & Intranet Site Development (personal/corporate web development)

4.   Web & DNS Server Installation, Configuration and Hosting.

5.   Presentation of project work

References

1. Andrew S. Tanenbaum, "Computer Networks"; Prentice Hall
2. Daniel Minoli, "Internet and Intranet Engineering"; McGraw-Hill
3. Comer, D.E and Stevens, " Internetworking with TCP/IP",
4. RFC 821/822/1543/1738/2068

PROJECT-II
CT 755

Lecturer : 0   **Year : IV**
Tutorial : 0   **Part : II**
Practical : 6

Course Objectives:
The objective of this project work is to develop hands-on experience of working in a project. During the course, students have to design and complete a functional project which should require integration of various course concepts. Students will develop various skills related to project management like team work, resource management, documentation and time management.

1. Group formation (Not exceeding 4 persons per group)

2. Project concept development (software engineering concept must include for computer engineering and hardware / software elements include electronics & communication engineering)

3. Proposal preparation (proposal content: title, objective, scope of project, methodology, expected outcome, hardware/software element, list of equipment, and historical background and reviewed should be clearly reflected)

4. Project documentation (follow the project documentation guideline)

Evaluation Scheme:
Project (Part B): Internal and Final Evaluation is done on the basis of **Regularity** of the work, **Completeness** of project, **Documentation**, **Progress Presentation** and **Final Presentation**.

ELECTIVE II

AGILE SOFTWARE DEVELOPMENT
CT 765 02

Lecture : 3   Year : IV
Tutorial : 1   Part : II
Practical : 3/2

Course Objectives:

- To deliver adaptable software iterations and releases based on Agile methodologies
- To minimize bugs and maximize productivity with Test-Driven Development and Unit Testing
- To Achieve quality design by adopting established coding principles
- To Provide an illustration on real life Agile Implementation through a case study in Extreme Programming
- To adopt best practices to successfully manage Agile projects

1. **Review of Traditional Approaches**   (4 hours)
   1.1   Overview of Waterfall Model
   1.2   Overview of Spiral Model
   1.3   Limitation of Traditional Approaches

2. **Introduction to Agile Methodologies**   (4 hours)
   2.1   Need of Agile Methodologies
   2.2   Objectives of Agile Methodologies
   2.3   Agile Implementations and Variants
   2.4   Introduction to the Agile Manifesto

3. **Planning an Agile Project**   (6 hours)
   3.1   Establishing the Agile project
         3.1.1   Adopting the best practices of the Agile Manifesto
         3.1.2   Recognizing the structure of an Agile team
         3.1.3   Programmers
         3.1.4   Managers
         3.1.5   Customers
   3.2   Developing a Foundation with User Stories
         3.2.1   Eliciting application requirements
         3.2.2   Writing user stories
   3.3   Estimating and "The Planning Game"
         3.3.1   Defining an estimation unit
         3.3.2   Distinguishing between release and iteration
         3.3.3   Prioritizing and selecting user stories with the customer
         3.3.4   Projecting team velocity for releases and iterations

4. Agile Iterations   **(5 hours)**

    4.1   Breaking user stories into tasks
        4.1.1   Recognizing a program's main purpose
        4.1.2   Prioritizing tasks for a cohesive design
        4.1.3   The Agile coding process
        4.1.4   Write Test, Write Code, Refactor
        4.1.5   Allocating time for a spike

5. Test Driven Development   **(12 hours)**

    5.1   Design process with automated testing
        5.1.1   Introduction to Test Driven Development
        5.1.2   Writing a User Acceptance Test
        5.1.3   Compiling and Running tests
    5.2   Integrating Unit Testing
        5.2.1   Distinguishing between user tests and unit tests
        5.2.2   Developing effective test suites
        5.2.3   Achieving "green lights" through continuous testing
    5.3   Optimizing test-driven development
        5.3.1   Drafting a unit test that is simple, isolated and fast
        5.3.2   Isolating classes for effective testing
        5.3.3   Creating mock objects for testing
    5.4   Refactoring
        5.4.1   Code Duplication
        5.4.2   Renaming fields and methods
        5.4.3   Extracting methods and base classes
        5.4.4   Programming by intention

6. Managing Agile Projects   **(4 hours)**

    6.1   Delivering the first release
    6.2   Planning the next release
    6.3   Adapting Agile to fit Development Methodology

7. Extreme Programming   **(10 hours)**

    7.1   Core Principles and Practices
    7.2   Requirements and User Stories
    7.3   Release Planning
    7.4   Iteration Planning
    7.5   Customer Tests
    7.6   Small, Regular Releases
    7.7   Pair Programming
    7.8   Continuous Integration
    7.9   Collective Code Ownership

7.10 Team Roles

7.11 Case Study

References

1. Robert C. Martin, "Agile Software Development, Principles, Patterns, and Practices", Prentice Hall.

2. Andrew Hunt, David Thomas,"The Pragmatic Programmer: From Journeyman to Master", Addison-Wesley Professional.

NETWORKING WITH IPV6
CT 765 03

Lecture   : 3   Year : IV
Tutorial : 1   Part : II
Practical : 3/2

Course Objective:

To know the fundamental issues in network protocol design and implementation with the principles underlying TCP/IP protocol design; historical development of the Internet Protocol Version-6; IPv6 and QoS, IP network migrations and applications.

1. Internet and the Networking Protocols   (3 hours)

  1.1   Historical Development
  1.2   OSI Model
  1.3   Internet IP/UDP/TCP
  1.4   IPv4 Addressing Review

2. Next Generation Internet Protocol   (14 hours)

  2.1   Internet Protocol Version 6 (IPv6)
        2.1.1   History of IPv6
        2.1.2   IPv6 Header Format
        2.1.3   Problems with IPv4
        2.1.4   Features of IPv6
        2.1.5   IPv6 Addressing format and Types
  2.2   ICMPv6
        2.2.1   Features
        2.2.2   General Message Format
        2.2.3   ICMP Error & Informational Message types
        2.2.4   Neighbor Discovery
        2.2.5   Path MTU Discovery

3. Security and Quality of Service in IPv6   (5 hours)

  3.1   Types of Threats
  3.2   Security Techniques
  3.3   IPSEC Framework
  3.4   QoS in IPv6 Protocols

4. Routing with IPv6 (6 hours)

4.1 Routing in the Internet and CIDR

4.2 Multicasting

4.3 Unidirectional Link Routing

4.4 RIPng

4.5 OSPF for IPv6

4.6 PIM-SM & DVMRP for IPv6

5. IPv4/IPv6 Transition Mechanisms (8 hours)

5.1 Tunneling

    5.1.1 Automatic Tunneling

    5.1.2 Configured tunneling

5.2 Dual Stack

5.3 Translation

5.4 Migration Strategies for Telcos and ISPs.

6. IPv6 Deployment (6 hours)

6.1 Challenges and Risks

6.2 IPv6 Deployment Plan

6.3 IPv6 DNS (AAAA & A6 records)

6.4 IPv6 enabled Proxy, Web & Mail Servers

7. Advanced Applications (3 hours)

7.1 MPLS

7.2 NGN

Practical:

For practical, one PC to one student either in virtual environment or real environment will be provided. Students will be divided into group which consists of 3 students. The working environment and machine connectivity will look like the following:

Tools Needed: TCPDUMP & WIRESHARK

1. Enable IPv6 in Windows/Linux

2. IPv6 Header Analysis

3. IPv6 Packet analysis (neighbor/router solicitation/discovery)

4. Unicast Routing Implementation using Zebra-OSPF & OSPF phase analysis

5. Multicast Routing Implementation using XORP-PIM/SM & PIM/SM phase analysis

6. IPv6 DNS/WEB/Proxy implementation & test

7. Case Study

Reference:

1. Joseph Davice, "Understanding IPv6

2. Silvia Hagen, "IPv6 Essentials", O'reilly

3. S. A. Thomas, "IPng and the TCP/IP Protocols", Wiley.

4. O. Hersent, D. Gurle, J.-P. Petit, "IP Telephony", Addison-Wesley.

ADVANCED COMPUTER ARCHITECTURE
CT 765 04

Lecture : 3   Year : IV
Tutorial : 1   Part : II
Practical : 3/2

Course Objectives:

To provide advanced knowledge of computer architecture including parallel architectures, instruction-level parallel architectures, superscalar architectures, thread and process-level parallel architecture.

1. Computational models (5 hours)
 1.1 computational model,
 1.2 the von Neumann Computational model,
 1.3 Evolution and interpretation of the concept of computer architecture,
 1.4 Interpretation of the concept of the computer architectures at different levels of abstraction,
 1.5 Multilevel hierarchical framework

2. Parallel Processing (8 hours)
 2.1 Process, Thread, Processes and threads in languages,
 2.2 Concurrent and parallel execution and programming languages,
 2.3 Types of available parallelism,
 2.4 Levels of available functional parallelism,
 2.5 Utilization of functional parallelism,
 2.6 Classification of parallel architectures,
 2.7 Relationships between languages and parallel architectures

3. Pipelined Processors (8 hours)
 3.1 Principle of pipelining,
 3.2 Structure of pipelines,
 3.3 Performance measures,
 3.4 Application scenarios of pipelines,
 3.5 Layout of a pipeline, Dependence resolution,
 3.6 Design space,
 3.7 pipelined processing of loads and stores

4. Superscalar Processors (8 hours)
 4.1 The emergence and widespread adaption of superscalar processors,
 4.2 Specific tasks of superscalar processing,
 4.3 Parallel decoding,
 4.4 superscalar instruction issue,
 4.5 Scope of shelving,
 4.6 Layout of shelving buffers,
 4.7 Operand fetch policies,

4.8   Instruction dispatch schemes ,
4.9   Scope of register renaming with example

5.   Processing of control transfer Instructions   (6 hours)

5.1   Types of branches, Performance measures of branch processing ,
5.2   Branch handling ,
5.3   Delayed branching,
5.4   Branch processing,
5.5   Multiday branching

6.   Thread and process-level parallel architectures   (10 hours)

6.1   MIMD architectures
6.2   Distributed memory MIMD architectures,
6.3   Fine-gain and Medium-gain systems,
6.4   Coarse-grain multicomputer,
6.5   Cache coherence
6.6   Uniform memory access(UMA) machines,
6.7   Cache-coherent non-uniform memory access(CC-NUMA) machines,
6.8   Cache only memory architecture(COMA)

References:

1.   Deszo Sima, Terence Fountain, Peter Kacsuk, "Advanced Computer Architectures: a design space approach",
2.   John P. Hayes, "Computer Architecture and organization",
3.   David A. Patterson, John L. Hennessy, "Computer Organization and Design",

BIG DATA TECHNOLOGIES
CT 765 07

Lecture : 3   Year : IV
Tutorial : 1   Part : II
Practical : 3/2

Course Objectives:

To introduce the current scenarios of big data and provide various facets of big data and to be familiar with the technologies playing key role in it and equips them with necessary knowledge to use them for solving various big data problems in different domains.

1. Introduction to Big Data   **(7 hours)**
   1.1   Big Data Overview
   1.2   Background of Data Analytics
   1.3   Role of Distributed System in Big Data
   1.4   Role of Data Scientist
   1.5   Current Trend in Big Data Analytics

2. Google File System   **(7 hours)**
   2.1   Architecture
   2.2   Availability
   2.3   Fault tolerance
   2.4   Optimization for large scale data

3. Map-Reduce Framework   **(10 hours)**
   3.1   Basics of functional programming
   3.2   Fundamentals of functional programming
   3.3   Real world problems modeling in functional style
   3.4   Map reduce fundamentals
   3.5   Data flow (Architecture)
   3.6   Real world problems
   3.7   Scalability goal
   3.8   Fault tolerance
   3.9   Optimization and data locality
   3.10 Parallel Efficiency of Map-Reduce

4. NoSQL   **(6 hours)**
   4.1   Structured and Unstructured Data
   4.2   Taxonomy of NoSQL Implementation
   4.3   Discussion of basic architecture of Hbase, Cassandra and MongoDb

5. Searching and Indexing Big Data   **(7 hours)**
   5.1   Full text Indexing and Searching
   5.2   Indexing with Lucene
   5.3   Distributed Searching with elasticsearch

6. Case Study: Hadoop (8 hours)

    6.1   Introduction to Hadoop Environment

    6.2   Data Flow

    6.3   Hadoop I/O

    6.4   Query languages for Hadoop

    6.5   Hadoop and Amazon Cloud

Practical

Student will get opportunity to work in big data technologies using various dummy as well as real world problems that will cover all the aspects discussed in course. It will help them gain practical insights in knowing about problems faced and how to tackle them using knowledge of tools learned in course.

1. HDFS: Setup a hdfs in a single node to multi node cluster, perform basic file system operation on it using commands provided, monitor cluster performance
2. Map-Reduce: Write various MR programs dealing with different aspects of it as studied in course
3. Hbase: Setup of Hbase in single node and distributed mode, write program to write into hbase and query it
4. Elastic Search: Setup elastic search in single mode and distributed mode, Define template, Write data in it and finally query it
5. Final Assignment: A final assignment covering all aspect studied in order to demonstrate problem solving capability of students in big data scenario.

References

1. Jeffrey Dean, Sanjay Ghemawat, "Map Reduce: Simplified Data Processing on Large Clusters"
2. Sanjay Ghemawat, Howard Gobioff, and Shun-Tak Leung "The Google File System"
3. http://wiki.apache.org/hadoop/

OPTICAL FIBER COMMUNICATION SYSTEM
EX 765 01

Lecture   : 3   Year : IV
Tutorial   : 1   Part : II
Practical : 3/2

Course Objective:
To introduce the concept of optical fiber communication

1. **Introduction to Optical Fiber Communication**   (2 hours)
   1.1   Evolution of optical fiber communication
   1.2   Optical fiber communication system
   1.3   Advantage of optical fiber communication
   1.4   Applications of optical fiber communication

2. **Light Transmission in Optical Fiber**   (2 hours)
   2.1   Introduction of optical fiber structure
   2.2   Total internal reflection
   2.3   Acceptance angle
   2.4   Numerical aperture
   2.5   Meridional and skew rays in optical wave guide

3. **Electromagnetic Theory for Optical Propagation**   (2 hours)
   3.1   Review of Maxwell's equation
   3.2   The wave equation for slab waveguide
   3.3   Wave equation for cylindrical waveguide

4. **Mode Propagation in Optical Waveguide**   (3 hours)
   4.1   Modes in a planar optical guide
   4.2   Phase and group velocity
   4.3   Evanescent field
   4.4   Modes in cylindrical optical waveguide
   4.5   Mode coupling

5. **Optical Fibers**   (5 hours)
   5.1   Introduction and types
   5.2   Modes in multimode fibers: step index and graded index
   5.3   Modes in step index and graded index single mode fiber
   5.4   Cutoff wavelength, mode-field diameter and spot size
   5.5   Transmission properties of optical fiber
   5.6   Fiber attenuation
   5.7   Fiber bend loss
   5.8   Fiber dispersion

6. Optical Source for Optical Fiber Communication (4 hours)

6.1 Introduction, types and requirements
6.2 Light emitting diode (LED)
6.3 Laser diode (LD)
6.4 Properties of optical sources

7. Optical Detectors (4 hours)

7.1 Introduction
7.2 Semiconductor photodiode
7.3 PIN photodiode
7.4 Avalanche photodiode
7.5 Comparison of different photodiodes
7.6 Properties of photodiodes

8. Optical Modulation (3 hours)

8.1 Introduction and types
8.2 Analog modulation
8.3 Digital modulation

9. Connectors and Couplers (6 hours)

9.1 Introduction to optical connections
9.2 Optical fiber connectors: Principle and types
9.3 Characteristic losses in connectors
9.4 Optical fiber splices: Principle and types
9.5 Comparison of different types of splices
9.6 Comparison between splice and connector
9.7 Introduction to optical couplers and their types
9.8 Fused biconical taper (bus) coupler
9.9 Fused star coupler
9.10 Characteristic properties of optical couplers
9.11 Fully bidirectional four port optical coupler
9.12 Asymmetrical bidirectional three port optical coupler (ABC)
9.13 Comparison between four port full bidirectional coupler made with traditional three port coupler and ABC

10. Fiber Amplifiers and Integrated Optics (4 hours)

10.1 Introduction
10.2 Rare earth doped fiber amplifier
10.3 Raman and Brillouin fiber amplifier
10.4 Integrated optics
10.5 Optical switch

11. Optical Fiber Network (10 hours)

11.1 Introduction to analog and digital fiber optic transmission
11.2 Optical fiber local area networks
11.3 Design of passive digital fiber optic networks

Practicals:

1. Familiarization with optical fiber laboratory, safety and precaution. Demonstration of the concept of light propagation in optical waveguide with the help of polymer rod and water spout
2. Determination of fiber numerical aperture and fiber attenuation
3. Plotting a power-current characteristic for LED
4. Determination of different optical fiber connector losses.
5. Determination of coupling efficiency/loss from source to fiber, fiber to fiber, and fiber to photodetector.
6. Digital optical transmission.

References:

1. John M. Senior, "Optical Fiber Communications – Principles and Practice", Prentice Hall.
2. William B. Jones. Jr. "Introduction to Optical Fiber Communication Systems", Holt, Rinheart and Winston, Inc.
3. Gerd Keiser, "Optical Fiber Communication", Second edition, McGraw Hill, Inc.
4. Roshan Raj Karmacharya, "Passive Optical Fiber LAN Design". M.Sc. Thesis, University of Calgary, Canada.

BROADCAST ENGINEERING
EX 765 03

Lecture   : 3   Year : IV
Tutorial   : 1   Part : II
Practical : 3/2

Course Objectives:

* To make students familiar with the applications in different areas of broadcasting such as television, AM, FM, cable television, telecommunications, data communications, studio acoustics etc. through experiments and field researches
* To present a complete perspective of basic equipments or devices used for transmission of signals such as filters and oscillators, radio frequency power amplifiers and mixers, basic circuits of modulation and demodulation, transmitters and studio equipments
* To study and understand the basic concepts of broadcasting and obtain the knowledge of designing a simple AM/FM transmitter

1. Audio Principles   **(2 hours)**
   1.1   Decibel scale and units
   1.2   Balanced lines
   1.3   Principles and types of microphones
   1.4   Basic audio measurements and test gear
   1.5   Sampling theory and its application to audio signals
   1.6   Audio data rate reduction systems for recording and transport of audio signals including an overview of psychoacoustic techniques

2. Television Principles   **(10 hours)**
   2.1   Concepts of Scanning
   2.2   Video waveform signal bandwidth
   2.3   Low frequency response and DC restoration
   2.4   Sampling theory and it's application to the digital studio standard
   2.5   Effect of distortion and bit errors on picture
   2.6   Generation of color component signals
   2.7   International TV standards: Overview of different PAL standards, SECAM and NTSC, Problems of standards conversion

3. AM Transmitter   **(9 hours)**
   AM transmitter circuits and its modulation process

4. FM Transmitter   **(4 hours)**
   To know the basic FM transmitter circuits and its modulation process

5. AM Broadcasting   **(3 hours)**
   To know the actual set-up of devices/equipments used in AM broadcasting

6. FM Broadcasting (4 hours)

To know the actual set-up of devices/equipments used in FM broadcasting

7. TV Broadcasting (4 hours)

To know the actual set-up of devices/equipments used in TV broadcasting

8. CATV Broadcasting (4 hours)

To know the actual set-up of devices/equipments used in CATV broadcasting

9. Satellite Navigation and Global Positioning System: (5 hours)

9.1 Radio and Satellite navigation
9.2 GPS position location principles
9.3 GPS receivers and Codes
9.4 Satellite signal acquisition
9.5 GPS navigation message
9.6 GPS signal levels
9.7 Timing accuracy
9.8 GPS receiver operation

Practical:

1. Field visit to broadcasting stations
2. Field visit to VSAT stations.

References:

1. Roy Blake, "Comprehensive Electronic Communication", West Publishing Co.
2. B. Grob and Charles E. Herndon, "Basic Television and Video Systems", McGraw-Hill.

WIRELESS COMMUNICATIONS
EX765 04

Lecture : 3   Year : IV
Tutorial : 1   Part : II
Practical : 3/2

Course Objectives:
To introduce the principles and building blocks of wireless communications.

1. **Introduction**   (2 hours)
    1.1   Evolution of wireless (mobile) communications, worldwide market, examples
    1.2   Comparison of available wireless systems, trends
    1.3   Trends in cellular radio (2G, 2.5G, 3G, beyond 3G) and personal wireless communication systems

2. **Cellular mobile communication concept**   (4 hours)
    2.1   Frequency re-use and channel assignment strategies
    2.2   Handoff strategies, types, priorities, practical considerations
    2.3   Interference and system capacity, co-channel and adjacent channel interference, power control measures
    2.4   Grade of service, definition, standards
    2.5   Coverage and capacity enhancement in cellular network, cell splitting, sectoring, repeaters, microcells

3. **Radio wave propagation in mobile network environment**   (12 hours)
    3.1   ReviewFree space propagation model, radiated power and electric field
    3.2   ReviewPropagation mechanisms (large-scale path loss) - Reflection, ground reflection, diffraction and scattering
    3.3   Practical link budget design using path loss models.
    3.4   Outdoor propagation models (Longley-Rice, Okumura, Hata, Walfisch and Bertoni, microcell)
    3.5   Indoor propagation models (partition losses, long-distance path loss, multiple breakpoint, attenuation factor)
    3.6   Small scale fading and multipath (factors, Doppler shift), Impulse response model of multipath channel, multipath measurements, parameters of mobile multipath channel (time dispersion, coherence bandwidth, Doppler spread and coherence time)
    3.7   Types of small-scale fading (flat, frequency selective, fast, slow), Rayleigh and Ricean fading distribution

4. **Modulation-Demodulation methods in mobile communications**   (4 hours)
    4.1   Review of amplitude (DSB, SSB, VSB) and angle (frequency, phase) modulations and demodulation techniques
    4.2   Review of line coding,   digital linear   (BPSK, DPSK, QPSKs) and

constant envelop (BFSK, MSK, GMSK) modulation and demodulation techniques

4.3 M-ary (MPSK, MFSK, QAM and OFDM) modulation and demodulation techniques

4.4 Spread spectrum modulation techniques, PN sequences, direct sequence and frequency hopped spread spectrums

4.5 Performance comparison of modulations techniques in various fading channels

5. Equalization and diversity techniques (4 hours)

5.1 Basics of equalization. Equalization in communications receivers, linear equalizers

5.2 Non-linear equalization, decision feedback and maximum likelihood sequence estimation equalizations

5.3 Adaptive equalization algorithms, zero forcing, least mean square, recursive least squares algorithms, fractionally spaced equalizers

5.4 Diversity methods, advantages of diversity, basic definitions

5.5 Space diversity, reception methods (selection, feedback, maximum ratio and equal gain diversity)

5.6 Polarization, frequency and time diversity

5.7 RAKE receivers and interleaving

6. Speech and channel coding fundamentals (4 hours)

6.1 Characteristics of speech signals, frequency domain coding of speech (sub-band and adaptive transform coding)

6.2 Vocoders (channel, formant, cepstrum and voice-excited), Linear predictive coders (multipulse, code and residual excited LPCs), Codec for GSM mobile standard

6.3 Review of block codes, Hamming, Hadamard, Golay, Cyclic, Bosh-Chaudhary- Hocquenghgem (BCH), Reed-Solomon (RS) codes

6.4 Convolutional codes, encoders, coding gain, decoding algorithms (Viterbi and others)

6.5 Trellis Code Modulation (TCM), Turbo codes

7. Multiple Access in Wireless communications (9 hours)

7.1 Frequency Division Multiple Access (FDMA), principles and applications

7.2 Time Division Multiple Access (TDMA), principles and applications

7.3 Spread Spectrum Multiple Access, Frequency Hopped Multiple Access, Code Division Multiple Access, hybrid spread spectrum multiple access techniques

7.4 Space Division Multiple Access

7.5 Standards for Wireless Local Area Networks

8. Wireless systems and standards (6 hours)

8.1 Evolution of wireless telephone systems: AMPS, PHS, DECT, CT2, IS-

94, PACS, IS-95, IS-136, IS-54 etc.

8.2 Global system for Mobile (GSM): Services and features, system architecture, radio sub-system, channel types (traffic and control), frame structure, signal processing, example of a GSM call

8.3 CDMA standards: Frequency and channel specifications, Forward and Reverse CDMA channels

8.4 WiFi, WiMAX, UMB, UMTS, CDMA-EVDO, LTE, and recent trends

8.5 Regulatory issues (spectrum allocation, spectrum pricing, licensing, tariff regulation and interconnection issues)

Practical:

1. Case Study and Field Visit
2. Visits to mobile service operators, network service providers, internet service providers

References:

1. K. Feher, "Wireless Digital Communications"
2. T. Rappaport, "Wireless Communications"
3. J. Schiller, "Mobile Communications"
4. Leon Couch, "Digital and analog communication systems"
5. B.P.Lathi," Analog and Digital communication systems"
6. J. Proakis, "Digital communication systems"
7. D. Sharma, Course manual "Communication Systems II".

DATABASE MANAGEMENT SYSTEMS
EX 765 06

Lecture   : 3   Year : IV
Tutorial : 1   Part : II
Practical : 3/2

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.

ELECTIVE III

MULTIMEDIA SYSTEM
CT 785 03

Lecture   : 3   Year : IV
Tutorial   : 1   Part : II
Practical : 3/2

Course Objectives:
To introduce the multimedia system: devices, systems and applications.

1. **Introduction**   (5 hours)
    1.1   Global structure of Multimedia
    1.2   Medium
    1.3   Multimedia system and properties

2. **Sound / Audio System**   (6 hours)
    2.1   Concepts of sound system
    2.2   Music and speech
    2.3   Speech Generation
    2.4   Speech Analysis
    2.5   Speech Transmission

3. **Images and Graphics**   (5 hours)
    3.1   Digital Image Representation
    3.2   Image and graphics Format
    3.3   Image Synthesis , analysis and Transmission

4. **Video and Animation**   (6 hours)
    4.1   Video signal representation
    4.2   Computer Video Format
    4.3   Computer- Based animation
    4.4   Animation Language
    4.5   Methods of controlling Animation
    4.6   Display of Animation
    4.7   Transmission of Animation

5. **Data Compression**   (8 hours)
    5.1   Storage Space
    5.2   Coding Requirements
    5.3   Source, Entropy and Hybrid Coding
    5.4   Lossy Sequential DCT- based Mode
    5.5   Expanded Lossy DCT-based Mode
    5.6   JPEG and MPEG

6. **User Interfaces**   (5 hours)
    6.1   Basic Design Issues

6.2   Video and Audio at the User Interface
6.3   User- friendliness as the Primary Goal

7.   Abstractions for programming   (5 hours)
7.1   Abstractions Levels
7.2   Libraries
7.3   System Software
7.4   Toolkits
7.5   Higher Programming Languages
7.6   Object –oriented approaches

8.   Multimedia Application   (5 hours)
8.1.   Media preparation and composition
8.2.   Media integration and communication
8.3.   Media Entertainment

References:

1.   Ralf Steinmetz and KlaraNahrstedt, "Multimedia: Computing, Communications and Applications", Pearson Education Asia.
2.   Fred   Halsall,   "Multimedia   Communications,   Applications,   Networks, Protocols and   Standards", Pearson Education Asia.
3.   John F. Koegel Buford, "Multimedia Systems", Pearson Education Asia.

ENTERPRISE APPLICATION DESIGN AND DEVELOPMENT
CT 785 04

Lecture : 3	Year : IV
Tutorial : 1	Part : II
Practical : 3/2	

Course Objectives:
- To design and implementation of scalable enterprise applications.
- To introduce problem solving design patterns.
- To develop the service oriented solutions.
- To design and implement Rich Internet Applications

1. Introduction (3 hours)

    1.1   Enterprise Applications trends and Challenges
    1.2   Application Architecture
    1.3   Multi-tier Architecture
    1.4   MVC Architecture

2. Design Pattern (6 hours)

    2.1   Introduction
    2.2   Creational Pattern
    2.3   Structural Pattern
    2.4   Behavioral Patterns

3. Database Concepts (4 hours)

    3.1   Database Design
    3.2   Enterprise Database (Oracle/DB2/MSSQL)
    3.3   Database Connectivity (JDBC/ODBC)
    3.4   Connection Pool

4. Service-Oriented Architecture (5 hours)

    4.1   SOA Concepts and principles
    4.2   XML/SOAP
    4.3   Web services

5. Platform for Enterprise Solutions: Java EE5: (9 hours)

    5.1   Java EE Platform Overview
    5.2   Web Core Technologies: Servlets and JSP

6. Enterprise Java Bean (6 hours)

    6.1   Enterprise JavaBean architecture
    6.2   Developing EJB3.0
    6.3   Session and message-driven EJBs

7. Advanced Web Technology (12 hours)

7.1 Web2.0 Introduction and Concepts
7.2 Rich Internet Application Development
7.3 AJAX
7.4 AJAX Frameworks(Prototype Library, DWR Java Ajax Framework)

Reference

1. Kevin Mukhar, "Beginning Java EE 5", Apress.
2. Markl Grand, "Patterns in Java", John Wiley & Sons.
3. Dana Moore, Raymond Budd, Edward Benson," Professional Rich Internet Application", John Wiley & Sons.

GEOGRAPHICAL INFORMATION SYSTEM
CT 785 07

Lecture : 3   Year : IV
Tutorial : 1   Part : II
Practical : 3/2

Course Objective:
To provide the knowledge about basics of GIS with spatial data modelling and database design, capturing the real world, spatial analysis and visualization

1. **Introduction**   (4 hours)
    1.1   Overview, History and concepts of GIS
    1.2   Scope and application areas of GIS
    1.3   Purpose and benefits of GIS
    1.4   Functional components of GIS
    1.5   Importance of GPS and remote sensing data in GIS

2. **Spatial data modeling and database design**   (10 hours)
    2.1   Introduction to geographic phenomena
    2.2   Geographic fields and objects
    2.3   Geographic boundaries
    2.4   spatial relationships and topology
    2.5   scale and resolution
    2.6   vector, raster and digital terrain model
    2.7   Spatial database design with the concepts of geodatabase.

3. **Capturing the real world**   (12 hours)
    3.1   Different methods of data capture
    3.2   Map elements, map layers, map scales and representation
    3.3   Coordinate system
    3.4   Spatial referencing: ITRS, ITRF
    3.5   Different classes of Map projections
    3.6   Datum and Datum Transformation
    3.7   GPS& Remote Sensing
    3.8   Data preparation, conversion and integration
    3.9   Quality aspects of spatial data

4. **Spatial analysis and visualization**   (10 hours)
    4.1   Functional Components of GIS
    4.2   Analysis of spatial and attribute data
    4.3   Vector and Raster overlay operators
    4.4   Buffering
    4.5   Concepts of Spatial Data Mining
    4.6   Qualitative and Quantitative data visualization
    4.7   Map outputs and its basic elements

5. Spatial data infrastructure (5 hours)

5.1 SDI concepts and its current trend

5.2 The concept of metadata and clearing house

5.3 Critical factors around SDIs

6. Open GIS (4 hours)

6.1 Introduction of open concept in GIS

6.2 Open source software for spatial data analysis

6.3 Overview of OpenStreetMap

6.4 Web Based GIS system

Practical

Lab: The lab should cover the chapters 3, 4, 5 and 6 by using the GIS tools like ArchView/ArchGIS

Lab 1&2: tutorial on ArchView/ArchGIS with real world map

Lab 3&4: Digitization and Map Layering practice

Lab 5&6: Linking to Databases, Data Analysis and Visualization

Lab 7&8: Building of your own GIS system.

Reference:

1. rolf De By, Richard A. knippers, yuxian sun, " Principles of geographic information systems: An introductory textbook", international institute for Geo-information science and Earth observation, Netherlands
2. Andy Mitchell , "ESRI guide to GIS analysis", ESRI press, Red lands
3. GIS Cook BOOK

POWER ELECTRONICS
EE 785 07

Lecture   : 3   Year : IV
Tutorial : 1   Part : II
Practical : 3/2

Course Objectives:

*   To get an overview of different types of power semi-conductor devices and their switching characteristics.
*   To understand the operation, characteristics and performance parameters of controlled rectifiers.
*   To study the operation, switching techniques and basic topologies of Choppers.
*   To learn the different modulation techniques of pulse width modulated inverters and to understand the harmonic reduction methods.
*   To study simple applications

1. Power Semi-conductor Devices   (9 hours)

    1.1   Introduction
    1.2   Power Diodes
    1.3   Power BJT
    1.4   Thyristor Characteristics
    1.5   Two Transistor model of Thyristor
    1.6   Series and Parallel operation of Thyristors
    1.7   SCR, TRIAC, Power MOSFET, GTO, IGBT and SIT
        1.7.1   Device Structures and Characteristics
        1.7.2   Turn ON- Turn OFF methods and Circuits
        1.7.3   Protections, Ratings and applications
        1.7.4   Handling precautions and power dissipation

2. Controlled Rectifiers   (8 hours)

    2.1   Single Phase / Three Phase, Half wave / full wave, half controlled /fully controlled converters with R, RL and RLE loads
    2.2   Continuous and discontinuous current operations
    2.3   Evaluation of performance parameters
    2.4   Effects of source inductance
    2.5   Power factor improvement techniques
    2.6   6-pulse and 12-pulse converters
    2.7   Dual converters

3. Choppers   (11 hours)

    3.1   DC Choppers
        3.1.1   Introduction
        3.1.2   Principle of operation,
        3.1.3   Analysis with waveforms of Step-Down and Step-Up choppers
        3.1.4   Buck, boost and buck-boost Converter

3.2 AC Choppers:
    3.2.1 Operation of 1-phase voltage regulator with R, RL loads
    3.2.2 1-phase step up & step down cycloconverters

4. Inverters (9 hours)

4.1 Single phase and three phase (both 120° mode and 180°mode) inverters
4.2 PWM techniques: Sinusoidal PWM, modified sinusoidalPWM, multiple PWM
4.3 Introduction to space vector modulations
4.4 Voltage and harmonic control
4.5 Series resonant inverter
4.6 Current source inverter

5. Applications (8 hours)

5.1 Speed control of DC motor using rectifiers and choppers
5.2 Uninterruptible Power Supply (UPS)
5.3 Switched mode Power Supply (SMPS)
5.4 Battery Charger
5.5 Introduction to shunt and series compensators

Practical:

There should be experiments on
1. Basic characteristics of power transistors, diodes thyristors (SCRs)
2. Single phase, full wave and bridge rectifiers with resistive loads
3. Single phase SCR controller with UJT trigger
4. Three phase bridge rectifiers with diodes and with SCRs
5. Rectification for inductive loads
6. Various types of Choppers
7. Speed Control of DC Motor

References:

1. M.H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education.
2. Philip T. Krein, "Elements of Power Electronics", Oxford University Press.
3. Jay P. Agarwal, "Power Electronic Systems – Theory and Design", Prentice Hall.
4. Ned Mohan, Tore M. Undeland, William P. Robbins, "Power Electronics, Converters, Application and Design", John Wiley and Sons.
5. Cyril.W.Lander, "Power Electronics", McGraw – Hill.
6. M.D. Singh, K.B. Khanchandani, "Power Electronics", Tata McGraw – Hill.

REMOTE SENSING
CT 785 01

Lecture : 3   Year : IV
Tutorial : 1   Part : II
Practical : 3/2

Course Objective:

To present an introduction to technological and scientific aspects of remote sensing (RS) of the Earth and its atmosphere

1. **Introduction**   (7 hours)

    1.1   General concepts of remote sensing
    1.2   History and basics of remote sensing of the Earth and its atmosphere
    1.3   Classifications

2. **Physical Principles of Remote Sensing**   (10 hours)

    2.1   Basic quantities
    2.2   Electromagnetic principles
    2.3   Emission/radiation theory
    2.4   Radar backscattering theory

3. **Remote Sensing Technology**   (12 hours)

    3.1   Passive remote sensing
         3.1.1   Visible and infrared techniques
         3.1.2   Microwave radiometry
    3.2   Active remote sensing
         3.2.1   Radar remote sensing
         3.2.2   Lider remote sensing
    3.3   Basics of satellite remote sensing, and ground truths

4. **Applications**   (10 hours)

    4.1   Earth and its atmosphere
         4.1.1   Precipitation, winds, clouds and aerosols, temperature and trace gases
         4.1.2   Vegetation, forestry, ecology
         4.1.3   Urban and land use
         4.1.4   Water planet: meteorological, oceanographic and hydrologic RS
         4.1.5   Geological: Landforms, structure, topography, mine and resource exploration
         4.1.6   Geographic information system (GIS): GIS approach to decision making

4.2   Remote sensing into the 21st century: Outlook for the future RS

5.   Remote Sensing Data   **(6 hours)**

5.1   Processing and classification of remote sensing data

5.2   Data formats

5.3   Retrieval algorithms

5.4   Analysis and image interpretations

Practical:

1.   Familiarization to remote sensing data available from department's capacity (via web and/or possible collaborations with national/international remote sensing agencies/institutions)

2.   Data visualization/graphics

3.   Data processing and pattern recognition

4.   Computer simulations

5.   Technical Writing

References:

1.   Campbell, J.B., "Introduction to Remote Sensing," , The Guilford Press

2.   Drury, S.A., "Image Interpretation in Geology", Chapman & Hall, 243 pp.

3.   Drury, S.A., "Images of the Earth: A Guide to Remote Sensing", Oxford Press, 212 pp.

4.   Kuehn, F. (Editor), "Introductory Remote Sensing Principles and Concepts", Routledge, 215 pp.

5.   Lillesand, T.M. and Kiefer, R.W., "Remote Sensing and Image Interpretation", J. Wiley & Sons, 720 pp.

6.   Sabins, Jr., F.F., "Remote Sensing: Principles and Interpretation", W.H. Freeman & Co., 496 pp.

7.   Siegal, B.S. and Gillespie, A.R., "Remote Sensing in Geology", J. Wiley & Sons (especially Chapters 1 through 11)

8.   Swain, P.H. and Davis, S.M., "Remote Sensing - the Quantitative Approach", McGraw-Hill Book Co.

9.   Chen, H.S., "Space Remote Sensing Systems: An Introduction", Academic Press, Orlando

10.   Jensen J. R., "Remote sensing of the environment: An Earth resource perspective" Academic Press, Orlando

11.   Ulaby, F. T., R. K. Moore, and A. K. Fung, "Microwave Remote Sensing: Active and Passive", Artech House, Norwood, MA.

12.   Periodicals devoted largely to remote sensing methods and applications:

13. IEEE Transactions on Geoscience and Remote Sensing.

14. IEEE Geoscience and Remote Sensing Letters

15. International Journal of Remote Sensing.

16. Photogrammetric Engineering and Remote Sensing.

17. Remote Sensing of the Environment

18. Canadian Journal of Remote Sensing

19. Journal of Remote Sensing Society of Japan

XML: FOUNDATIONS, TECHNIQUES AND APPLICATIONS
CT 785 05

Lecture : 3	Year : IV
Tutorial : 1	Part : II
Practical : 3/2	

Course objectives:

To provide knowledge of the Extensible Markup Language (XML), a standard for self-describing data, knowledge interchange, and information integration. Since representation, interchange and integration of information are fundamental to all information systems, there is a wide range of possible applications of XML.

1. XML Foundations (10 hours)

    1.1   History and background
    1.2   XML syntax
    1.3   Document Type Definition (DTD)
    1.4   XML Schema
    1.5   XML Stylesheet Language Transformation (XSLT)
    1.6   XML document design

2. XML Models (4 hours)

    2.1   XML conceptual models
    2.2   XML and logic

3. XML and Databases (10 hours)

    3.1   XML as a database model
    3.2   XML query languages – Xpath, XSLT, XQuery
    3.3   XML native databases

4. XML and Semantics (6 hours)

    4.1   RDF(Resource Description Framework) syntax and semantics
    4.2   RDF schema
    4.3   Web Ontology Language (OWL)
    4.4   The Semantic Web

5. Web Services (8 hours)

    5.1   SOAP
    5.2   WSDL
    5.3   UDDI
    5.4   Semantic Web Services

6. XML Applications (7 hours)

    6.1   XBRL
    6.2   Case studies of real XML applications

Practical:

A number of lab sessions can be conducted using XML Spy which is an XML editor and development environment.

References:

1. E.R. Harold, "XML Bible", IDG Books Worldwide.

2. S. Holzner and S. Holzner, "Real World XML", Peachpit Press.

3. S. Holzner, "Inside XML", New Riders Publishing.

4. S. Abiteboul, P. Buneman, and J. Gray, "Data on the Web: From Relations to Semistructured Data and XML", (Morgan Kaufmann Series in Data Management Systems, Morgan Kaufmann Publishers.

5. XML W3C Recommendation. http://www.w3.org/TR/2008/REC-xml-20081126/

ARTIFICIAL INTELLIGENCE
CT 785 06

Lecture : 3	Year : IV
Tutorial : 1	Part : II
Practical : 3/2	

Course Objectives:
- To provide basic knowledge of Artificial Intelligence
- To familiarize students with different search techniques
- To acquaint students with the fields related to AI and the applications of AI

1. Introduction (4 hours)

1.1 Definition of Artificial Intelligence
1.2 Importance of Artificial Intelligence
1.3 AI and related fields
1.4 Brief history of Artificial Intelligence
1.5 Applications of Artificial Intelligence
1.6 Definition and importance of Knowledge, and learning.

2. Problem solving (4 hours)

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

3. Search techniques (5 hours)

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

4. Knowledge representation, inference and reasoning (8 hours)

4.1 Formal logic-connectives, truth tables, syntax, semantics, tautology, validity, well-   formed-formula,
4.2 Propositional logic, predicate logic, FOPL, interpretation, quantification, horn clauses,

4.3   Rules of inference, unification, resolution refutation system (RRS), answer extraction from RRS, rule based deduction system,

4.4   Statistical Reasoning-Probability and Bayes' theorem and causal networks, reasoning in belief network

5.   Structured knowledge representation   (4 hours)

5.1   Representations and Mappings,

5.2   Approaches to Knowledge Representation,

5.3   Issues in Knowledge Representation,

5.4   Semantic nets, frames,

5.5   Conceptual dependencies and scripts

6.   Machine learning   (6 hours)

6.1   Concepts of learning,

6.2   Learning by analogy, Inductive learning, Explanation based learning

6.3   Neural networks,

6.4   Genetic algorithm

6.5   Fuzzy learning

6.6   Boltzmann Machines

7.   Applications of AI   (14 hours)

7.1   Neural networks

    7.1.1   Network structure

    7.1.2   Adaline network

    7.1.3   Perceptron

    7.1.4   Multilayer Perceptron, Back Propagation

    7.1.5   Hopfield network

    7.1.6   Kohonen network

7.2   Expert System

    7.2.1   Architecture of an expert system

    7.2.2   Knowledge acquisition, induction

    7.2.3   Knowledge representation, Declarative knowledge, Procedural knowledge

    7.2.4   Development of expert systems

7.3   Natural Language Processing and Machine Vision

    7.3.1   Levels of analysis: Phonetic, Syntactic, Semantic, Pragmatic

    7.3.2   Introduction to Machine Vision

Practical:

Practical exercises should be conducted in either LISP or PROLOG. Laboratory exercises must cover the fundamental search techniques, simple question answering, inference and reasoning.

References:

1. E. Rich and Knight, "Artificial Intelligence", McGraw Hill.

2. D. W. Patterson, "Artificial Intelligence and Expert Systems", Prentice Hall.

3. P. H. Winston, "Artificial Intelligence", Addison Wesley.

4. Stuart Russel and Peter Norvig, "Artificial Intelligence A Modern Approach", Pearson.

SPEECH PROCESSING
CT 785 08

Lecture : 3
Tutorial : 1
Practical : 3/2

Year : IV
Part : II

Course Objectives:
- To introduce the characteristics of Speech signals and the related time and frequency domain methods for speech analysis and speech compression
- To introduce the models for speech production
- To develop time and frequency domain techniques for estimating speech parameters
- To introduce a predictive technique for speech compression
- To understand speech recognition, synthesis and speaker identification.

1. Nature of speech signal   **(8 hours)**
   1.1   Speech production: Mechanism of speech production
   1.2   Acoustic phonetics
   1.3   Digitalmodels for speech signals
   1.4   Representations of speech waveform
      1.4.1   Sampling speechsignals
      1.4.2   Basics of quantization
      1.4.3   Delta modulation
      1.4.4   Differential PCM

2. Time domain methods for speech processing   **(8 hours)**
   2.1   Time domain parameters of Speech signal
   2.2   Methods for extracting the parameters
      2.2.1   Short-time Energy
      2.2.2   Average Magnitude
      2.2.3   Short-time average Zero crossing Rate
   2.3   Auditoryperception: psychoacoustics.
   2.4   Silence Discrimination using ZCR and energy
   2.5   Short Time Auto Correlation Function
   2.6   Pitch period estimation using AutoCorrelation Function

3. Frequency domain method for speech processing   **(10 hours)**
   3.1   Short Time Fourier analysis
      3.1.1   Fourier transform and linear filtering interpretations
      3.1.2   Sampling rates
   3.2   Spectrographic displays
   3.3   Pitch and formant extraction
   3.4   Analysis bySynthesis
   3.5   Analysis synthesis systems
      3.5.1   Phase vocoder

      3.5.2   Channel Vocoder
3.6   Homomorphic speech analysis
      3.6.1   Cepstral analysis of Speech
      3.6.2   Formant and PitchEstimation
      3.6.3   Homomorphic Vocoders

4. Linear predictive analysis of speech   (10 hours)

4.1   Basic Principles of linear predictive analysis
4.2   Auto correlation method
4.3   Covariance method
4.4   Solution of LPC equations
4.5   Cholesky method
4.6   Durbin's Recursive algorithm
4.7   Application of LPC parameters
      4.7.1   Pitch detection using LPC parameters
      4.7.2   Formant analysis
      4.7.3   VELP
      4.7.4   CELP

5. Application of speech & audio signal processing   (9 hours)

5.1   Algorithms:
      5.1.1   Dynamic time warping
      5.1.2   K-means clustering and Vector quantization
      5.1.3   Gaussian mixture modeling
      5.1.4   Hidden Markov modeling
5.2   Automatic Speech Recognition
      5.2.1   Feature Extraction for ASR
      5.2.2   Deterministic sequence recognition
      5.2.3   Statistical Sequence
      5.2.4   Recognition
      5.2.5   Language models
5.3   Speaker identification and verification
5.4   Voice response system
5.5   Speech synthesis
      5.5.1   Basics of articulatory
      5.5.2   Source-filter
      5.5.3   Concatenative synthesis

Practical:

There should be at 4-6 experiments based on following topics

1.   Spectral analysis
2.   Time-Frequency analysis
3.   Pitch extraction
4.   Formant tracking
5.   Speech enhancement
6.   Audio coding

7.   Speaker recognition

All these lab works may be performed in Matlab or similar softwares capable of processing speech signals. It can also be implemented in hardware if available.

References:

1.   Thomas F. Quatieri, "Discrete-Time Speech Signal Processing", Prentice Hall /Pearson Education.

2.   Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing", John Wiley and Sons Inc.

3.   L.R.Rabiner and R.W.Schaffer, "Digital Processing of Speech signals", Prentice Hall

4.   L.R. Rabiner and B. H. Juang, "Fundamentals of Speech Recognition", Prentice Hall.

5.   J.R. Deller, J.H.L. Hansen and J.G. Proakis, "Discrete Time Processing of SpeechSignals", John Wiley, IEEE Press.

6.   J.L Flanagan, "Speech Analysis Synthesis and Perception",Springer, Verlag.

TELECOMMUNICATION
EX 785 03

Lecture : 3   Year : IV
Tutorial : 1   Part : II
Practical : 3/2

Course Objectives:
To continue the study of modern communication systems, their characteristics and design.

1. Telecommunication Networks: (4 hours)
  1.1   Evolution of telecommunications
  1.2   Classification of switching system

2. Transmission Media: (4 hours)
  2.1   Transmission media characteristics
  2.2   Transmission lines
  2.3   Hybrid Transformer and circuits
  2.4   Signal and noise measurement

3. Signal Multiplexing: (4 hours)
  3.1   Frequency division multiplex, Wavelength division multiplex
  3.2   Space division multiplex
  3.3   Time division multiplex; North American TDM system, The European E1

4. Digital Switching: (8 hours)
  4.1   Digital Telephone Exchange
  4.2   Space(S) Switch
  4.3   Time(T) Switch
  4.4   ST, TS, STS and TST switch
  4.5   Comparison between TST and STS switch

5. Signaling System: (4 hours)
  5.1   Classification of Signaling Systems: Channel Associated Signaling and Common Channel Signaling
  5.2   ITU Common Channel Signaling System # 7 (SS7)

6. Telephone Traffic: (9 hours)
  6.1   Network Traffic load and parameters
  6.2   Loss System: Grade of service (GOS) and Blocking probability
  6.3   Delay System: Queuing theory
  6.4   Routing
  6.5   Numbering Plans, Charging Plans