COURSE SCHEME

FOR

B.E. – ELECTRONICS AND COMPUTER ENGINEERING

2018
### SEMESTER-I

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* Each student will attend one Lab Session of 2 hrs in a semester for a bridge project in this course. (Mechanics)
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*TO BE CARRIED OUT IN INDUSTRY/RESEARCH INSTITUTION

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**BASED ON HANDS ON WORK ON INNOVATIONS AND ENTREPRENEURSHIP**
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### ELECTIVE – V

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# Semester Wise Credits for BE (Electronics & Computer Engineering)

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<td><strong>Total Credits</strong></td>
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Course Objective: The course aims at elucidating principles of applied chemistry in industrial systems, water treatment, engineering materials and analytical techniques.

Atomic Structure and Bonding: Chemical change; elements, compounds and mixtures, Atomic structure, dual nature of electron, concept of atomic orbitals, Pauli’s Exclusion principle, Concept of chemical bonding: covalent, ionic, metallic, hydrogen bond, Vander Waal’s, Hybridization and shapes of molecule, electronic structure and periodic table.

Chemical Equilibrium: Law of mass action, Factors that influence the position of equilibrium. Ionic equilibria: ionic equilibria in aqueous solutions; strong and weak acids and bases; buffer solution and indicators.

Electrochemistry: Migration of ions, Transference number, Specific, equivalent and molar Conductivity of electrolytic solutions, Conductometric titrations, Electrode potential and types of electrodes, Introduction to galvanic and concentration cells, Liquid junction potential.

Colligative Properties of Dilute Solutions: Depression of freezing point and elevation of boiling point.

Phase Rule: States of matter, Phase, Component and Degree of freedom, Gibbs phase rule, One component and two component systems.


Fuels: Classification of fuels, Calorific value, Cetane and Octane number, fuel quality, Comparison of solid liquid and gaseous fuel, properties of fuel, alternative fuels: biofuels, Power alcohol, synthetic petrol.

Application of Atomic and Molecular Spectroscopic Methods: Structure determination of certain model compounds of industrial importance.

Assignments based on working and applications of advanced instruments will be given in the tutorial class.

Laboratory Work:

Electrochemical measurements: Experiments involving use of pH meter, conductivity meter, potentiometer.

Acid and Bases: Determination of mixture of bases.
Spectroscopic techniques: Colorimeter, UV-Vis spectrophotometer.

Kinetics: Kinetics of oxidation of iodine ion by peroxydisulphate ion.

Thermochemistry: Cloud point and pour point determination

Water and its treatment: Determination of hardness, alkalinity, chloride, chromium, iron and copper in aqueous medium.

Course Learning Outcomes (CLO):

The students will be able to:

1. analyse trends in periodic table with electronic and atomic structure.
2. interpret phase diagrams of pure and binary substances.
3. demonstrate the working of electrodes and their applications.
4. calculate various parameters defining water and fuel quality
5. identify the various functional groups through IR spectra.
6. carry out basic experimental procedure and to emphasize need for safety and safety procedure in laboratory.

Text Books:


Reference Books:


Evaluation Scheme:

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<tr>
<th>Sr. No.</th>
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<td>3.</td>
<td>Sessionals ( May include Assignments/Projects/Tutorials/Quiz)</td>
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Course Objective: To introduce concepts of DC and AC circuits, electromagnetism, single-phase transformers, DC motor and generators.

DC Circuits: Kirchhoff’s voltage and current laws; power dissipation; Voltage source and current source; Mesh and Nodal analysis; Star-delta transformation; Superposition theorem; Thevenin’s theorem; Norton’s theorem; Maximum power transfer theorem; Millman’s theorem and Reciprocity theorem; Transient response of series RL and RC circuits.

AC Circuits: Sinusoidal sources, RC, RL and RLC circuits, Concept of Phasors, Phasor representation of circuit elements, Complex notation representation, Single phase AC Series and parallel circuits, power dissipation in ac circuits, power factor correction, Resonance in series and parallel circuits, Balanced and unbalanced 3-phase circuit - voltage, current and power relations, 3-phase power measurement, Comparison of single phase and three phase supply systems.


Single Phase Transformers: Constructional features of transformer, operating principle and applications, equivalent circuit, phasor analysis and calculation of performance indices.

Motors and Generators: DC motor operating principle, construction, applications, DC generator operating principle, reversal of energy transfer, applications.

Laboratory Work: Network laws and theorems, Measurement of R,L,C parameters, A.C. series and parallel circuits, Measurement of power in 3 phase circuits, Reactance calculation of variable reactance choke coil, open circuit and short circuit tests on single phase transformer, Starting of rotating machines, Magnetisation curve of DC generator.

Course Learning Outcome (CLO):
After the completion of the course the students will be able to:
1. Apply networks laws and theorems to solve electric circuits.
2. Represent AC quantities through phasor and compute AC system behaviour during steady state
3. Explain principle and characteristics of Electro-Mechanical energy conversion devices and apply them.

Text Books:

Reference Books:

Evaluation Scheme:

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<td>Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)</td>
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</table>
Course Objectives: The exposure to this course would facilitate the students in understanding the terms, definitions and scope of environmental and energy issues pertaining to current global scenario; understanding the value of regional and global natural and energy resources; and emphasize on need for conservation of energy and environment.

Natural Resources: Human settlements and resource consumption; Biological, mineral and energy resources; Land, water and air; Natural resources vis-à-vis human resources and technological resources; Concept of sustainability; Sustainable use of natural resources

Ecology, Structure and Functioning of Natural Ecosystems: Ecology, ecosystems and their structure, functioning and dynamics; Energy flow in ecosystems; Biogeochemical cycles and climate; Population and communities

Agricultural, Industrial Systems and Environment: Agricultural and industrial systems vis-à-vis natural ecosystems; Agricultural systems, and environment and natural resources; Industrial systems and environment

Environment Pollution, Global Warming and Climate Change: Air pollution (local, regional and global); Water pollution problems; Land pollution and food chain contaminations; Carbon cycle, greenhouse gases and global warming; Climate change – causes and consequences; Carbon footprint; Management of greenhouse gases at the source and at the sinks

Energy Technologies and Environment: Electrical energy and steam energy; Fossil fuels, hydropower and nuclear energy; Solar energy, wind energy and biofuels; Wave, ocean thermal, tidal energy and ocean currents; Geothermal energy; Future energy sources; Hydrogen fuels; Sustainable energy

Group Assignments: Assignments related to Sanitary landfill systems; e-waste management; Municipal solid waste management; Biodiversity and biopiracy; Air pollution control systems; Water treatment systems; Wastewater treatment plants; Solar heating systems; Solar power plants; Thermal power plants; Hydroelectric power plants; Biofuels; Environmental status assessments; Energy status assessments, etc.

Course Learning Outcomes (CLO):

After the completion of this course, the student will be able to:

1. outline the scenario of natural resources and their status
2. calculate the flow of energy and mass balance in ecosystems
3. analyse environmental status of human settlements
4. monitor the energy performance of systems
Text Books:

Reference Books:

Evaluation Scheme:

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Course Objectives: The objective of this module is to help students develop the techniques needed to solve general engineering mechanics problems. Students will learn to describe physical systems mathematically so that their behaviour can be predicted.

Review of Newton’s law of motion and vector algebra:

Equilibrium of Bodies: Free-body diagrams, conditions of equilibrium, torque due to a force, statical determinacy.

Plane Trusses: Forces in members of a truss by method of joints and method of sections.

Friction: Sliding, belt, screw and rolling.

Properties of Plane Surfaces: First moment of area, centroid, second moment of area etc.

Virtual Work: Principle of virtual work, calculation of virtual displacement and virtual work.

Work and Energy: Work and energy, work-energy theorem, principle of conservation of energy, collisions, principles of momentum etc.


Experimental Project Assignment/ Micro Project: Students in groups of 4/5 will do project on Model Bridge Experiment: This will involve construction of a model bridge using steel wire and wood.

Course Learning Outcomes (CLO):

The students will be able to:

1. Determine resultants in plane force systems
2. Identify and quantify all forces associated with a static framework
3. Solve problems in kinematic and dynamic systems

Text Books:


Reference Books:


**Evaluation Scheme:**

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<td>3.</td>
<td>Sessionals (May include Assignments/Projects/Tutorials/Quiz</td>
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</table>
Course Objectives: To provide students with skills and knowledge in sequence and series, advanced calculus and calculus of several variables which would enable them to devise solutions for given situations they may encounter in their engineering profession.

Applications of Derivatives: Mean value theorems and their geometrical interpretation, Cartesian graphing using first and second order derivatives, Asymptotes and dominant terms, Graphing of polar curves, applied minimum and maximum problems.


Series Expansions: Power series, Taylor series, Convergence of Taylor series, Error estimates, Term by term differentiation and integration.

Partial Differentiation: Functions of several variables, Limits and continuity, Chain rule, Change of variables, Partial differentiation of implicit functions, Directional derivatives and its properties, Maxima and minima by using second order derivatives.

Multiple Integrals: Change of order of integration, Change of variables, Applications of multiple integrals.

Course Learning Outcomes (CLO): Upon completion of this course, the students will be able to:

1. apply the knowledge of calculus to plot graphs of functions, approximate functions and solve the problem of maxima and minima.
2. determine the convergence/divergence of infinite series.
3. evaluate multiple integrals and their applications to engineering problems.
4. analyse and design mathematical problems encountered in engineering applications.

Text Books:

Reference Books:
### Evaluation Scheme:

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Course Objective: This course is designed to explore computing and to show students the art of computer programming. Students will learn some of the design principles for writing good programs.

Introduction to ‘C++’ programming: Fundamentals, Structure of a C++ program, Compilation and linking processes.

Expressions and Console I/O : Basic Data types, Identifier Names, Variables, Scope, Type qualifiers, Storage class specifier, Constants, Operators, Reading and writing characters, Reading and writing strings, Formatted and console I/O, cin(), cout(), Suppressing input.

Statements: True and False, Selection statements, Iteration statements, Jump statements, Expression statements, Block statements.

Arrays and Strings: Single dimension array, two dimension array, Strings, Array of strings, Multi-dimension array, Array initialization, Variable length arrays.

Structures, Unions, Enumerations, and Typedef: Structures, Array of structures, passing structures to functions, Structure pointers, Arrays and structures within structures, Unions, Bit-fields, Enumerations, typedef.

Introduction to Object Oriented Programming with C++: Objects and Classes, basic concepts of OOPs (Abstraction, Encapsulation, Inheritance, Polymorphism), Constructors/Destructor, Copy constructor, Dynamic Constructor, Overloading (Function and Operator).

Pointers: Pointer variables, Pointer operators, Pointer expressions, Pointers and arrays, multiple indirection, Pointer initialization, Pointers to arrays, dynamically allocated arrays, Problems with pointers, Pointers and classes, pointer to an object, this pointer.

Functions: General form of a function, Understanding scope of a function, Function arguments, Command line arguments, Return statement, Recursion, Function prototype, Pointers to functions, Friend function and class.

Pre-processor and Comments: Pre-processor, #define, #error, #include, Conditional compilation directives, #undef, Single line and multiple line comments.

File I/O: Streams and files, File system basics, fread() and fwrite(), fseek() and random access I/O, fprintf() and fscanf(), Standard streams.

Laboratory Work:
To implement Programs for various kinds of programming constructs in C++ Language.

**Course Learning Outcomes (CLO):**
On completion of this course, the students will be able to
1. write, compile and debug programs in C++ language.
2. use different data types, operators and console I/O function in a computer program.
3. design programs involving decision control statements, loop control statements and case control structures.
4. understand the implementation of arrays, pointers and functions and apply the dynamics of memory by the use of pointers.
5. comprehend the concepts of structures and classes: declaration, initialization and implementation.
6. apply basics of object oriented programming, polymorphism and inheritance.
7. use the file operations, character I/O, string I/O, file pointers, pre-processor directives and create/update basic data files.

**Text Books:**

**Reference Books:**

**Evaluation Scheme:**

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SEMESTER - II

UEC001: Electronic Engineering

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**Course Objective:** To enhance comprehension capabilities of students through understanding of electronic devices, various logic gates, SOP, POS and their minimization techniques, various logic families and information on different IC’s and working of combinational circuits and their applications.

**Semiconductor Devices:** p-n junction diode: Ideal diode, V-I characteristics of diode, Diode small signal model, Diode switching characteristics, Zener diode

**Electronics Devices and Circuits:** PN Diode as a rectifier, Clipper and clamper, Operation of Bipolar Junction Transistor and Transistor Biasing, CB, CE, CC (Relationship between α, β, γ) circuit configuration Input-output characteristics, Equivalent circuit of ideal and real amplifiers, Low frequency response of amplifiers, Introduction to Field Effect Transistor and its characteristics

**Operational Amplifier Circuits:** The ideal operational amplifier, The inverting, non-inverting amplifiers, Op-Amp Characteristics, Frequency response of op-amp, Application of op-amp

**Digital Systems and Binary Numbers:** Introduction to Digital signals and systems, Number systems, Positive and negative representation of numbers, Binary arithmetic, Definitions and basic theorems of boolean Algebra, Algebraic simplification, Sum of products and product of sums formulations (SOP and POS), Gate primitives, AND, OR, NOT and Universal Gate, Minimization of logic functions, Karnaugh maps.

**Combinational and Sequential Logic:** Code converters, multiplexors, decoders, Addition circuits and priority encoder, Master-slave and edge-triggered flip-flops, Synchronous and Asynchronous counters, Registers

**Logic families:** N and P channel MOS transistors, CMOS inverter, NAND and NOR gates, General CMOS Logic, TTL and CMOS logic families, and their interfacing.

**Laboratory Work:**
Familiarization with CRO, DSO and Electronic Components, Diodes characteristics - Input-Output and Switching, BJT and MOSFET Characteristics, Zener diode as voltage regulator, Rectifiers, Clippers and Clamplers, adder circuit implementation, Multiplexer & its application, Latches/Flip-flops, up/down counters.

**Course learning outcomes (CLO):** The student will be able to:
1. Demonstrate the use of semiconductor diodes in various applications.
2. Discuss and explain the working of transistors and operational Amplifiers, their configurations and applications.
3. Recognize and apply the number systems and Boolean algebra.
4. Reduce Boolean expressions and implement them with Logic Gates.
5. Analyze, design and implement combinational and sequential circuits.
6. Analyze and differentiate logic families, TTL and CMOS.

**Text Books:**

**Reference Books:**

**Evaluation Scheme:**

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<td>Sessional (May include Assignments/Projects/Tutorials/Quiz(es)/Lab Evaluations)</td>
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Course Objective: To introduce the students to effective professional communication. The student will be exposed to effective communication strategies and different modes of communication. The student will be able to analyze his/her communication behavior and that of the others. By learning and adopting the right strategies, the student will be able to apply effective communication skills, professionally and socially.

Effective Communication: Meaning, Barriers, Types of communication and Essentials. Interpersonal Communication skills.

Effective Spoken Communication: Understanding essentials of spoken communication, Public speaking, Discussion Techniques, Presentation strategies.

Effective Professional and Technical writing: Paragraph development, Forms of writing, Abstraction and Summarization of a text; Technicalities of letter writing, internal and external organizational communication. Technical reports, proposals and papers.

Effective non-verbal communication: Knowledge and adoption of the right non verbal cues of body language, interpretation of the body language in professional context. Understanding Proxemics and other forms of non verbal communication.

Communicating for Employment: Designing Effective Job Application letter and resumes; Success strategies for Group discussions and Interviews.

Communication Networks in Organizations: Types, barriers and overcoming the barriers.

Laboratory Work:

1. Pre-assessment of spoken and written communication and feedback.
2. Training for Group Discussions through simulations and role plays.
3. Training for effective presentations.
4. Project based team presentations.
5. Proposals and papers-review and suggestions.

Minor Project (if any): Team projects on technical report writing and presentations.

Course Learning Outcomes (CLO):

1. Understand and appreciate the need of communication training.
2. Use different strategies of effective communication.
3. Select the most appropriate mode of communication for a given situation.
4. Speak assertively and effectively.
5. Correspond effectively through different modes of written communication.
6. Write effective reports, proposals and papers.
7. Present himself/herself professionally through effective resumes and interviews.
Text Books:


Reference Books:


Evaluation Scheme:

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<td>3</td>
<td>Sessionals (Group Discussions; professional presentations; panel discussions; public speaking; projects, quizzes)</td>
<td>30</td>
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</tbody>
</table>
Course Objectives: To introduce students the theory and concepts of differential equations, linear algebra, Laplace transformations and Fourier series which will equip them with adequate knowledge of mathematics to formulate and solve problems analytically.

Linear Algebra: Row reduced echelon form, Solution of system of linear equations, Matrix inversion, Linear spaces, Subspaces, Basis and dimension, Linear transformation and its matrix representation, Eigen-values, Eigen-vectors and Diagonalisation, Inner product spaces and Gram-Schmidt orthogonalisation process.


Laplace Transform: Definition and existence of Laplace transforms and its inverse, Properties of the Laplace transforms, Unit step function, Impulse function, Applications to solve initial and boundary value problems.

Fourier Series: Introduction, Fourier series on arbitrary intervals, Half range expansions, Applications of Fourier series to solve wave equation and heat equation.

Course Learning Outcomes (CLO):
Upon completion of this course, the students will be able to:
1. Solve differential equations of first and 2nd order using various analytical methods.
2. apply methods of Laplace transform and Fourier series to solve initial and boundary value problems, respectively.
3. Solve systems of linear equations using row reduction method
4. analyze vectors algebraically and geometrically in $\mathbb{R}^n$

Text Books:

Reference Books:
**Evaluation Scheme:**

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<th>Sr. No.</th>
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<td>3</td>
<td>Sessionals (May include assignments/quizzes)</td>
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</table>
UPH004: APPLIED PHYSICS

Course Objectives: Introduce the laws of oscillators, acoustics of buildings, ultrasonics, electromagnetic waves, wave optics, lasers, and quantum mechanics and demonstrate their applications in technology. Student will learn measurement principles and their applications in investigating physical phenomenon.

Oscillations and Waves: Oscillatory motion and damping, Applications - Electromagnetic damping – eddy current; Acoustics: Reverberation time, absorption coefficient, Sabine’s and Eyring’s formulae (Qualitative idea), Applications - Designing of hall for speech, concert, and opera; Ultrasonics: Production and Detection of Ultrasonic waves, Applications - green energy, sound signaling, dispersion of fog, remote sensing, Car’s airbag sensor.

Electromagnetic Waves: Scalar and vector fields; Gradient, divergence, and curl; Stokes’ and Green’s theorems; Concept of Displacement current; Maxwell’s equations; Electromagnetic wave equations in free space and conducting media, Application - skin depth.


Quantum Mechanics: Wave function, Steady State Schrodinger wave equation, Expectation value, Infinite potential well, Tunneling effect (Qualitative idea), Application - Quantum computing.

Laboratory Work:
1. Determination of damping effect on oscillatory motion due to various media.
2. Determination of velocity of ultrasonic waves in liquids by stationary wave method.
4. Determination of dispersive power of sodium-D lines using diffraction grating.
5. Determination of specific rotation of cane sugar solution.
6. Study and proof of Malus’ law in polarization.
7. Determination of beam divergence and beam intensity of a given laser.
8. Determination of displacement and conducting currents through a dielectric.
9. Determination of Planck’s constant.

Micro Project: Students will be asked to solve physics based problems/assignments analytically or using computer simulations, etc.
Course Learning Outcomes (CLO):

Upon completion of this course, students will be able to:

1. demonstrate a detailed knowledge of oscillations, ultrasonics, electromagnetic waves, wave optics, lasers, and quantum mechanics;
2. discuss how the laws of physics have been exploited and applied in the development and design of simple engineering systems;
3. collate, analyse and formulate an experimental report with error analysis and conclusions;

Text Books:


Reference Books:


Evaluation Scheme:

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<tr>
<td>3</td>
<td>Sessionals (May include assignments/quizzes)</td>
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</table>
Course Objectives: This module is dedicated to graphics and includes two sections: manual drawing and AutoCAD. This course is aimed at to make the student understand dimensioned projections, learn how to create two-dimensional images of objects using first and third angle orthographic projection as well as isometric, perspective and auxiliary projection, to interpret the meaning and intent of tolerated dimensions and geometric tolerance symbolism and to create and edit drawings using drafting software AutoCAD.

Engineering Drawing
1. Introduction
2. Orthographic Projection: First angle and third angle projection system
3. Isometric Projections
4. Auxiliary Projections
5. Perspective Projections
6. Introduction to Mechanical Drawing
7. Sketching engineering objects
8. Sections, dimensions and tolerances

AutoCAD
1. Management of screen menus commands
2. Introduction to drawing entities
3. Co-ordinate systems: Cartesian, polar and relative coordinates
4. Drawing limits, units of measurement and scale
5. Layering: organizing and maintaining the integrity of drawings
6. Design of prototype drawings as templates.
7. Editing/modifying drawing entities: selection of objects, object snap modes, editing commands,
8. Dimensioning: use of annotations, dimension types, properties and placement, adding text to drawing

Micro Projects /Assignments:
1. Completing the views - Identification and drawing of missing lines in the projection of objects
2. Missing views – using two views to draw the projection of the object in the third view, primarily restricting to Elevation, Plan and Profile views
3. Projects related to orthographic and isometric projections
   a. Using wax blocks or soap bars to develop three dimensional object from given orthographic projections
b. Using wax blocks or soap bars to develop three dimensional object, section it and color the section

c. Use of AUTOCAD as a complementary tool for drawing the projections of the objects created in (1) and (2).

4. Develop the lateral surface of different objects involving individual or a combination of solids like Prism, Cone, Pyramid, Cylinder, Sphere etc.

5. To draw the detailed and assembly drawings of simple engineering objects/systems with due sectioning (where ever required) along with bill of materials.
   e.g. Rivet joints, simple bearing, wooden joints, Two plates connected with nut and bolt etc.

**Course Learning Outcomes (CLO):**

Upon completion of this module, students will be able to:

1. creatively comprehend geometrical details of common engineering objects
2. draw dimensioned orthographic and isometric projections of simple engineering objects
3. draw sectional views of simple engineering objects.
4. interpret the meaning and intent of tolerated dimensions and geometric tolerance symbolism
5. create and edit dimensioned drawings of simple engineering objects using AutoCAD
6. organize drawing objects using layers and setting up of templates in AutoCAD

**Text Books:**


**Reference Books:**


**Evaluation Scheme:**

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<td>2</td>
<td>End semester test (formal written test)</td>
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</table>
Object Oriented Programming with C++: Class declaration, creating objects, accessing objects members, nested member functions, memory allocation for class, objects, static data members and functions. Array of objects, dynamic memory allocation, this pointer, nested classes, friend functions, constructors and destructors, constructor overloading, copy constructors, operator overloading and type conversions.

Inheritance and Polymorphism: Single inheritance, multi-level, multiple inheritance, runtime polymorphism, virtual constructors and destructors.

File handling: Stream in C++, Files modes, File pointer and manipulators, type of files, accepting command line arguments.

Templates and Exception Handling: Use of templates, function templates, class templates, handling exceptions.


Laboratory work: To implement Programs for various kinds of programming constructs in C++ Language.

COURSE LEARNING OUTCOMES (CLOS):

On completion of this course, the students will be able to

1. Write, compile and debug programs in C++, use different data types, operators and I/O function in a computer program.
2. Comprehend the concepts of classes, objects and apply basics of object oriented programming, polymorphism and inheritance.
3. Demonstrate use of file handling.
4. Demonstrate use of templates and exception handling.
5. Demonstrate use of windows programming concepts using C++

Evaluation Scheme:

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<td>3</td>
<td>Sessionals (Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)</td>
<td>35</td>
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</tbody>
</table>
Introduction: Circuit components, Network graph, KCL, KVL, Circuit analysis and methods, Mutual inductance, Co-efficient of coupling (Dot analysis), Network Classification.

Network Theorems and Two Port Network Descriptions: Thevenin’s theorem, Norton’s theorem, Maximum power transfer theorem, Superposition theorem, Tellengen’s theorem, Reciprocity theorem, Two port description in terms of open circuits impedance Parameters, Short circuit admittance parameters, Hybrid parameters, Image parameters, Inter-connection of two port network, Indefinites admittance matrix and its applications, Duality networks.

Network Functions: Concept of Complex frequency, Transform impedances, Network functions of one port & two port networks.

Time Domain Analysis: Unit, Step, Impulse and ramp function, Solution of networks using Laplace Transform, Steady state analysis of networks.


Filters: Determination of pass and attenuation bands constant K-type, Low pass, High pass, Band pass, Band stop, M-derived filters, Lattice filter, Crystal filters.

Network Synthesis: Concept of Poles & Zero, Reliability of one port Networks, Positive real function(prf) Graphical Interpretation of positive realness, Properties of prf, Even & Odd parts of palmonies Necessary & Sufficient Condition for a function to be positive real function, Hurwitz polynomials, Hurwitz polynomials test, Foster & Caner form properties of driving point impedance function of one port passive lumped reactive element network, Properties of the driving point impedance function of RL Network Properties of the driving point Impedance function of RC Network, Minimum Function Realization of Driving point Function of two-element kind by Canonic Networks, Realization of LC driving point function, Synthesis of LC, RC and RL driving point immitance function using Foster and cauer first and second forms.

Course Learning Outcomes (CLO):
The students will be able to:
1. To understand the basics of different types of circuit components and their analysis procedures.
2. To do analysis based on network theorems and to determine the current, voltage and power.
3. To analyze two port networks and to analyze time response of the circuit.
4. To check stability of a circuit and to design the circuit using foster and cauer forms

Text Books:


Reference Books:


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</table>
Course Objective: The aim of this subject is to develop analytical capability of students, by which they would be able to handle real-time signal processing related problems and projects. The knowledge of various transforms will help students to work in multi-disciplinary fields of engineering in group activities.

Representation of Signals and Systems: Signals, Basic Continuous and discrete Time signals and systems, Energy and power signals, System modeling concepts, Linear time invariant systems, Representation of signals in terms of impulses, Discrete time LTI systems continuous time LTI systems, Properties of LTI systems, Systems described by differential and difference equations, Sampling theorem, Quantization.


Introduction to Fast Fourier Transforms: Discrete Fourier transform, Properties of DFT, Fast Fourier transforms, Divide and Conquer Approach, Decimation in time and decimation in frequency, Radix-2 FFT, Radix-4 FFT algorithms, Linear Convolution, Circular Convolution, Power spectrum and correlation with FFT.

Other transforms: Discrete Sine Transform, Discrete Cosine Transform and its types.

Laboratory work:
Signal generation, Solving difference equation, Calculating Z-transform, Linear and Circular convolution, Correlation, DFT / IDFT, FFT algorithms using Matlab.

Course learning outcome (CLO): The student will be able to:
1. analyze the properties of continuous and discrete time signals and systems.
2. represent signals and systems in the frequency domain using Fourier tools.
3. apply Z-transform to analyze discrete time signals and system.
4. obtain the Fast Fourier transform of a sequence and measure its computational efficiency.
Text Books:

Reference Books:

Evaluation Scheme:

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</table>
Course objective:

Embedded systems are pervasive in all areas of society, and as such, knowledge of how to design them is a vital skill for all electronic engineers. The objective of this course is to equip students with the necessary fundamental knowledge and skills that enable them to design basic embedded systems, where a microprocessor or microcontroller is the central element.

Introduction to Processor Design

General purpose processor architecture and organization, Von-Neuman and Harvard architectures, Processor design trade-offs, CISC and RISC architectures, Advantages of RISC architecture, Processor cores: soft and hard.

ARM Introduction and Pipeline structures

ARM processor architecture, Endianness, Processor core VS CPU core, ARM7TDMI Interface signals, Memory Interface, Bus Cycle types, Register set, Operational Modes. Instruction Format, ARM Core Data Flow Model, ARM 3 stage Pipeline, ARM family attribute comparison. ARM 5 stage Pipeline, Pipeline Hazards, Data forwarding

ARM7TDMI assembly instructions and modes

ARM ISA and Processor Variants, Different Types of Instructions, ARM Instruction set, condition codes, Load-Store instructions, Data processing instructions, Shift Operations, Arithmetic, Logical instructions, Addressing modes. Swap Instructions, Swap Register related Instructions, Control Flow Instructions, Interrupts and Exceptions, software Interrupt Instruction, Assembly Language Programming, Thumb state, Thumb Programmers model, Thumb Applications, ARM coprocessor interface and Instructions, Coprocessor Instructions,

ARM tools and Peripherals

Course learning outcome (CLO):
On completion of this course, the students will be able to

- analyze ARM processor assembly instructions, their formats and usage.
- write ARM processor-based assembly language programs.
- understand how thumb mode operations are designed and various coprocessors are interfaced in an embedded system.
- interface AMBA bus architecture, various HW peripherals in embedded systems and how memory mapping can be done.
- understand issues to be handled in any processor software tool chain for embedded system development especially using C/C++.

Text Books:


Reference Books:


Laboratory Work: Practical/experiments based on the assembly language programming, C/C++ programming and integration of ARM core with embedded peripherals.

Evaluation Scheme:

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<td>Sessionals (Assignments/Projects/ Lab Evaluations)</td>
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</table>
Course Objectives: The objective of the course is to provide basic understanding of engineering materials, their structure and the influence of structure on mechanical, chemical, electrical and magnetic properties.

Structure of Solids: Classification of engineering materials, Structure-property relationship in engineering materials, Crystalline and non-crystalline materials, Miller Indices, Crystal planes and directions, Determination of crystal structure using X-rays, Inorganic solids, Silicate structures and their applications. Defects; Point, line and surface defects.


Electrical and Magnetic Materials: Conducting and resister materials, and their engineering application; Semiconducting materials, their properties and applications; Magnetic materials, Soft and hard magnetic materials and applications; Superconductors; Dielectric materials, their properties and applications. Smart materials: Sensors and actuators, piezoelectric, magnetostrictive and electrostrictive materials.

Diffusion and Corrosion: Diffusion in solids, Corrosion: their type, cause and protection against corrosion.

Materials Selection: Overview of properties of engineering materials, Material selection in design based on properties covering timber, aluminium, glass, polymers and ceramics.

Laboratory Work:
1. Determination of the elastic modulus and ultimate strength of a given fiber strand.
2. To measure grain size and study the effect of grain size on hardness of the given metallic specimens.
3. To determine fiber and void fraction of a glass fiber reinforced composite specimen.
4. To study cooling curve of a binary alloy.
5. Detection of flaws using ultrasonic flaw detector (UFD).
6. To determine the dielectric constant of a PCB laminate.
7. To estimate the Hall coefficient, carrier concentration and mobility in a semiconductor crystal.
8. To estimate the band-gap energy of a semiconductor using four probe technique.
Micro Project:
The micro-project will be assigned to the group(s) of students at the beginning of the semester. Based on the interest and branch of the student, he will carry out one of the followings:

1. Design experiments to determine various mechanical properties like strength, ductility, elastic modulus, etc. of a given specimen(s) and correlate them.
2. Design an experiment to classify the given specimens based on their electrical properties.
3. Identify the most suitable material from the given specimens for solar cell application.
4. Identify the suitability of given samples in marine, acidic and alkaline environment.
5. Design a virtual experiment to analyse / predict physical properties of a given material/composite.

Course Learning Outcomes (CLO):
Student will be able to:

1. understand structure-property correlation;
2. read phase diagrams and can predict the properties of the solid based on the phase diagram.
3. discriminate between materials based on their electrical and magnetic properties and should be able to describe temperature and field dependence of electrical and magnetic properties.
4. select materials based on their properties for a defined application.

Text Books:

Reference Books:

Evaluation Scheme:

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</table>
Course Objective: The main objective of this course is to motivate the students to understand and learn various numerical techniques to solve mathematical problems representing various engineering, physical and real life problems.

Floating-Point Numbers: Floating-point representation, rounding, chopping, error analysis, conditioning and stability.

Non-Linear Equations: Bisection, secant, fixed-point iteration, Newton method for simple and multiple roots, their convergence analysis and order of convergence.

Linear Systems and Eigen-Values: Gauss elimination method using pivoting strategies, LU decomposition, Gauss--Seidel and successive-over-relaxation (SOR) iteration methods and their convergence, ill and well conditioned systems, Rayleigh's power method for eigen-values and eigen-vectors.

Interpolation and Approximations: Finite differences, Newton's forward and backward interpolation, Lagrange and Newton's divided difference interpolation formulas with error analysis, least square approximations.

Numerical Integration: Newton-Cotes quadrature formulae (Trapezoidal and Simpson's rules) and their error analysis, Gauss--Legendre quadrature formulae.

Differential Equations: Solution of initial value problems using Picard, Taylor series, Euler's and Runge-Kutta methods (up to fourth-order), system of first-order differential equations.

Laboratory Work: Lab experiments will be set in consonance with materials covered in the theory. Implementation of numerical techniques using MATLAB.

Course learning outcomes: Upon completion of this course, the students will be able to:

1) understand the errors, source of error and its effect on any numerical computations and also analysis the efficiency of any numerical algorithms.
2) learn how to obtain numerical solution of nonlinear equations using bisection, secant, Newton, and fixed-point iteration methods.
3) solve system of linear equations numerically using direct and iterative methods.
4) understand how to approximate the functions using interpolating polynomials.
5) learn how to solve definite integrals and initial value problems numerically.
Texts Books:

References Books:

Evaluation Scheme:

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<td>4.</td>
<td>Laboratory Evaluation</td>
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</table>
UTA013: ENGINEERING DESIGN PROJECT-I

Course Objectives: To develop design skills according to a Conceive-Design-Implement-Operate (CDIO) compliant methodology. To apply engineering sciences through learning-by-doing project work. To provide a framework to encourage creativity and innovation. To develop team work and communication skills through group-based activity. To foster self-directed learning and critical evaluation.

To provide a basis for the technical aspects of the project a small number of lectures are incorporated into the module. As the students would have received little in the way of formal engineering instruction at this early stage in the degree course, the level of the lectures is to be introductory with an emphasis on the physical aspects of the subject matter as applied to the ‘Mangonel’ project. The lecture series include subject areas such as Materials, Structures, Dynamics and Digital Electronics delivered by experts in the field.

This module is delivered using a combination of introductory lectures and participation by the students in 15 “activities”. The activities are executed to support the syllabus of the course and might take place in specialised laboratories or on the open ground used for firing the Mangonel. Students work in groups throughout the semester to encourage teamwork, cooperation and to avail of the different skills of its members. In the end the students work in sub-groups to do the Mangonel throwing arm redesign project. They assemble and operate a Mangonel, based on the lectures and tutorials assignments of mechanical engineering they experiment with the working, critically analyse the effect of design changes and implement the final project in a competition. Presentation of the group assembly, redesign and individual reflection of the project is assessed in the end.

Breakup of lecture details to be taken up by MED:

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<th>Lec No.</th>
<th>Topic</th>
<th>Contents</th>
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<tbody>
<tr>
<td>Lec 1</td>
<td>Introduction</td>
<td>The Mangonel Project. History. Spreadsheet.</td>
</tr>
<tr>
<td>Lec 2</td>
<td>PROJECTILE MOTION</td>
<td>no DRAG, Design spread sheet simulator for it.</td>
</tr>
<tr>
<td>Lec 3</td>
<td>PROJECTILE with DRAG</td>
<td>with DRAG, Design spread sheet simulator for it.</td>
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1 0 2 5.0
Breakup of lecture details to be taken up by ECED:

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<td>Lec 1-5</td>
<td>Digital Electronics</td>
<td>Prototype, Architecture, Using the Integrated Development Environment (IDE) to Prepare an Arduino Sketch, structuring an Arduino Program, Using Simple Primitive Types (Variables), Simple programming examples. Definition of a sensor and actuator.</td>
</tr>
</tbody>
</table>

Tutorial Assignment / Laboratory Work:

Associated Laboratory/Project Program: T- Mechanical Tutorial, L- Electronics Laboratory, W- Mechanical Workshop of “Mangonel” assembly, redesign, operation and reflection.

Title for the weekly work in 15 weeks

<table>
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<tr>
<th>Code</th>
<th>Title</th>
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<tr>
<td>T1</td>
<td>Using a spread sheet to develop a simulator</td>
</tr>
<tr>
<td>T2</td>
<td>Dynamics of projectile launched by a Mangonel - No Drag</td>
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Dynamics of projectile launched by a Mangonel - With Drag T3
Design against failure under static actions T4
Design against failure under dynamic actions T5
Electronics hardware and Arduino controller L1
Electronics hardware and Arduino controller L2
Programming the Arduino Controller L3
Programming the Arduino Controller L4
Final project of sensors, electronics hardware and programmed Arduino controller based measurement of angular velocity of the “Mangonel” throwing arm L5
Assembly of the Mangonel by group W1
Assembly of the Mangonel by group W2
Innovative redesign of the Mangonel and its testing by group W3
Innovative redesign of the Mangonel and its testing by group W4
Final inter group competition to assess best redesign and understanding of the “Mangonel” W5

**Project:** The Project will facilitate the design, construction and analysis of a “Mangonel”. In addition to some introductory lectures, the content of the students’ work during the semester will consist of:

1. the assembly of a Mangonel from a Bill Of Materials (BOM), detailed engineering drawings of parts, assembly instructions, and few prefabricated parts;
2. the development of a software tool to allow the trajectory of a “missile” to be studied as a function of various operating parameters in conditions of no-drag and drag due to air;
3. a structural analysis of certain key components of the Mangonel for static and dynamic stresses using values of material properties which will be experimentally determined;
4. the development of a micro-electronic system to allow the angular velocity of the throwing arm to be determined;
5. testing the Mangonel;
6. redesigning the throwing arm of the Mangonel to optimise for distance without compromising its structural integrity;
7. an inter-group competition at the end of the semester with evaluation of the group redesign strategies.

**Course Learning Outcomes (CLO):**

Upon completion of this module, students will be able to:

1. simulate trajectories of a mass with and without aerodynamic drag using a spreadsheet based software tool to allow trajectories be optimized;
2. perform a test to acquire an engineering material property of strength in bending and analyze the throwing arm of the “Mangonel” under conditions of static and dynamic loading;
3. develop and test software code to process sensor data;
4. design, construct and test an electronic hardware solution to process sensor data;
5. construct and operate a Roman catapult “Mangonel” using tools, materials and assembly instructions, in a group, for a competition;
6. operate and evaluate the innovative redesign of elements of the “Mangonel” for functional and structural performance;

**Text Books:**


**Reference Book:**


**Evaluation Scheme:**

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<tr>
<td>Project (Assembly of the “Mangonel”, innovative redesign with reflection, prototype competition, Final Presentation and viva-voce)</td>
<td>30</td>
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</tbody>
</table>
Course Objective: The aim of this course is to familiarize the student with the analysis and design of basic transistor amplifier circuits, oscillators and wave shaping circuits.


Power Amplifiers: Class A, B, AB, Push pull & Class C amplifiers, Comparison of their Efficiencies, Types of distortion.

Feedback Amplifiers: Classification of Amplifiers, The feedback concept, The transfer gain with feedback, General characteristics of negative-feedback amplifiers, Input resistance, Output resistance, Method of Analysis of a Feedback Amplifier, Voltage-series feedback, A voltage-series feedback pair, Current-series feedback, Current-shunt feedback, Voltage-shunt feedback


Wave shaping circuits: Multi-vibrators (Astable, Mono-stable, Bi-Stable), High pass and low pass filters using R-C Circuits and R-L, R-L-C Circuits & their response to step input, Pulse
input, Square input and Ramp Input, Attenuators, Clamping Circuit theorem, Clipping and Clamping circuits, Schmitt Trigger, Comparator.


**Course learning outcome (CLO):** The student will be able to:

1. Determine operating point and various stability factors of transistor.
2. Analyse low and high frequency transistor model.
3. Evaluate the performance parameters of various multistage and power amplifiers.
4. Analyse the concept of feedback amplifier and its characteristics.
5. Design oscillator circuits and analyse its performance.
6. Analyse various filters and multi-vibrators circuits.

**Text Books:**


**Reference Books**


**Evaluation Scheme:**

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Prerequisite(s): Nil

Course Objectives: To gain knowledge and understand the concepts of probability theory, random variables, stochastic processes and Information theory. To familiarize the students with the applications of probabilistic/stochastic techniques/methods in communication engineering and information theory.

Details of Contents:

Probability Theory: Review of Probability, Bernoulli Trials, Bernoulli’s Theorem, Concepts of Random Variables, Distribution and Probability Density Functions, Conditional Distributions, Binomial Random variables Functions of One Random Variable, its Distribution, Mean and Variance, Moments, Characteristic Functions; Two Functions of Two Random Variables, Joint Moments, Joint Characteristic Functions, Conditional Distributions, Conditional Expected Values, Normality, Center Limit Theorem, and Bayes’ Theorem


Estimation & Hypothesis Testing: Time and Ensemble Averages, Covariance Functions. Simple Binary Hypothesis Tests, Decision Criteria, Neyman Pearson Tests, Bayes’ Criteria, z-Score, and p-Value Test


Information Theory: Unit of Information, Rate of Information, Entropy, Joint Entropy and Conditional Entropy, Mutual Information, Shannon-Hartley Theorem, Channel Capacity Calculations of Different Channels, Source Coding- Coding Efficiency, Shannon-Fano Coding, Huffman Coding.

Text Books:

Reference Books:
5. IEEE Transactions on Information Theory

Course Learning Outcomes:
At the end of this course, the students will be able to

- apply the probabilistic concepts as well as properties of the random variables
- perform the spectral analysis of stationary stochastic processes, for the modeling of real-time desired signals and spurious-signals/noise
- incorporate the estimation and hypothesis testing principles to find remedial solutions
- utilize the features/characteristics of queueing theory in communication systems
- employ information theory and coding concepts, to improve information symbol transmission rate, and also use it for data compression

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Course Objectives: To familiarize the student with the analysis, design and evaluation of digital systems of medium complexity that are based on SSI, MSI and Programmable logic devices. Also, to familiarize the students with the issues in the design of iterative networks, timing analysis of synchronous and asynchronous systems.

Binary Codes: Review of special binary codes, Error detection and correction codes.


Sequential Circuits: Various types of latches and flip-flops and their conversions, Universal Shift Registers, Counters – Ring, Johnson, Design of Counters, Timing issues, Setup and hold times, operating frequency limitations, Static Timing Analysis, Standard ICs for their applications, Finite State Machines – Moore and Mealy, Design of Synchronous and Asynchronous sequential circuits, Races and hazards, hazard free design.

Logic Circuits: DTL, TTL, MOS, CMOS logic families their comparison, Detailed study of TTL & CMOS logic families and their characteristics i.e. Fan-in, Fan-out, Unit load, Propagation delay, Power dissipation, Current & voltage parameters, Tristate Logic, Interfacing of TTL & CMOS logic families, reading and analyzingDatasheets, Performance estimation of digital systems.

Laboratory Work: To study standard ICs and their usage, To study latches and Flip-flops, Design of registers and asynchronous/synchronous up/down counters, Variable modulus counters, Design of Finite State Machines, Study of timing waveforms, Usage of IC tester.

Course Learning Outcomes: The student will be able to:

1. Perform Logic Minimization for single/multiple output function(s).
2. Generate multiple digital solutions to a verbally described problem.
3. Evaluate the performance of a given Digital circuit/system.
4. Draw the timing diagrams for the identified signals in a digital circuit.
5. Assess the performance of a given digital circuit with Mealy and Moore configurations.
6. Perform static timing analysis of the digital circuits/systems.
7. Compare the performance of a given digital circuits/systems with respect to their speed, power consumption, number of ICs, and cost.
Text Books:


Reference Books:


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Course Objective: The main objective of the course is to formulate mathematical models and to understand solution methods for real life optimal decision problems. The emphasis will be on basic study of linear programming problem, Integer programming problem, Transportation problem, Two person zero sum games with economic applications and project management techniques using PERT and CPM.

Scope of Operations Research: Introduction to linear and non-linear programming formulation of different models.

Linear Programming: Geometry of linear programming, Graphical method, Linear programming (LP) in standard form, Solution of LP by simplex method, Exceptional cases in LP, Duality theory, Dual simplex method, Sensitivity analysis.

Integer Programming: Branch and bound technique.

Transportation and Assignment Problem: Initial basic feasible solutions of balanced and unbalanced transportation/assignment problems, Optimal solutions.

Project Management: Construction of networks, Network computations, Floats (free floats and total floats), Critical path method (CPM), Crashing.

Game Theory: Two person zero-sum game, Game with mixed strategies, Graphical method and solution by linear programming.

Course learning outcome: Upon Completion of this course, the students would be able to:

1) formulate and solve linear programming problems.
2) solve the transportation and assignment problems
3) solve the Project Management problems using CPM
4) to solve two person zero-sum games

Text Books:

Recommended Books:
2) Bazaaraa Mokhtar S., Jarvis John J. and Shirali Hanif D., Linear Programming and Network flows, John Wiley and Sons (1990)

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Course Objectives: This course introduces the basic concepts of manufacturing via machining, forming, joining, casting and assembly, enabling the students to develop a basic knowledge of the mechanics, operation and limitations of basic machining tools. The course also introduces the concept of metrology and measurement of parts.

Machining Processes: Principles of metal cutting, Cutting tools, Cutting tool materials and applications, Geometry of single point cutting tool, Introduction to multi-point machining processes – milling, drilling and grinding, Tool Life, Introduction to computerized numerical control (CNC) machines, G and M code programming for simple turning and milling operations, introduction of canned cycles.

Metal Casting: Principles of metal casting, Introduction to sand casting, Requisites of a sound casting, Permanent mold casting processes.

Metal Forming: Forging, Rolling, Drawing, Extrusion, Sheet Metal operations.


Laboratory Work:

Relevant shop floor exercises involving practices in Sand casting, Machining, Welding, Sheet metal fabrication techniques, CNC turning and milling exercises, Experiments on basic engineering metrology and measurements to include measurements for circularity, ovality, linear dimensions, profiles, radius, angular measurements, measurement of threads, surface roughness.

Basic knowledge and derivations related to above measurements, uncertainties, statistical approaches to estimate uncertainties, Line fitting, static and dynamic characteristics of instruments will be discussed in laboratory classes.

Assignments: Assignments for this course will include the topics: Manufacturing of micro-chips used in IT and electronics industry and use of touch screens. Another assignment will be given to practice numerical exercises on topics listed in the syllabus.

Micro Project: Fabrication of multi-operational jobs using the above processes as per requirement by teams consisting of 4-6 members. The use of CNC machines must be part of micro project. Quality check should be using the equipment available in metrology lab.

Course Learning Outcomes (CLO):

Upon completion of this module, students will be able to:

1. analyse various machining processes and calculate relevant quantities such as velocities, forces, powers etc;
2. suggest appropriate process parameters and tool materials for a range of different operations and workpiece materials;
3. understand the basic mechanics of the chip formation process and how these are related to surface finish and process parameters;
4. recognise cutting tool wear and identify possible causes and solutions;
5. develop simple CNC code, and use it to produce components while working in groups.
6. perform calculations of the more common bulk and sheet forming, casting and welding processes and given a particular component.
7. select the most appropriate manufacturing process to achieve product quality through the efficient use of materials, energy and process.

Text Books:

Reference Books:

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Arduino Microcontroller:

Introduction to ARM processor: Features of ARM processor, ARM Architecture, Instruction set, ARM Programming


Laboratory work: Introduction to Arduino board. Programming examples of Arduino board. Interfacing of LED, seven segment display, ADC and DAC with Arduino board. Introduction to ARM processor kit.

Projects: Arduino and ARM based projects to be allocated by concerned faculty.

Course Learning Outcomes: The student should be able to:
1. understand of features of Arduino board.
2. analyze of internal Architecture of Arduino board.
3. apply Arduino board programming concepts.
4. design and implement Buggy project based on different goals and challenges defined.

Text Books:
**Reference Book:**

1. **JOHN BOXALL, ARDUINO WORKSHOP - A HANDS-ON INTRODUCTION WITH 65 PROJECTS, NO STARCH PRESS; 1 EDITION (2013).**

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Course objective: Role and purpose of the operating system, Functionality of a typical operating system, managing atomic access to OS objects.

Operating System Principles: Structuring methods (monolithic, layered, modular, microkernel models), processes, and resources, Concepts of APIs, Device organization, interrupts: methods and implementations, Concept of user/system state and protection, transition to kernel mode.

Concurrency: Implementing synchronization primitives, Multiprocessor issues (spin locks, reentrancy).

Scheduling and Dispatch: Dispatching and context switching, Preemptive and non-preemptive scheduling, Schedulers and policies, Processes and threads.

Memory Management: Review of physical memory and memory management hardware, Working sets and thrashing, Caching, Paging and virtual memory, Virtual file systems.

File Systems: Files: data, metadata, operations, organization, buffering, sequential, nonsequential, Directories: contents and structure, Naming, searching, access, backups, Journaling and log-structured file systems.


Security and Protection: Overview of system security, Security methods and devices, Protection, access control, and authentication.

Virtual Machines: Types of virtualization (including Hardware/Software, OS, Server, Service, Network).

Device Management: Characteristics of serial and parallel devices, Buffering strategies, Direct memory access, Disk structure, Disk scheduling algorithms.

Laboratory work: To explore different operating systems like Linux, Windows etc. To implement main algorithms related to key concepts in the operating systems.

1. Detailed architecture of linux commands and flow of command execution.
2. Detailed commands related to basics of linux, file handling, process management.
3. Shell program having sequential, decision and loop control constructs.
4. CPU Scheduling Algorithms
5. Threaded programming in Linux (eg. POSIX threads in LINUX)

**Course learning outcome (CLO):**
On completion of this course, the students will be able to

1. Explain basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.
2. Distinguish concepts related to concurrency including, synchronization primitives, race conditions, critical sections and multi-threading.
3. Analyze and apply CPU scheduling algorithms, deadlock detection and prevention algorithms.
4. Examine and categorise various memory management techniques like caching, paging, segmentation, virtual memory, and thrashing.
5. Appraise high-level operating systems concepts such as file systems, security, protection, virtualization and device-management, disk-scheduling algorithms and various file systems.

**Text Books:**

**Reference Books:**
1. *Daniel P. Bovet, Marco Cesati, "Understanding the Linux Kernel", 3rd Ed., O'Reilly Media, November 2005*

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Course objectives: to become familiar with different types of data structures and their applications and learn different types of algorithmic techniques and strategies.

Linear data structures: arrays, records, strings and string processing, references and aliasing, linked lists, strategies for choosing the appropriate data structure, abstract data types and their implementation: stacks, queues, priority queues, sets, maps.

Basic Analysis: Differences among best, expected, and worst case behaviors of an algorithm, Asymptotic analysis of upper and expected complexity bounds, Big O notation: formal definition and use, Little o, big omega and big theta notation, Complexity classes, such as constant, logarithmic, linear, quadratic, and exponential, Time and space trade-offs in algorithms, Recurrence relations, Analysis of iterative and recursive algorithms.

Searching and Sorting: Linear Search, Binary Search, Bubble Sort, Selection Sort, Insertion Sort, Shell Sort, Quick Sort, Heap Sort, Merge Sort, Counting Sort, Radix Sort.


Non-Linear Data Structures And Sorting Algorithms: Hash tables, including strategies for avoiding and resolving collisions, Binary search trees, Common operations on binary search trees such as select min, max, insert, delete, iterate over tree, Graphs and graph algorithms, Representations of graphs, Depth- and breadth-first traversals, Heaps, Graphs and graph algorithms, Shortest-path algorithms (Dijkstra and Floyd), Minimum spanning tree (Prim and Kruskal).

Problem Clauses: P, NP, NP- Hard and NP-complete, deterministic and non-deterministic polynomial time algorithm approximation and algorithm for some NP complete problems. Introduction to parallel algorithms, Genetic algorithms, intelligent algorithms.

Laboratory work: Implementation of Arrays, Recursion, Stacks, Queues, Lists, Binary trees, Sorting techniques, Searching techniques. Implementation of all the algorithmic techniques.

Project: It will contain a Project which should include designing a new data structure/algorithm/language/tool to solve new problems & implementation. It can also involve creating visualizations for the existing data structures and algorithms. Quantum of project should reflect
at least 60 hours of Work excluding any learning for the new techniques and technologies. It should be given to group of 2-4 students. Project should have continuous evaluation and should be spread over different components. There should be a formal project report. Evaluation components may include a poster, video presentation as well as concept of peer evaluation and reflection component.

**Course learning outcome (CLOs):** The students will be able to

1. Implement the basic data structures and solve problems using fundamental algorithms.
2. Implement various search and sorting techniques.
3. Analyze the complexity of algorithms, to provide justification for that selection, and to implement the algorithm in a particular context.
4. Analyse, evaluate and choose appropriate data structure and algorithmic technique to solve real-world problems.

**Text Books:**


**Reference Books:**


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Course Objective: The aim of this course is to build fundamental understanding of a communication system and its performance metrics. The course will describe the theory of modulation and its different counterparts with the help of mathematical analysis of their various characteristics. The generation of AM, FM and PM waves will be described. The course will also focus on the design of AM and FM receivers and will deal with various types of noises in the communication channel.

Introduction to Communication systems: Introduction to Communication system, analog and digital messages, signal to noise ratio, Noise, Resistor noise, Multiple resistor noise sources, Noise Temperature, Noise bandwidth, Effective input noise temperature, channel bandwidth, rate of communication, modulation, necessity for modulation, signal distortion over a communication channel, signal energy and signal energy density, signal power, power spectral density,

Amplitude Modulation: Baseband and carrier communication, Theory of amplitude modulation, DSB-AM, SSB-AM, Vestigial sideband transmission, carrier acquisition, power calculations, Square law modulation, Amplitude modulation in amplifier circuits, Suppressed carrier AM generation (Balanced Modulator) ring Modulator, Product Modulator/balanced Modulator.

AM Reception: Tuned Ratio Frequency (TRF) Receiver, Super heterodyne Receiver, RF Amplifier, Image Frequency Rejection, AM diode detector, AM receiver using a phase locked loop (PLL), AM receiver characteristics.


FM/PM Reception: Direct methods of Frequency demodulation, Travis detector/frequency discrimination (Balanced stop detector), Foster seely of phase discriminator, Ratio detector, Indirect method of FM demodulation, FM detector using PLL, Zero crossing detector as a Frequency Demodulator, Pre-emphasis / de-emphasis, Limiters, The FM receiver

Analog Pulse Modulation: Introduction, Pulse amplitude modulation (PAM), Pulse Time Modulation (PTM), Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), Spectra of pulse modulated signals, SNR calculations for pulse modulation systems.

Laboratory work: Study of AM modulators / demodulators: (Balanced modulator, Ring modulator) / (Balanced modulator Super heterodyne Receiver), Study of FM/PM modulators/demodulators: (direct method, Varactor diode Modulator, Indirect generation of FM) / (Balanced stop detector, Foster seeley of phase discriminator, Ratio detector), FM stereo receiver.

Course learning outcome (CLOs): The students will be able to
1. describe different types of noise and predict its effect on various analog communication systems.
2. analyze energy and power spectral density of the signal.
3. express the basic concepts of analog modulation schemes
4. evaluate analog modulated waveform in time /frequency domain and also find modulation index.
5. develop understanding about performance of analog communication systems
6. calculate bandwidth and power requirements for analog systems.
7. analyze different characteristics of receiver

Text Books:

Reference Books:

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Course Objective: To enhance comprehension capabilities of students through understanding of designing procedure of digital filters both FIR and IIR using different approaches and their associated structures, linear predictors for adaptive signal processing, Different adaptive filtering algorithms and obtain results from multirate signal processing.

Review of Signals and Systems: Overview of the Frequency Analysis of the Signals and Systems, FFT algorithm, Properties of the DFT, Circular Convolution, Linear Convolution using the DFT.

Design of Digital Filters: Basic principles of Filters and Filtering, Different types of the filters, Problems associated with Passive filters, Difference between analog and digital filter design.

Design of FIR Filters: Symmetric and Antisymmetric FIR filters, Linear phase concept, Design of ideal and practical FIR filter (LPF, HPF, BPF and BRF) without using Window functions and with window functions, Comparison of window functions, Design of FIR filters using frequency sampling methods, Design of digital differentiator, Structure for realizing digital FIR filters.


Multirate Signal Processing: Concept of multirate signal processing, Decimation and Interpolation, Upsampling and Downsampling in the Z-domain, FIR filter polyphase structure, Filters for decimation and interpolation, Multistage decimators and interpolators. Filter banks, Uniform DFT filter bank, Polyphase realization of the uniform DFT filter bank, Two channel QMF bank, FIR QMF banks with PR, Half-band filters, Different applications of the Multirate signal processing.

Equalization: Zero-Forcing and MMSE equalizer, Fractionally Spaced Equalization, Adaptive Equalizer

Laboratory Work:
Generation of multiple frequencies signal, Familiarization of the frequency transform as DTFT and DFT, Convolution process, Implementation of the different types of digital IIR and FIR Filters, Analyse the effects of filters with varying parameters, Some problems on the sample rate conversion, Implementation of the different adaptive filters and solve some practical problems.
**Course Learning Outcomes (CLOs):** The students will be able to:

1. analyze the concept of basic filters and filtering process and their realization.
2. design both digital FIR and IIR filters using different approaches and their associated structures.
3. Analyse the concept of multi-rate signal processing and sampling rate conversion.
4. design a filtering algorithm for the real time application.
5. Analyse the concept of equalization and design different equalizers

**Text Books:**


**Reference Books:**


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Course Objectives: To introduce the concept of parallelism followed in the modern RISC based computers by introducing the basic RISC based DLX architecture. To make the students understand and implement various performance enhancement methods like memory optimization, Multiprocessor configurations, Pipelining and interfacing of I/O structures using interrupts and to enhance the student’s ability to evaluate performance of these machines by using evaluation methods like CPU time Equation, MIPS rating and Amdahl’s law.


Instruction Set Principles: Classification of Instruction set architectures, Memory Addressing, Operations in the instruction set, Type and Size of operands, Encoding an Instruction set, Program Execution, Role of registers, Evaluation stacks and data buffers, The role of compilers, The DLX Architecture, Addressing modes of DLX architecture, Instruction format, DLX operations, Effectiveness of DLX.

Pipelining and Parallelism: Idea of pipelining. The basic pipeline for DLX, Pipeline Hazards, Data hazards, Control Hazards, Design issues of Pipeline Implementation, Multicycle operations, The MIPS pipeline, Instruction level parallelism, Pipeline Scheduling and Loop Unrolling, Data, Branch Prediction, Name and Control Dependences, Overcoming data hazards with dynamic scheduling, Superscalar DLX Architecture, The VLIW Approach.


Multiprocessors: Characteristics of Multiprocessor Architectures, Centralized Shared Memory Architectures, Distributed Shared Memory Architectures, Synchronization, Models of Memory Consistency.


Course Learning Outcomes (CLO S): The students will be able to:
1. Understand and analyze a RISC based processor.
2. Understand the concept of parallelism and pipelining.
3. Evaluate the performance of a RISC based machine with an enhancement applied and make a decision about applicability of that respective enhancement as a design engineer.
4. Understand the memory hierarchy design and optimise the same for best results. Understand how input/output devices can be interfaced to a processor in serial or parallel with their priority of access defined.

Text Books:


Reference Books:


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Course objective: The course aims to present the principles and techniques of both MOS based digital and analog circuit design, connecting digital circuits, logic design, and analog components with the fundamental device physics, processing techniques and transistor level characteristics of Silicon integrated circuits, both in theoretical and practical aspects.


Combinational Circuits: MOS Logic Circuits with Depletion NMOS loads, CMOS Logic Circuits, CMOS logic Styles, Realization of simple gates, Complex logic circuits, Pass Gate, Transmission Gate.

Operation of MOS Circuits: Behaviour of MOS Circuits at DC, MOS as an Amplifier, Calculation of the DC Bias Point, Voltage Gain, Transconductance, T Equivalent Circuit Model, Modeling the Body Effect, Biasing of Discrete MOS Amplifiers and Integrated Circuit MOS Amplifiers.

Laboratory Work:
Familiarization with Circuit design/simulation tools (Cadence/Mentor/Tanner Tools) for schematic and layout entry, Circuit simulation using SPICE, DC transfer Characteristics of Inverters, Transient response, Calculating propagation delays, rise and fall times, Circuit design of inverters, Complex gates with given constraints.

Course Learning Outcomes (CLO):
Upon completion of this course, the student will be able to:
1. Use MOS structures in basic digital and analog circuits.
2. Describe the general processing steps required to fabricate an integrated circuit.
3. Analyse the fundamental static and dynamic performance of CMOS inverter.
4. Analyse the fundamental static and dynamic performance of logic gates with given constraints.
5. Implement various CMOS logic circuits.
6. Design simple circuits to meet stated operating specifications.
Text Books:

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<td>Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)</td>
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SEMESTER - VI

UCS304: INFORMATION MANAGEMENT SYSTEM (WITH 2 SELF EFFORT HOURS)

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Course objective: Emphasis is on the need of information systems. Main focus is on E-R diagrams, relational database, concepts of normalization and de-normalization and SQL commands.

Detail contents:
Introduction: Data, data processing requirement, desirable characteristics of an ideal data processing system, traditional file based system, its drawback, concept of data dependency, Definition of database, database management system, 3-schema architecture, database terminology, benefits of DBMS, Database development process - conceptual data modeling, logical database design, physical database design, database implementation, database maintenance.

Database Analysis: Conceptual data modeling using E-R data model - entities, attributes, relationships, generalization, specialization, specifying constraints. 5 – 6 practical problems based on E-R data model.

Relational Database: Relational data model: Introduction to relational database theory: definition of relation, relational model integrity rules, relational algebra and relational calculus.

Relational Database Design: Normalization- 1NF, 2NF, 3NF, BCNF, 4NF and 5NF. Concept of De-normalization and practical problems based on these forms.

Indexing of Data: Impact of indices on query performance, basic structure of an index, creating indexes with SQL, Types of Indexing and its data structures.

Database Implementation: Introduction to SQL, DDL aspect of SQL, DML aspect of SQL – update, insert, delete & various form of SELECT- simple, using special operators, aggregate functions, group by clause, sub query, joins, co-related sub query, union clause, exist operator. PL/SQL - cursor, stored function, stored procedure, triggers, error handling, package.

Laboratory work: Students will learn SQL and other database concepts. One project, which should include database designing & implementation.

Project: It will contain a Project which should include database designing & implementation, should be given to group of 2-4 students. While doing projects emphasis should be more on
back-end programming like use of SQL, concept of stored procedure, function, triggers, cursors, package etc. Project should have continuous evaluation and should be spread over different components. There should be a formal project report. Evaluation components may include a poster, video presentation as well as concept of peer evaluation and reflection component.

**Course learning outcome (CLO):**

On completion of this course, the students will be able to

1. Analyze the Information Systems as socio-technical systems, its need and advantages as compared to traditional file based systems.
2. Comprehend architecture of DBMS, conceptual data modelling, logical database design and physical database design.
3. Analyze Database design using E-R data model by identifying entities, attributes, relationships, generalization and specialization along with relational algebra.
4. Apply and create Relational Database Design process with Normalization and De-normalization of data.
5. Demonstrate use of SQL and PL/SQL to implementation database applications with usage of DDL aspect of SQL, DML aspect of SQL, aggregate functions, group by clause, sub query, joins, co-related sub query and indexes, cursor, stored function and procedure, triggers etc.

**Text Books:**


**Reference Books:**


**Evaluation Scheme:**

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Course objective: This course provides a broad introduction to machine learning and statistical pattern recognition. It offers some of the most cost-effective approaches to automated knowledge acquisition in emerging data-rich disciplines and focuses on the theoretical understanding of these methods, as well as their computational implications.

Introduction to Python Programming
Types of Variables, Control Statements, Linear and Nonlinear data structures, Python Packages: Numpy, Matplotlib, Pandas, Seaborn etc.

Introduction and Regression ML models: Basic concepts, Designing a learning system, Issues in machine learning (ML), Applications of machine learning, Why machine learning is the future, Simple Linear Regression, Multiple Linear Regression, Polynomial Regression, Support vector Regression, Decision Tree regression, Random Forest regression.

Classification: Logistic Regression, K-nearest Neighbors (K-NN), Support Vector machine (SVM), Kernel SVM, Naïve Bayes classifier, Decision tree classification, Random Forest classification, Evaluation the performance of various classification models, appropriate problems for decision tree learning.

Clustering and Learning: K-means clustering, hierarchical clustering, Association rule learning, A-priori and Eclat, Reinforcement learning, Upper confidence bound, Thomson sampling, Natural Language Processing.

Artificial Neural Network: Neural network representation, Neural Networks as a paradigm for parallel processing, Linear discrimination, Pairwise separation, Gradient Perceptron, Training a perceptron, Back propagation Algorithm, Deep Learning, Convolutional Neural Networks, Dimensionality Reduction.

Course learning outcome (CLO):
On completion of this course, the students will be able to

1. Demonstrate the use of Python programming to datasets.
2. Demonstrate in-depth knowledge of methods and theories in the field of machine learning and provide an introduction to the basic principles, techniques, and applications of machine learning, classification tasks, decision tree learning.
3. Apply decision tree learning, bayesian learning and artificial neural network in real world problems.
4. Apply inductive and analytical learning with perfect domain theories.
5. Critically evaluate and compare different learning models and learning algorithms and be able to adapt or combine some of the key elements of existing machine learning algorithms to design new algorithms as needed.

**Text Books:**


**Reference Books:**


**Lab Syllabus**

1. Basics of Python Programming
2. To perform the data preprocessing for creating machine learning models
3. To create Machine learning models for simple regression on a certain dataset.
4. To create machine learning model for polynomial regression
5. To create machine learning models for classification
6. To create machine learning model for clustering and learning
7. To develop python programs for ANN and convolutional neural networks

Micro-projects will also be given to further strengthen the lab activity.

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Course Objectives: The aim of this course is to build the foundation for communication system design focusing on the challenges of digital communication. The intended objective is to impart knowledge to the engineering students about the transmission/reception of data over physical layer through any channel. They will be able to identify the physical interpretation of mathematical expressions/modelling, while dealing with communication systems in the presence of noise, interference and fading.

Details of Contents:

Introduction to Pulse Modulation Systems: Basic model of digital communication system, Bandpass and lowpass signal and system representations, lowpass equivalent of bandpass signals, Sampling theorem for baseband and bandpass signals, quantization, companding, signal reconstruction filter, Shannon-Hartley channel capacity theorem, Bandwidth – SNR tradeoff and bounds, Difference between analog pulse modulation and digital pulse modulation techniques, Details about PCM, Differential-PCM, DM, Adaptive-DM, time-division-multiplexed system (T- & E-type), and output SNR calculations

Digital Formats and Baseband Shaping for Data Transmission: NRZ, RZ, Manchester formats, Power spectra of discrete-PAM signals, ISI, Nyquist’s criterion for distortionless baseband transmission with ideal and practical solutions, generalized correlative coding and its types, and eye pattern

Fundamentals of Detection and Estimation: Gram-Schmidt orthogonalization procedure, MAP criterion, maximum likelihood (ML) decision rule, Correlator receiver, Matched filter receiver, ML estimation procedure, probability of bit-error & symbol-error calculations for digital modulation techniques under AWGN channel, and union bound on probability of error

Digital Modulation Schemes With & Without Memory: Details about Binary-ASK, BFSK, BPSK, QPSK, M-ary ASK, M-ary FSK, M-ary PSK, M-ary QAM; MSK, generalized continuous-phase-FSK; Differential-PSK, phase-locked-loop, and carrier recovery procedures

Coding Aspects: Block-code generation, its types and decoding procedures, convolutional code generation, its types and Viterbi decoding procedure, error detection and correction concepts in decoding

Multiple Access Techniques: Brief introduction about TDMA, FDMA, WDMA, CDMA, and OFDM systems
**Laboratory Work:** Practical/experiments based on the hardware using communication kits, and simulation with the help of available simulation packages.

**Text Books:**

**Reference Books:**

**Course Learning Outcomes:**
Upon completion of this course, the students will be able to:

1. Evaluate different modulation techniques in the presence of AWGN working under the various capacity constraints.
2. Incorporate digital formats and M-ary baseband modulations to improve bandwidth efficiency.
3. Perform statistical analysis of the transmitted and received modulated waveforms from estimation and detection point of view.
4. Improve the overall performance of digital communication systems by interference suppression/excision and by implementing the signal-to-noise-ratio enhancement techniques.
5. Analyze the concepts of correlative coding and channel coding to mitigate the effects of interference and noise in the channel.

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Course Objective: To introduce basic concepts of Data communication with different models. Enumerate the physical layer, Data Link Layer, Network Layer, Transport Layer and Application Layer, explanation of the function(s) of each layer. Understanding of switching concept and different types of switching techniques.


Physical layer: Analog and digital, Analog signals, Digital signals, Analog versus digital, Data rate limit, Transmission impairments, Line coding, Block coding, Sampling, Transmission mode, Modulation of digital data, Telephone modems, Modulation of analog signal, FDM, WDM, TDM, Guided media, Unguided media, Circuit switching, Telephone networks, DSL technology, Cable modem, SONET

Data link layer: Types of errors, Detection, Error correction, Flow and error control, Stop and wait ARQ, go back n ARQ, Selective repeat ARQ, HDLC, Point to point protocol, PPP stack, Random access, Controlled access, Channelization, Traditional Ethernet, Fast Ethernet, Gigabit Ethernet, IEEE802.11, Bluetooth, Connecting devices, Backbone network, Virtual LAN, Cellular telephony, Satellite networks, Virtual circuit switching, Frame relay, ATM.

Network layer: Internetworks, Addressing, Routing, ARP, IP, ICMP, IPv6, Unicast routing, Unicast routing protocol, Multicast routing, Multicast routing protocols.

Transport layer: Process to process delivery, User datagram protocol (UDP), Transmission control protocol (TCP), Data traffic, Congestion, Congestion control, Quality of service, Techniques to improve QOS, Integrated services, Differentiated services, QOS in switched networks.

Application layer: Client server model, Socket interface, Name space, Domain name space, Distribution of name space, DNS in the internet, Resolution, DNS messages, DDNS, Encapsulation, Electronic mail, File transfer, HTTP, World wide web (WWW), Digitizing audio and video, Audio and video compression, Streaming stored audio/video, Streaming live audio/video, Real time interactive audio/video, Voice over IP.


List of laboratory experiments
The laboratory work includes the open source simulator GNS3. GNS3 is a graphical network simulator that allows emulation of complex networks.
1. Different networking commands such as hostname, ipconfig, getmac, arp, ping, netstat, tracert, nslookup, nbstat, route.
2. How to configure router and telnet in GNS3 simulator.
3. Design of general topology in GNS3 simulator.
4. Design of network topology such as Bus, Ring, Star and Tree in GNS3 simulator.
5. How to classify the network on the basis of classful and classless IP addressing scheme.
6. Demonstrate RIP routing protocol in GNS3 simulator.

**Course Learning Outcomes (CLO):** Upon completion of this course, the student will be able to:

1. Give the basic information of how a network can be designed, possible choice of various models for designing a network.
2. Understand the protocol layer specific communication between two trusted entities.
3. Analyse the possible attacks on a network to interrupt the transmission and mislead the communication between different entities.
4. Analyse the shortest path over which data can be transmitted, able to design a routing protocol implementing security mechanisms for secure transmission of data from sender to the receiver.
5. Understand the subject based on course work, assignments and through implementation on a specific platform.
6. Design a network topology with the available networking elements and can implement a routing protocol along with a secure mechanism ensuring the error free transmission of data.

**Text Books:**


**Reference Books:**


**Evaluation Scheme:**

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Course objective: To make students understand image fundamentals and how digital images can be processed, Image enhancement techniques and its application, Image compression and its applicability, fundamentals of computer vision, geometrical features of images, object recognition and application of real time image processing.

Introduction: Digital image representation, fundamental steps in image processing, elements of digital image processing systems digitization.


Image Enhancement: Histogram processing, image subtraction, image averaging, smoothing filters, sharpening filters, enhancement in frequency and spatial domain, low pass filtering, high pass filtering.


Computer Vision: Imaging Geometry; Coordinate transformation and geometric warping for image registration, Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal Component Analysis, Shape priors for recognition.

Laboratory Work:
1. Introduction to image processing on MATLAB.
2. Image effects based on image quantization.
3. Image enhancement algorithms for histogram processing, filtering.
4. Fourier transform of images and filtering in frequency domain.
5. Realization of any one image compression algorithm.
6. Introduction to computer vision tools.


Course learning outcome (CLO):
Upon completion of the course, the student will be able to:

1. Fundamentals of image processing.
2. Basic skills to enhancing images.
3. Fundamental and state of the art image compression standards.
4. Real time image processing with computer vision.

**Text Books:**


**Reference Books:**


**Evaluation Scheme:**

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Course Objectives: This course aims to provide the students with a basic understanding in the field of entrepreneurship, entrepreneurial perspectives, concepts and frameworks useful for analysing entrepreneurial opportunities, understanding eco-system stakeholders and comprehending entrepreneurial decision making. It also intends to build competence with respect business model canvas and build understanding with respect to the domain of startup venture finance.

Introduction to Entrepreneurship: Entrepreneurs; entrepreneurial personality and intentions - characteristics, traits and behavioural; entrepreneurial challenges.

Entrepreneurial Opportunities: Opportunities- discovery/ creation, Pattern identification and recognition for venture creation; prototype and exemplar model, reverse engineering.

Entrepreneurial Process and Decision Making: Entrepreneurial ecosystem , Ideation, development and exploitation of opportunities; Negotiation, decision making process and approaches, - Effectuation and Causation.

Crafting business models and Lean Start-ups: Introduction to business models; Creating value propositions - conventional industry logic, value innovation logic; customer focused innovation; building and analysing business models; Business model canvas , Introduction to lean startups, BusinessPitching.

Organizing Business and Entrepreneurial Finance: Forms of business organizations; organizational structures; Evolution of organisation, sources and selection of venture finance options and its managerial implications.Policy Initiatives and focus; role of institutions in promoting entrepreneurship.

Course learning outcome (CLO):

Upon successful completion of the course, the students should be able to:

1. Define the fundamentals of entrepreneurship
2. Explain the role of entrepreneurial process and entrepreneurial decision making.
3. Describe various Business Models and design a business model canvas.
4. Evaluate various forms of Enterprises and sources of raising finance for start-up ventures.
5. Articulate the latest developments and challenges in the entrepreneurship domain in India.
Text Books:


Reference Books:

3. Kachru, Upendra, India Land of a Billion Entrepreneurs, Pearson
6. Bansal, Rashmi, Stay Hungry Stay Foolish, CIIE, IIM Ahmedabad
8. Mitra, Ramana (2008), Entrepreneur Journeys (Volume 1), Booksurge Publishing
13. Guillebeau, Chris (2012). The $100 startup: Fire your Boss, Do what you love and work better to live more, Pan Macmillan
15. Prasad, Rohit (2013), Start-up sutra: what the angels won’t tell you about business and life, Hachette India.

EVALUATION SCHEME:

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<td>3.</td>
<td>Sessionals (May include assignments/quizzes)</td>
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Course Objectives: The objective of the course is to understand the interplay between, psychological, ethical and economic principles in governing human behaviour. The course is designed to help the students to understand the basic principles underlying economic behaviour, to acquaint students with the major perspectives in psychology to understand human mind and behavior and to provide an understanding about the how ethical principles and values serve as a guide to behavior on a personal level and within professions.

UNIT I: PSYCHOLOGICAL PERSPECTIVE

Introduction to Psychology: Historical Background, Psychology as a science. Different perspectives in Psychology.

Perception and Learning: Determinants of perception, Learning theories, Behavior Modification.


Group Dynamics and Interpersonal relationships.

Development of self and personality.

Transactional Analysis.

Culture and Mind.

Practicals:

1. Experiments on learning and behaviour modification.
3. Experiments on understanding Emotions and their expressions.
4. Personality Assessment.
5. Exercises on Transactional analysis.
6. Role plays, case studies, simulation tests on human behaviour.
UNIT II: HUMAN VALUES AND ETHICAL PERSPECTIVE


Value Spectrum for a Good Life: Role of Different Types of Values such as Individual, Societal, Material, Spiritual, Moral, and Psychological in living a good life.

Moral and Ethical Values: Types of Morality, Kant's Principles of Morality, Factors for taking ethical decisions, Kohlberg's Theory of Moral Development.

Analyzing Individual human values such as Creativity, Freedom, Wisdom, Love and Trust. Professional Ethics and Professional Ethos, Codes of Conduct, Whistle-blowing, Corporate Social Responsibility.

Laboratory Work:

Practical application of these concepts by means of Discussions, Role-plays and Presentations, Analysis of Case studies on ethics in business and CSR.

UNIT III: ECONOMIC PERSPECTIVE

Basics of Demand and Supply

Production and cost analysis

Market Structure: Perfect and Imperfect Markets.

Investment Decisions: capital Budgeting, Methods of Project Appraisal.


Laboratory Work:

The practicals will cover numerical on demand, supply, market structures and capital budgeting, Trading games on financial markets, Group discussions and presentations on macroeconomic issues. The practicals will also cover case study analysis on openness and globalisation and the impact of these changes on world and Indian economy.

Micro Project: Global Shifts and the impact of these changes on world and Indian economy.

Course Learning Outcomes (CLO):

Upon the successful completion of this course, students will be able to:

1. Improve the understanding of human behavior with the help of interplay of professional, psychological and economic activities.
2. Able to apply the knowledge of basic principles of psychology, economics and ethics for
the solution of engineering problems.
3. Explain the impact of contemporary issues in psychology, economics and ethical principles on engineering.

**Text Books:**


**Reference Books:**


**Evaluation Scheme:**

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ELECTIVE - I

UEC709: FIBER OPTIC COMMUNICATION

Summary:

Course Objectives: To understand the optical fiber communication system, transmitter section, medium- the optical fiber, receiver section, analyze system based on important parameters for characterizing optical fiber, optical source, detector and amplifier, fundamentals and advances in lasers, LEDs, photodiodes, advanced optoelectronics.


Photo detectors: Operating principle and physical properties of photodiodes, p-n and pin photo diodes, Photodetector noise, Response time, Avalanche multiplication noise, Temperature effect on avalanche gain, Photodiode material.

Optical Communication Systems: Optical receiver operation- Fundamental receiver operation, Digital receiver performance calculation, Preampifier types, Analog receivers. Digital transmission systems- Point to point links, Line coding, Eye pattern, Noise effects on system performance. Analog system: Overview of analog links, Carrier to noise ratio, Multichannel transmission techniques, WDM: basics and components, LAN, Coherent optical fiber communication- Classification of coherent system, Requirements on semiconductor lasers, Modulation techniques, Modulation techniques, Polarization control requirements.


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**Laboratory Work:** Basic optical communication link experiments (analog & digital), measurement of numerical aperture, splicing, multiplexing experiments, bending losses, measurement with OTDR, design and performance analysis using simulation tools.

**Micro-project:** To design a single mode photonic crystal fiber with low dispersion at telecom wavelength.

**Course Learning Outcomes (CLOs):** The students will be able to:

1. understand the fundamentals, advantages and advances in optical communication system
2. acquire a detailed understanding of types, basic properties and transmission characteristics of optical fibers
3. understand configuration and architecture of advanced optical communication, advanced system techniques and nonlinear optical effects and their applications
4. gain the knowledge of knowledge of working and analysis of optical amplifiers and important devices/components at the transmitter (Semiconductor lasers/LEDs, modulators etc) as well as at the receiver sides (optical detector etc.) of the optical communications system.

**Text Books:**


**Reference Books:**


**Evaluation Scheme:**

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Course objective: To familiarize with soft computing concepts. Introduce the ideas of Neural networks, fuzzy logic and use of heuristics based on human experience. Familiarize the concepts of Genetic algorithm. Apply the soft computing concepts to solve practical problems.

Introduction: Introduction to soft computing, Problem complexity, Problem complexity classification, Types of soft computing techniques, Soft computing versus hard computing, Advantages of soft computing.

Artificial Neural Networks: Biological neuron, Artificial Neural Network, Mathematical Models, McCulloch Neural Model, Perceptron, Adaline and Madaline, Learning & Training in ANN, Hopfield Neural Network, Self-Organizing Networks, Recurrent Networks, Associative memories

Fuzzy Logic System: Crisp Vs Fuzzy set theory, Membership functions, Fuzzy set operations, Fuzzy rules, Mamdani and Sugeno fuzzy inference systems, Defuzzification methods.

Genetic Algorithms: Introduction and biological background of GA, String Encoding of chromosomes, Selection methods, Single & multi-point crossover operation, Mutation, Adjustment of strategy parameters such as Population size, Mutation & Crossover probabilities

Tools & Applications: MATLAB Toolboxes: Fuzzy Logic Toolbox, Neural Network Toolbox, FLS for Antilock Breaking System (ABS), GA in route planning for Travelling Sales Person, Time-Series forecasting using ANN.

Laboratory Work: Familiarization of MATLAB toolboxes for neural network and fuzzy logic. Implementing neural networks and fuzzy logic in MATLAB for different applications. Familiarization of GA toolbox MATLAB and implementing it to find optimal solution of optimization problems.

Micro Project: The student shall work on any micro project based on various learning schemes of their choice. Every student will verify results of his/her micro project using MATLAB and submit report to the course coordinator for its evaluation.

Course Learning Outcomes:

Upon completion of this course, the student should be able to:

1. Understand the characteristics of Soft Computing Techniques
2. Explain neural networks and their applications.
3. Demonstrate proficient performance in the application of neural nets.
4. Apply fuzzy logic and fuzzy reasoning for decision making
5. Explain genetic algorithms and their applications.
6. Demonstrate proficient performance in the application of genetic algorithms.

**Text Books**


**Reference Books:**

1. Jacek M. Zurada – *Introduction to Artificial Neural Systems*
3. John Yen, Reza Langari – *Fuzzy Logic Intelligence, Control, and Information*

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**UCS508: GRAPHICS AND VISUAL COMPUTING**

**Course Objective:** Detailed study of computer graphics, 2 D and 3 D transformations, representations and visualization.

**Fundamentals of Computer Graphics:** Applications of computer Graphics in various, Video Display Devices, Random scan displays, raster scan displays, DVST, Flat Panel displays, I/O Devices.

**Graphics Primitives:** Algorithms for drawing Line, circle, ellipse, arcs & sectors, Boundary Fill & Flood Fill algorithm, Color Tables

**Transformations & Projections:** 2D & 3D Scaling, Translation, rotation, shearing & reflection, Composite transformation, Window to View port transformation, Orthographic and Perspective Projections.

**Clipping:** CohenSutherland, Liang Barsky, Nicholl-Lee-Nicholl Line clipping algorithms, Sutherland Hodgeman, Weiler Atherton Polygon clipping algorithm.

**Three Dimensional Object Representations:** 3D Modeling transformations, Parallel & Perspective projection, Clipping in 3D. Curved lines & Surfaces, Spline representations, Spline specifications, Bezier Curves & surfaces, B-spline curves & surfaces, Rational splines, Displaying Spline curves & surfaces.

**Basic Rendering:** Rendering in nature, Polygonal representation, Affine and coordinate system transformations, Visibility and occlusion, depth buffering, Painter’s algorithm, ray tracing, forward and backward rendering equations, Phong Shading per pixel per vertex Shading.

**Visualization:** Visualization of 2D/3D scalar fields: color mapping, iso surfaces. Direct volume data rendering: ray-casting, transfer functions, segmentation. Visualization of: Vector fields and flow data, Time-varying data, High-dimensional data: dimension reduction, parallel coordinates, Non-spatial data: multi-variate, tree/graph structured, text Perceptual and cognitive foundations, Evaluation of visualization methods, Applications of visualization, Basic Animation Techniques like traditional, keyframing.

**Laboratory work:** Lab work should be done in OpenGL (version 3+). Covers all the basic drawing, filling, transformation and clipping algorithms. Usage of OpenGL for implementation of applications like Solar System (planetary system and its working) and Graphics Editors (Paint brush) etc.

**Course Learning Outcomes (CLO):**
On completion of this course, the students will be able to:
1. Comprehend the concepts related to basics of computer graphics and visualization.
2. Demonstrate various graphics primitives and 2-D, 3-D geometric transformations and clipping techniques.
3. Comprehend the concepts related three dimensional object representations.
4. Implement various hidden surface removal techniques.
5. Demonstrate the use of OpenGL to create interactive computer graphics applications.

Text Books:

Reference Books:
2. Zhigang Xiang, Roy A Plastock, Computer Graphics, Schaums Outline, TMH.

Evaluation Scheme:

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Course objective: To provide students with the knowledge of basic characteristics of speech signal in relation to production and hearing of speech by humans. To describe basic algorithms of speech analysis common to many applications. To give an overview of applications (recognition, synthesis, coding) and to inform about practical aspects of speech algorithms implementation.


Digital Models for Speech signals: Speech production and acoustic tube modeling, vocal tract and ear.

Digital Vocoders: Linear predictive coding (LPC), hybrid coders—voice excited vocoders, and voice excited linear predictor, hybrid coders.

Speech Recognition: Isolated word recognition, continuous speech recognition, speaker (in) dependent, measures and distances, Dynamic time warping (DTW), HMM, Introduction to speaker recognition, Adaptive noise cancellation, Hands free system.

Advanced Topics: Introduction to emerging speech coding standards (e.g., 2400 bps MELP), Internet phone, audio signal generation, speech generation and recognition algorithms.

Laboratory Work: Frames, windows, spectrum, pre-processing, Linear prediction (LPC), Fundamental frequency estimation, Coding, Recognition - Dynamic time Warping (DTW), Recognition - hidden Markov models (Hidden Markov Model)

Course Learning Outcomes (CLO):

Upon completion of the course, the student will be able to:

1. Characterise the speech signal in relation to production and hearing by humans.
2. Differentiate various mathematical techniques for speech recognition.
3. Analyse coders for speech signals.
4. Simulate a simple system for speech processing and its applications.

Text Books:

Reference Books:

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Course Objective: To impart knowledge about wireless communication systems and related design parameters to undergraduate students. To inculcate ability in students to design wireless communication systems, which can provide high data rate to a large number of users. The main goal is to utilize the concepts of analog/digital modulation techniques and signal processing in transmission and reception of wireless signals under static and dynamic channels, in the presence of noise.


Laboratory Work: Minor Project, Experiments based on Contemporary Hardware and Software Tools (MATLAB).

Course Learning Outcomes (CLOs): The student will be able to:

1. Model Time-Invariant and Time-Variant Multipath Fading Channels
2. Use Different Multiple Assess Communication Strategies to Enhance System Capacity
3. Use Equalization and Coding Schemes to Control Bit Error Rate
4. Use Various Wireless Diversity and Reception Techniques to Improve Signal to Noise Ratio
5. Design High Data-Rate Indoor and Outdoor Wireless Communication Systems

Text Books:


Reference Books:

3. IEEE Journal on Selected Areas in Communications
4. IEEE Communications Magazine

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Course objective: To apply principles of software development and evolution. To specify, abstract, verify, validate, plan, develop and manage large software and learn emerging trends in software engineering.

Introduction:


Software Design and construction: System design principles: levels of abstraction (architectural and detailed design), separation of concerns, information hiding, coupling and cohesion, Structured design (top-down functional decomposition), object-oriented design, event driven design, component-level design, test driven design, data-structured centered, aspect oriented design, function oriented, service oriented, Design patterns, Coding Practices: Techniques, Refactoring, Integration Strategies, Internal Documentation.


Software Project Management: SP Estimation of scope(LOC,FP etc),time(Pert/CPM Networks), and cost(COCOMO models), Quality Management, Plan for software Quality Control and Assurance, Earned Value Analysis.


Laboratory work: Implementation of Software Engineering concepts and exposure to CASE tools like Rational Software suit, Turbo Analyst, Silk Suite. Follow entire SDLC depending on project domain.

Course learning outcome (CLO): On completion of this course, the students will be able to
1. Analyze software development process models, including agile models and traditional models like waterfall.
2. Demonstrate the use of software life cycle through requirements gathering, choice of process model and design model.
3. Apply and use various UML Models for software analysis, design and testing.
4. Acquire knowledge about the concepts of application of formal specification, CASE tools and configuration management for software development.
5. Analysis of software estimation techniques for creating project baselines.

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Course objective: To introduce the fundamentals of parallel and distributed programming and application development in different parallel programming environments.

Detail contents:

Parallelism Fundamentals: Scope and issues of parallel and distributed computing, Parallelism, Goals of parallelism, Parallelism and concurrency, Multiple simultaneous computations, Programming Constructs for creating Parallelism, communication, and coordination. Programming errors not found in sequential programming like data races, higher level races, lack of liveness.

Parallel Architecture: Architecture of Parallel Computer, Communication Costs, parallel computer structure, architectural classification schemes, Multicore processors, Memory Issues : Shared vs. distributed, Symmetric multiprocessing (SMP), SIMD, vector processing, GPU, co-processing, Flynn’s Taxonomy, Instruction Level support for parallel programming, Multiprocessor caches and Cache Coherence, Non-Uniform Memory Access (NUMA)

Parallel Decomposition and Parallel Performance: Need for communication and coordination/synchronization, Scheduling and contention, Independence and partitioning, Task-Based Decomposition, Data Parallel Decomposition, Actors and Reactive Processes, Load balancing, Data Management, Impact of composing multiple concurrent components, Power usage and management. Sources of Overhead in Parallel Programs, Performance metrics for parallel algorithm implementations, Performance measurement, The Effect of Granularity on Performance Power Use and Management, Cost-Performance trade-off;

Distributed Computing: Introduction: Definition, Relation to parallel systems, synchronous vs asynchronous execution, design issues and challenges, A Model of Distributed Computations , A Model of distributed executions, Models of communication networks, Global state of distributed system, Models of process communication.

Communication and Coordination: Shared Memory, Consistency, Atomicity, Message-Passing, Consensus, Conditional Actions, Critical Paths, Scalability, cache coherence in multiprocessor systems, synchronization mechanism.

CUDA programming model: Overview of CUDA, Isolating data to be used by parallelized code, API function to allocate memory on the parallel computing device, API function to transfer data to parallel computing device, Concepts of Threads, Blocks, Grids, Developing kernel function that will be executed by threads in the parallelized part, Launching the execution of kernel function by parallel threads, transferring data back to host processor with API function call.
Parallel Algorithms design, Analysis, and Programming: Parallel Algorithms, Parallel Graph Algorithms, Parallel Matrix Computations, Critical paths, work and span and relation to Amdahl’s law, Speed-up and scalability, Naturally parallel algorithms, Parallel algorithmic patterns like divide and conquer, map and reduce, Specific algorithms like parallel Merge Sort, Parallel graph algorithms, parallel shortest path, parallel spanning tree, Producer-consumer and pipelined algorithms.

Laboratory work: To implement parallel programming using CUDA with emphasis on developing applications for processors with many computation cores, mapping computations to parallel hardware, efficient data structures, paradigms for efficient parallel algorithms.

Course learning outcome (CLO):
On completion of this course, the students will be able to

1. Apply the fundamentals of parallel and distributed computing including parallel architectures and paradigms.
2. Apply parallel algorithms and key technologies.
3. Develop and execute basic parallel and distributed applications using basic programming models and tools.
4. Analyze the performance issues in parallel computing and trade-offs.

Text Books:

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UCS736: CLOUD COMPUTING

Course Objective: To appreciate the benefits of Cloud computing and apply Cloud paradigms for evolving businesses. To familiarize with Cloud architectural models and resource allocation strategies. The student should comprehensively be exposed to Cloud based services.

Introduction: Basics of the emerging Cloud computing paradigm, Cloud computing history and evolution, Cloud enabling technologies, practical applications of Cloud computing for various industries, the economics and benefits of Cloud computing.

Cloud Computing Architecture: Cloud Architecture model, Types of Clouds: Public, private & Hybrid Clouds, Resource management and scheduling, QoS (Quality of Service) and Resource Allocation, Clustering.


Data Processing in Cloud: Introduction to Map Reduce for Simplified data processing on Large clusters, Design of data applications based on Map Reduce in Apache Hadoop

Advanced Technologies: Advanced web technologies (AJAX and Mashup), distributed computing models and technologies (Hadoop and MapReduce), Introduction to Open Source Clouds like Virtual Computing Lab (Apache VCL), Eucalyptus

Cloud Issues and Challenges: Cloud computing issues and challenges like Cloud provider Lock-in, Security etc.

Introduction to Python Runtime Environment: The Datastore, Development Workflow

Course learning outcome (CLOs):
Upon completion of this course, the student will be able to:
1. Familiarization with Cloud architectures.
2. Knowledge of data processing in Cloud.
3. Ability to apply clustering algorithms to process big data real time.
4. Ability to address security issues in Cloud environment.
5. Understand the nuances of Cloud based services.

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Course Objectives: To enhance comprehension capabilities of students through understanding of operational amplifiers, frequency response, various applications of operational amplifiers, active filters, oscillators, analog to digital and digital to analog converters and few special function integrated circuits.

Introduction to Differential Amplifiers: Differential Amplifier, configurations of differential amplifier, Analysis of single input balanced output, single input unbalanced output, dual input balanced output and dual input unbalanced output differential amplifiers


Active Filters and Oscillators: Butterworth Filters, Band-Pass Filters, Band Reject Filters, All Pass Filters, Phase Shift Oscillator, Wien Bridge Oscillator, Voltage-Controlled Oscillator (VCO), Square Wave Generator.


Course Learning Outcomes (CLOs): The student will be able to:
1. know the importance and significance of Op-Amp.
2. apply the concepts in real time applications.
3. design Integrators, Differentiators, and Comparators using Op-Amp.
4. use Op-Amp to generate Sine and Square wave forms.
5. design active filters and oscillators using Op-Amp.
6. use IC 555 as an astable, monostable and bi-stable multivibrators.

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Reference Books:

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Course objective: This course is designed to impart a critical theoretical and detailed practical knowledge of a range of computer network security technologies as well as network security tools.

Detail contents:

Basic of Cryptography: Symmetric and asymmetric cryptography, cryptographic hash functions, authentication and key establishment, Message Authentication Codes (MACs), digital signatures, PKI.


Web Security: Phishing attack, SQL Injection, Securing databases and database access, Cross Site Scripting Attacks, Cookies, Session Hijacking, E-commerce security


Laboratory work: Insert malicious shell code into a program file and check its malicious or benign status, create Client Server program to send data across systems as two variants clear text data and encrypted data with different set of encryption algorithms, demonstrate Buffer Overflow and showcase EIP and other register status, perform ARP poisoning, SQL Injection and demonstrate its countermeasure methods, implement stateful firewall using IP Tables, showcase different set of security protocol implementation of Wireless LAN.

Course learning outcome (CLO):
On completion of this course, the students will be able to:
1. Comprehend and implement various cryptographic algorithms to protect the confidential data.
2. Identify network vulnerabilities and apply various security mechanisms to protect networks from security attacks.
3. Apply security tools to locate and fix security leaks in a computer network/software.
4. Secure a web server and web application
5. Configure firewalls and IDS

**Text Books:**


**Reference Books:**


**Evaluation Scheme:**

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Course Objective: To make students acquainted with state-of-the-art video processing techniques, their technical details and challenges. To develop algorithms for video compression.

Prerequisite(s): Digital Signal Processing

Introduction: Video formats, Capturing of video signals, Color space, Quality.

Video Compression: Introduction to H.264 & HEVC, H.264 encoding and decoding process, H.264 Profiles and Levels.

Prediction and Transform Model: Macroblock prediction, Intra and Inter prediction, Loop filter, Transform and Quantization, Block scan orders.

H.264 Standardization Process: Conforming, Transport support, Licensing.

Advanced Topics: Scalable video coding, Multiview video coding, reconfigurable video coding.

Laboratory work and Project: Students have to write MATLAB® programs for dividing raw video into frames, divide them into macroblocks. Compression of macroblock and reframing the video. Various operations on video frames. Introduction to Video Processor.

Course Learning Outcomes (CLOs):

Upon completion of this course, the student will be able to:
1. Understand video formats and color spaces.
2. Understand video prediction model and compression.
3. Understand standardization process.
4. Get acquaintance state-of-the-art video topics.

Text Books:

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Course objective: This course is concerned with the development of applications on mobile and wireless computing platforms.

Introduction: Cost of Mobile Application Development, Importance of Mobile Strategies, Challenges, Myths, Third-Party Frameworks, Mobile Web Presence, Applications

Introduction to Mobility: Mobility Landscape, Mobile Platforms, Mobile apps development, Overview of Android Platform, Setting up the mobile apps development environment with emulator.

Building block of Mobile apps: App user Interface Designing, Layout, User Interface elements, Draw-able, Menu, Activity states and lifecycle, Interaction among activities. Mobile App development hurdles.

App functionality based user interface: Threads, Asynchronous task, Services-states and lifecycle, Notifications, Broadcast receivers, Telephony and SMS API.

Naive Data Handling: On Device File I/O, Shared preferences, Mobile Databases such as SQLite and enterprise data access.

Sprucing up Mobile Apps: Graphics and animation-custom views, canvas, animation API multimedia-audio/video playback and record, location aware.

Testing Mobile apps: Debugging Apps, White and Black Box Testing and test automation of apps.

Creating Consumable Web Services for Mobile Devices: What is a Web Service, Web Services Languages (Formats), creating an Example Web Service, Debugging Web Services.

Mobile User Interface Design: Effective Use of Screen Real Estate, Understanding Mobile Information Design, Understanding Mobile Application Users, Understanding Mobile Platforms, Using the Tools of Mobile Interface Design, introduction to VUIs and Mobile Apps (including Text-to-Speech Techniques), principles of designing the Right UI, Multichannel and Multimodal UIs.

Mobile Websites: Choosing a Mobile Web Option, Adaptive Mobile Websites, Dedicated Mobile Websites Mobile Web Apps with HTML5, Security of mobile sites.

Android: Android as Competition to itself, Connecting to the Google Play, Android Development Practices, Building an App in Android
iOS: iOS Project, Debugging iOS Apps, Objective-C Basics, Building the Derby App in IOS

Windows Phone 7: Windows Phone 7 Project, Building an App in Windows Phone 7 Distribution

Laboratory work: To develop robust mobile applications and work on related tools and technologies. Exploring the application development for different mobile platforms like Android, iPhone, Symbian

Course learning outcome (CLO):
On completion of this course, the students will be able to

1. Comprehend the concept of mobility landscape, mobile apps development and mobile app development environment along with emulator.
2. Evaluation of the limitations and challenges of mobile and wireless environment as well as the commercial and research opportunities presented by these technologies.
3. Analysis of the factors that need to be considered while designing mobile applications for multiple platforms like Android and iPhone.
4. Knowledge of the working of Threads, Services, Notifications and Broadcast Receivers, on device file IO and Shared preferences.
5. Design the mobile apps by the use of animation API for the major mobile device players such as - Apple, iPhone and Google Android.

Text Books:

Reference Books:
1. Lauren Darcy, Shane Conder, Sams Teach Yourself Android Application Development in 24 Hrs, 1st ed.

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ELECTIVE - IV

UEC854: ASICs and FPGAs

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Course Objective: This course covers the different types of programming technologies and logic devices, the design flow of different types of ASIC and the architecture of different types of FPGA. To gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC. To know about different high performance algorithms and its applications in ASICs.

Introduction: Course outline, Logistics introduction to ASICs, FPGAs, Economics.

HDL: Logic design Review, Behavior, Dataflow, Structural modeling, Control statements, FSM modeling.

CMOS Review: Classical, CMOS (Deep Sub-micron), ASIC Methodologies (classical) ASIC Methodologies (aggressive).


Programmable Logic Devices: Types of Programmable Logic Devices, Combinational Logic Examples, PROM - Fixed AND Array and Programmable OR Array, Implementation of Functions using PROM, PLA - Programmable Logic Array (PLA) – Implementation Examples.

Programmable Array Logic: PAL - Programmable Array Logic, Comparison of PROM, PLA and PAL, Implementation of a Function using PAL, Types of PAL Outputs, Device Examples.

Introduction to Sequential Circuits: R-S Latch and CLO scked R-S Latch, D Flip Flop, J-K Flip Flop, Master Slave Operation, Edge Triggered Operation.

FPGA: Programmable logic FPGA, Configuration logic blocks, Function Generator, ROM implementation, RAM implementation, Time skew buffers, FPGA Design tools, Network-on-chip, Adaptive System-on-chip.

System Design Examples using FPGA Board: Design Applications using FPGA Board - Traffic Light Controller and Real Time CLO sck, XSV FPGA Board Features, Testing of FPGA Board, Setting the XSV Board CLO sck Oscillator Frequency, Downloading Configuration Bit Streams.

Logic Synthesis: Fundamentals, Logic synthesis with synopsys, Physical design compilation, Simulation, implementation. Floor planning and placement, Commercial EDA tools for synthesis.

Course learning outcome (CLOs):
The students will be able to:

1. To utilize the top-down design methodology in the design of complex digital devices such as FPGAs/ASICs.
2. To learn modern hardware/software design tools to develop modern digital Systems.
3. Ability to design and verification of integrated circuits chips.
4. To design and implement different Field Programmable Gate Array (FPGA) architectures and their applications to real life.

**Text Books:**


**Reference Books:**


**Evaluation Scheme:**

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Course Objective: To educate the student to understand the fundamentals of Micro Electro Mechanical Systems (MEMS), different materials used for MEMS, semiconductors and solid mechanics to fabricate MEMS devices, various sensors and actuators, applications of MEMS to disciplines beyond Electrical and Mechanical engineering.


Sensing and Actuation Principles: Mechanical sensor and actuation: Principle, Beam and Cantilever, Microplates, Capacitive effects, Piezoelectric Materials as sensing and actuating elements, Stain Measurement, Pressure measurement, Thermal sensor and actuation, Micro-Opto-Electro mechanical systems (MOEMS), Radio Frequency (RF) MEMS, Bio-MEMS.

Application case studies: Pressure Sensor, Accelerometer, Gyroscope, Digital Micromirror Devices (DMD), Optical switching, Capacitive Micromachined Ultrasonic Transducers (CMUT)

Course Learning Outcomes (CLO S):
Upon completion of this course, the student will be able to:
1. integrate the knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
2. analyze operation of micro devices, micro systems and their applications
3. design the micro devices using the MEMS fabrication process
4. apply different materials used for MEMS

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Reference Books:


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Course Objective: To enhance comprehension capabilities of students through understanding power electronics devices, phase controlled converters, choppers, inverters, AC voltage controllers and CyCLO s converters with their operation and types.

Introduction: Review of power semiconductor devices, Their characteristics, Thyristors, Their static and dynamic characteristics, Turn-on and Turn-off methods and circuits, Ratings and protection of SCR’S, Other members of thyristor family, Series and parallel operation of thyristors, Firing circuits for SCRs.

Phase Controlled Converters: Principle of phase control, Single phase half wave circuit with different types of loads, Single phase and three phase semi converter and full converter bridge circuits with line commutation, Continuous and discontinuous conduction effect of source inductance on single phase and three phase full converters, Single phase and three phase dual converters and their operation with circulating and non circulating currents.

DC Choppers: Principle of chopper operation, Control strategies, Types of choppers, Step up and step down choppers, Types of choppers, Steady state time domain analysis with R, L, and E type loads, Voltage, Current and Load commutated choppers.


AC Voltage Controllers: Types of single-phase voltage controllers, Single-phase voltage controller with R and RL type of loads. Three phase voltage controller configurations R Load.

Cyclo Converters: Principles of operation, Single phase to single phase step up and step down cyclo sconverters. Three phase to single phase and three-phase to three-phase cyclo sconverters, Output voltage equation for a cyclo sconverter.

Course Learning Outcomes (CLOs):
Upon completion of this course, the student will be able to:
1. analyze the characteristics of power semiconductor devices.
2. understand the operation and types of Phase Controlled Converters.
3. understand the operation and types of DC Choppers.
4. understand differences between different types of inverters.
5. understand the operation and types of AC Voltage Controllers and Cyclo sconverters.
Text Books:

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Course objective: To be familiar with the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular engineering problems.

Detail contents:
Fundamental Issues: Overview of AI problems, Examples of successful recent AI applications, Intelligent behaviour, The Turing test, Rational versus non-rational reasoning, Problem characteristics.

Basic Search Strategies: Problem spaces (states, goals and operators), Problem solving by search, Factored representation (factoring state into variables), Uninformed search (breadth-first, depth-first, depth-first with iterative deepening), Heuristics and informed search (hill-climbing, generic best-first, A*), Space and time efficiency of search, Constraint satisfaction (backtracking and local search methods), AO* algorithm.

Advanced Search Strategies (Game playing): Minimax Search, Alpha-beta pruning, Expectimax search (MDP-solving) and chance nodes.

Knowledge Representation: Propositional and predicate logic, Resolution in predicate logic, Question answering, Theorem proving, Semantic networks, Frames and scripts, conceptual graphs, conceptual dependencies.

Languages for AI problem solving: Introduction to PROLOG syntax and data structures, representing objects and relationships, built-in predicates. Introduction to LISP- Basic and intermediate LISP programming

Reasoning under Uncertainty: Review of basic probability, Random variables and probability distributions: Axioms of probability, Probabilistic inference, Baye’s Rule, Conditional Independence, Knowledge representations using Bayesian Networks, Exact inference and its complexity, Randomized sampling (Monte Carlo) methods (e.g. Gibbs sampling), Markov Networks, Relational probability models, Hidden Markov Models, Decision Theory Preferences and utility functions, Maximizing expected utility.

Agents: Definitions of agents, Agent architectures (e.g., reactive, layered, cognitive), Agent theory, Rationality, Game Theory Decision-theoretic agents, Markov decision processes (MDP), Software agents, Personal Assistants, Believable agents, Learning agents, Collaborative agents, Multi-agent systems, Environment characteristics: Fully versus partially observable, Single versus multi-agent, Deterministic versus stochastic, Static versus dynamic, Discrete versus continuous, Nature of agents: Autonomous versus semi-autonomous, Reflexive, Goal-based, and
Utility-based, Importance of perception and environmental interactions, Philosophical and ethical issues.

**Expert Systems:** Architecture of an expert system, existing expert systems like MYCIN, RI, Expert system shells.

**Laboratory work:** Programming in C/C++/Java/LISP/PROLOG: Programs for Search algorithms- Depth first, Breadth first, Hill climbing, Best first, A* algorithm, Implementation of games: 8-puzzle, Tic-Tac-Toe using heuristic search, Designing expert system using logic in PROLOG, Implementing an intelligent agent.

**Course learning outcome (CLO):**
On completion of this course, the students will be able to

1. Learn the basics and applications of artificial intelligence and categorize various problem domains, basic knowledge representation and reasoning methods.
2. Analyze basic and advanced search techniques including game playing, Markov decision processes, constraint satisfaction.
3. Learn and design intelligent agents for concrete computational problems.
4. Design of programs in AI language(s).
5. Acquire knowledge about the architecture of an expert system and design new expert systems for real life applications.

**Text Books:**

**Reference Books:**

**Evaluation Scheme:**

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(Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)
An Introduction to DSP Processors: Advantages of DSP, characteristics of DSP systems, classes of DSP applications, DSP processor embodiment and alternatives, Fixed and floating point number representation, IEEE 754 format representation Fixed Vs Floating point processors.

DSP Architecture: An introduction to Harvard Architecture, Differentiation between Von-Neumann and Harvard Architecture, Quantization and finite word length effects, Bus Structure, Central Processing Unit, ALU, Accumulators, Barrel Shifters, MAC unit, compare, select, and store unit (CSSU), data addressing and program memory addressing.

Memory Architecture: Memory structures, features for reducing memory access required, wait states, external memory interfaces, memory mapping, data memory, program memory and I/O memory, memory mapped registers.

Addressing and Instruction Set: Various addressing modes - implied addressing, immediate data addressing, memory direct addressing, register direct and indirect addressing, and short addressing modes, Instruction types, various types registers, orthogonality, assembly language and application development.

Interrupts and Pipelining: Interrupts, pipelining and performance, pipelining depth, interlocking, interrupt effects, instruction pipelining.


Micro Project: Audio amplification with the help of DSP kit.

Laboratory Work

Introduction to code composer studio, Using CCS write program to compute factorial, dot product of two arrays, Generate Sine, Square and Ramp wave of varying frequency and amplitude, Design various FIR and IIR filters, Interfacing of LED, LCD, Audio and Video Devices with the DSP processor.
Course Learning Outcomes (CLO):

Upon completion of this course, the student will be able to:

1. Differentiate between generalised processor and DSP processor.
2. Analyze special characteristics and features of generalized DSP processors.
3. Understand the software model and pipelining for generalized DSP processor.
4. Understand detailed architectures and instruction sets of TMS 320C3X, 5X and 67XX.
5. Understand the Programming concepts for TMS 320C3X, 5X and 67XX.

Text Books


Reference Books:


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Course Objective: To gain knowledge about crystal growth and wafer preparation techniques. Subsequently, the thoroughly understanding of different integral steps needed for IC components fabrication mainly bipolar and field effect transistors. To acquire knowledge of various linear and nonlinear ICs and the various packaging techniques.

Integrated Circuits: Introduction, Impact of ICs on Industry, Advantages over discrete components, Monolithic and Hybrid ICs, Scales of integration and related issues.

Growth of Single Crystals wafers: Crystal growth using Czochralski’s method, Float Zone method and Bridgeman technique, Zone refining, characteristics and crystal evaluation, Wafer Shaping operations, Slicing, polishing and etching.

Epitaxy Film Formation: Importance of epitaxial layer growth, Types of epitaxy: VPE, MBE, MOCVD Defects in epitaxial layers and their removal.


MOSFET Technology: Design of junction diode, Transistor, FET and MOSFETs Polysilicon gates and Well Structures.


Packaging of I.C’s: Mountings in packages using Dual-in-line (DIP) or TO packages. Packages using surface-mount-technology (SMT).

Course Learning Outcomes (CLOs):
Upon completion of this course, the student will be able to:
1. Acquire knowledge about crystal growth and wafer preparation techniques.
2. Learn about different fabrication process used in ICs industry.
3. Understand various linear and non-linear ICs.
4. To understand the various packaging techniques.
**Text Books:**

**Reference Books:**

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Course Objective: The objective of this course is to introduce the concept of virtual instrumentation and to develop basic VI programs using loops, case structures etc. including its applications in image, signal processing and motion control.

Review of Virtual Instrumentation: Historical perspective, Block diagram and Architecture of Virtual Instruments

Data-flow Techniques: Graphical programming in data flow, Comparison with conventional programming.

VI Programming Techniques: VIs and sub-VIs, Loops and Charts, Arrays, Clusters and graphs, Case and sequence structures, Formula nodes, Local and global variables, Strings and file I/O.

Data Acquisition Basics: ADC, DAC, DIO, Counters and timers.

Common Instrumentation Interfaces: RS232C/ RS485, GPIB, PC Hardware structure, DMA software and hardware installation.

Use of Analysis Tools: Advanced analysis tools such as Fourier transforms, Power spectrum, Correlation methods, Windowing and filtering and their applications in signal and image processing, Motion Control.

Additional Topics: System buses, Interface buses: PCMCIA, VXI, SCXI, PXI, etc.

Laboratory Work: Components of Lab VIEW, Celsius to Fahrenheit conversion, Debugging, Sub-VI, Multiplot charts, Case structures, ASCII files, Function Generator, Property Node, Formula node, Shift registers, Array, Strings, Clusters, DC voltage measurement using DAQ

Course Learning Outcomes (CLO): After the completion of the course student will be able to:
1. demonstrate the working of LabVIEW.
2. explain the various types of structures used in LabVIEW.
3. analyze and design different type of programs based on data acquisition.
4. demonstrate the use of LabVIEW for signal processing, image processing etc.
5. use different analysis tools

Text Books:

Reference Book:

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Course Objectives: The objective of the course is to introduce students with the fundamental concepts in graph Theory, with a sense of some its modern applications. They will be able to use these methods in subsequent courses in the computer, electrical and other engineering.

Introduction: Graph, Finite and infinite graph, incidence and degree, Isolated vertex, Pendent vertex and null graph, Isomorphism, Sub graph, Walks, Paths and circuits, Euler circuit and path, Hamilton path and circuit, Euler formula, Homeomorphic graph, Bipartite graph, Edge connectivity, Computer representation of graph, Digraph.

Tree and Fundamental Circuits: Tree, Distance and center in a tree, Binary tree, Spanning tree, Finding all spanning tree of a graph, Minimum spanning tree.

Graph and Tree Algorithms: Shortest path algorithms, Shortest path between all pairs of vertices, Depth first search and breadth first of a graph, Huffman coding, Cuts set and cut vertices, Warshall’s algorithm, topological sorting.

Planar and Dual Graph: Planner graph, Kuratowski’s theorem, Representation of planar graph, five-color theorem, Geometric dual.

Coloring of Graphs: Chromatic number, Vertex coloring, Edge coloring, Chromatic partitioning, Chromatic polynomial, covering.

Course learning outcomes: Upon completion of the course, the students will be able to:

1) understand the basic concepts of graphs, directed graphs, and weighted graphs and able to present a graph by matrices.
2) understand the properties of trees and able to find a minimal spanning tree for a given weighted graph.
3) understand Eulerian and Hamiltonian graphs.
4) apply shortest path algorithm to solve Chinese Postman Problem.
5) apply the knowledge of graphs to solve the real life problem.

Text Books:

1) Narsingh, Deo, Graph Theory with Application to Engineering with Computer Science, PHI (2007).

Reference Books:


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Course Objectives: In this course the students will learn interconnect models, device models, interconnect analysis and interconnect materials.


Device Models: Introduction, device I-V characteristics, General format of device Models, device models in explicit expression, device model using a table-Lookup model and effective capacitive model.


Crosstalk Analysis: Introduction, Capacitive coupled and inductive coupled interconnect model and analysis, Transmission line based model.

Advanced Interconnect Materials: Basic materials: Copper and aluminium. Problem with existing material in deep submicron: Electro-migration effect, surface and grain boundary effect. CNT as an interconnect, impedance parameters of CNT, types of CNT, GNR and Optical interconnects.

Course Learning Outcomes (CLOs):
Upon the completion of this course, the students are able to:
1. understand the advanced interconnect materials
2. acquire knowledge about Technology trends, Device and interconnect scaling.
3. identify basic device and Interconnect Models.
4. perform RLC based Interconnect analysis.
5. analyse the problem with existing material in deep submicron.

TextBooks:
**Reference Books:**


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Course Objective: This course provides the insight of the fundamentals of modern control theory by analysing time and frequency response of open and closed loop systems. Furthermore, the concept is extended to advanced concepts of modern control theory - centred on the system stability and state space methods. Emphasis is placed on concepts of controllability and observability in addition to fundamentals of digital control systems.

Mathematical Models, Block Diagrams and Signal Flow Graphs of Systems: Introduction of mathematical models and transfer function, Construction and reduction of block diagram and signal flow graphs, Application of Mason’s gain formula.

Time-Domain Analysis of Control Systems: Transient and steady state response, time response of first and second-order systems, sensitivity to parameter variations, steady-state errors, Types of Systems and Error Constants.


Classical Controller Design Methods: General aspects of the closed-loop control design problem, Controller circuits design concepts for P, PD, PI and PID Controllers

State Variable Analysis: Introduction, state variable representation, conversion of transfer function model to state variable model, conversion of state variable model to transfer function model, Eigen values and Eigen vectors, solution of state equations. Concepts of controllability and observability,

Digital Control System: Basic structure of digital control systems, description and analysis of Linear Time-Invariant Discrete-time systems.

Course learning outcome (CLOs): The student will be able to:

1. Understand CLO sse and open loop control system representations in terms of block diagrams, signal flow graphs and transfer function,
2. Analyze the time and frequency response of the control systems and to establish the correlation between them,
3. Analyze the stability of the control systems and learn various methods to judge the stability criterion.
4. Understand the fundamentals of designing of P-I-D controllers,
5. Achieve knowledge about the concepts of the state space analysys and the concept of controllability and observability for classical and digital control system.
**Text Books:**


**Reference Books:**


**Evaluation Scheme:**

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Course Objective: To enhance comprehension capabilities of students through understanding on the use of VHDL and Verilog for the design, synthesis, modeling, and testing of VLSI devices. These are IEEE standards that are used by engineers to efficiently design and analyze complex digital designs.

Basic Digital Circuits: Lexical Elements and data types, program skeleton, structural, dataflow and behavioural descriptions, testbench.

RTL Combinational circuit: Operators, Block statement, Concurrent assignment statements, Modelling with a process, Routing circuit with if and case statements, Constants and Generics

Regular Sequential Circuit: HDL code of Flip flops and Registers, simple design examples, testbench for sequential circuits, case study

FSM: Mealy and Moore FSMs, Design Examples

Synthesis: Register Transfer level description, Timing and CLO sck Constraints, technology libraries, Translation, Boolean optimization, Factoring, Mapping to gates

Xilinx FPGA Implementation Memory: Method to incorporate memory modules, HDL templates for memory interface

Laboratory Work: Modeling and simulation of all VHDL and Verilog constructs using ModelSim, their testing by modeling and simulating test benches, Logic Synthesis using FPGA Advantage, Mapping on FPGA Boards.

Micro Project: Design & Simulate a digital system in VHDL or Verilog and its implementation on FPGA board.

Course Learning Outcomes (CLOs): The student will be able to:
1. Build a synchronous system in hdl and verify its performance.
2. Build and test complex FSMs
3. Automate testbenches for automatic pass/fail
4. Make design decisions for fixed point implementations given constraints
5. Analyse memory usage/requirements for FPGA
6. Target sequential designs to FPGA

Text Books:
2. Palnitkar, Samir, Verilog HDL, Prentice Hall, 2nd Edition,
Reference Books:

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GENERIC ELECTIVE

UPH063 NANOSCIENCE AND NANOMATERIALS

Course Objectives:
To introduce the basic concept of Nanoscience and advanced applications of nanotechnology,

Fundamental of Nanoscience: Features of Nanosystem, Free electron theory and its features, Idea of band structures, Density of states in bands, Variation of density of state and band gap with size of crystal,
Quantum Size Effect: Concepts of quantum effects, Schrodinger time independent and time dependent equation, Electron confinement in one-dimensional well and three-dimensional infinite square well, Idea of quantum well structure, Quantum dots and quantum wires,
Nano Materials: Classification of Nano Materials their properties, Basic concept relevant to application, Fullerenes, Nanotubes and nano-wires, Thin films chemical sensors, Gas sensors, Vapour sensors and Bio sensors,
Synthesis and processing: Sol-gel process, Cluster beam evaporation, Ion beam deposition, Chemical bath deposition with capping techniques and ball milling, Cluster assembly and mechanical attrition, Sputtering method, Thermal evaporation, Laser method,
Characterization: Determination of particle size, XRD technique, Photo luminescence, Electron microscopy, Raman spectroscopy, STEM, AFM,
Applications: Photonic crystals, Smart materials, Fuel and solar cells, Opto-electronic devices

Course outcomes:
Upon completion of the course, Students will be able to
1. discriminate between bulk and nano materials,
2. establish the size and shape dependence of Materials’ properties,
3. correlate ‘quantum confinement’ and ‘quantum size effect’ with physical and chemical properties of nanomaterials,
4. uses top-down and bottom-up methods to synthesize nanoparticles and control their size and shape
5. characterize nanomaterials with various physico-chemical characterization tools and use them in development of modern technologies

Recommended Books:
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Course Objectives: To provide acquaintance with modern cleaner production processes and emerging energy technologies; and to facilitate understanding the need and application of green and renewable technologies for sustainable development of the Industry/society

Course Contents:
Concepts of Sustainability and Industrial Processes: Industrialization and sustainable development; Cleaner production (CP) in achieving sustainability; Source reduction techniques - Raw material substitution; Process modification and equipment optimization; Product design or modification; Reuse and recycling strategies; Resources and by-product recovery from wastes; Treatment and disposal; CDM and Pollution prevention programs; Good housekeeping; CP audits,
Green Design: Green buildings - benefits and challenges; public policies and market-driven initiatives; Effective green specifications; Energy efficient design; Passive solar design; Green power; Green materials and Leadership in Energy and Environmental Design (LEED)
Renewable and Emerging Energy Technologies: Introduction to renewable energy technologies- Solar; wind; tidal; biomass; hydropower; geothermal energy technologies; Emerging concepts; Biomolecules and energy; Fuel cells; Fourth generation energy systems,

Course Learning Outcomes (CLOs):
Upon completion of the course, the students will be able to:
1. comprehend basic concepts in source reduction, waste treatment and management
2. identify and plan cleaner production flow charts/processes for specific industrial sectors
3. examine and evaluate present and future advancements in emerging and renewable energy technologies

Recommended Books

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Course Objectives: This course provides an introduction to the study of intelligence, mind and brain from an interdisciplinary perspective. It encompasses the contemporary views of how the mind works, the nature of reason, and how thought processes are reflected in the language we use. Central to the course is the modern computational theory of mind and it specifies the underlying mechanisms through which the brain processes language, thinks thoughts, and develops consciousness.

Course Contents:
Overview of Cognitive Science: Newell’s big question, Constituent disciplines, Interdisciplinary approach, Unity and diversity of cognitive science.
Philosophy: Philosophy of Mind, Cartesian dualism Nativism vs. empiricism, Mind-body problem, Functionalism, Turing Test, Modularity of mind, Consciousness, Phineas Gage, Physicalism.
Psychology: Behaviorism vs. cognitive psychology, The cognitive revolution in psychology, Hardware/software distinction, Perception and psychophysics, Visual cognition, Temporal dynamics of visual perception, Pattern recognition, David Marr’s computational theory of vision, Learning and memory, Theories of learning, Multiple memory systems, Working Memory and Executive Control, Memory span, Dissociations of short- and long-term memory, Baddeley’s working memory model.
Linguistics: Components of a grammar, Chomsky, Phrases and constituents, Productivity, Generative grammars, Compositional syntax, Productivity by recursion, Surface- and deep structures, Referential theory of meaning, Compositional semantics, Semantics, Language acquisition, Language and thought.
Neuroscience: Brain anatomy, Hierarchical functional organization, Decorticate animals, Neuroimaging, Neurophysiology, Neuron doctrine, Ion channels, Action potentials, Synaptic transmission, Synaptic plasticity, Biological basis of learning, Brain damage, Amnesia, Aphasia, Agnosia, Parallel Distributed Processing(PDP), Computational cognitive neuroscience, The appeal of the PDP approach, Biological Basis of Learning, Cajal’s synaptic plasticity hypothesis, Long-term potentiation (LTP) and depotentiation (LTD), NMDA receptors and their role in LTP, Synaptic consolidation, Vertical integration, The Problem of representation, Shannon’s information theory.
Artificial Intelligence: Turing machines, Physical symbol systems, Symbols and Search Connectionism, Machine Learning, Weak versus strong AI, Subfields, applications, and recent trends in AI, Turing Test revisited, SHRDLU, Heuristic search, General Problem Solver (GPS), Means-ends analysis.

Course Learning Outcomes (CLOs):
Upon completion of the course, the students will be able to:
1. identify cognitive science as an interdisciplinary paradigm of study of cross-cutting areas such as Philosophy, Psychology, Neuroscience, Linguistics, Anthropology, and Artificial Intelligence.
2. explain various processes of the mind such as memory and attention, as well as representational and modelling techniques that are used to build computational models of mental processes;
3. acquire basic knowledge of neural networks, linguistic formalism, computing theory, and the brain.
4. apply basic Artificial Intelligence techniques to solve simple problems.

Recommended Books


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Course Objective:
This course aims to provide the students with the fundamental concepts, principles and approaches of corporate finance, enable the students to apply relevant principles and approaches in solving problems of corporate finance and help the students improve their overall capacities.

Course Content:
Introduction to corporate finance: Finance and corporate finance. Forms of business organizations, basic types of financial management decisions, the goal of financial management, the agency problem; the role of the financial manager; basic types of financial management decisions.
Financial statements analysis: Balance sheet, income statement, cash flow, fund flow financial statement analysis Computing and interpreting financial ratios; conducting trend analysis and Du Pont analysis.
The time value of money: Time value of money, future value and compounding, present value and discounting, uneven cash flow and annuity, discounted cash flow valuation.
Risk and return: Introduction to systematic and unsystematic risks, computation of risk and return, security market line, capital asset pricing model.
Long-term financial planning & Financial Decisions: Various sources of long term financing, the elements and role of financial planning, financial planning model, percentage of sales approach, external financing needed. Cost of capital, financial leverage, operating leverage. Capital structure, theories of capital structure net income, net operating income & M&M proposition I and II.
Short-term financial planning and management: Working capital, operating cycle, cash cycle, cash budget, short-term financial policy, cash management, inventory management, credit management.
Capital budgeting: Concepts and procedures of capital budgeting, investment criteria (net present value, payback, discounted payback, average accounting return, internal rate of return, profitability index), incremental cash flows, scenario analysis, sensitivity analysis, break-even analysis,
Dividend policy: Dividend, dividend policy, Various models of dividend policy ( Residual approach, Walter model, Gordon Model, M&M, Determinants of dividend policy.

Recommended Books:

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Course Objective:
The objective of the course is to introduce students with the fundamental concepts in graph Theory, with a sense of some its modern applications. They will be able to use these methods in subsequent courses in the computer, electrical and other engineering.

Introduction: Graph, Finite and infinite graph, incidence and degree, Isolated vertex, Pendent vertex and null graph, Isomorphism, Sub graph, Walks, Paths and circuits, Euler circuit and path, Hamilton path and circuit, Euler formula, Homeomorphic graph, Bipartite graph, Edge connectivity, Computer representation of graph, Digraph.

Tree and Fundamental Circuits: Tree, Distance and center in a tree, Binary tree, Spanning tree, Finding all spanning tree of a graph, Minimum spanning tree.

Graph and Tree Algorithms: Shortest path algorithms, Shortest path between all pairs of vertices, Depth first search and breadth first of a graph, Huffman coding, Cuts set and cut vertices, Warshall’s algorithm, topological sorting.

Planar and Dual Graph: Planner graph, Kuratowski’s theorem, Representation of planar graph, five-color theorem, Geometric dual.

Coloring of Graphs: Chromatic number, Vertex coloring, Edge coloring, Chromatic partitioning, Chromatic polynomial, covering.


Course Learning Outcomes:
Upon completion of the course, the students will be able to:

6) understand the basic concepts of graphs, directed graphs, and weighted graphs and able to present a graph by matrices.
7) understand the properties of trees and able to find a minimal spanning tree for a given weighted graph.
8) understand Eulerian and Hamiltonian graphs.
9) apply shortest path algorithm to solve Chinese Postman Problem.
10) apply the knowledge of graphs to solve the real life problem.

Recommended Books
1. Deo, N., Graph Theory with Application to Engineering with Computer Science, PHI, New Delhi (2007)
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Course Objective:
The main objective of this course is to motivate the students to understand and learn various advanced numerical techniques to solve mathematical problems governing various engineering and physical problems.

Non-Linear Equations: Methods for multiple roots, Muller’s, Iteration and Newton-Raphson method for non-linear system of equations and Newton-Raphson method for complex roots.

Polynomial Equations: Descartes’ rule of sign, Birge-Vieta, Giraffe’s methods.

System of Linear Equations: Cholesky and Partition methods, SOR method with optimal relaxation parameters.

Eigen-Values and Eigen-Vectors: Similarity transformations, Gerschgorin’s bound(s) on eigenvalues, Given’s and Rutishauser methods.

Interpolation and Approximation: Cubic and B – Spline and bivariate interpolation. Least squares approximations, Gram-Schmidt orthogonalisation process and approximation by orthogonal polynomial, Legendre and Chebyshev polynomials and approximation.

Differentiation and Integration: Differentiation and integration using cubic splines, Romberg integration and multiple integrals.

Ordinary differential Equations: Milne’s, Adams-Moulton and Adam’s Bashforth methods with their convergence and stability, Shooting and finite difference methods for second order boundary value problems.

Course Learning Outcomes:
Upon completion of this course, the students will be able to:
1) find multiple roots of equation and apply Newton-Raphson's method to obtain complex roots as well solution of system of non-linear equations.
2) learn how to obtain numerical solution of polynomial equations using Birge-Vieta and Giraffe's methods.
3) apply Cholesky, Partition and SOR methods to solve system of linear equations.
4) understand how to approximate the functions using Spline, B-Spline, least square approximations.
5) learn how to solve definite integrals by using cubic spline, Romberg and initial value problems and boundary value problems numerically.

Recommended Books
**Evaluation Scheme:**

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Course Objectives:
The objectives of the course is to introduce to the students:
1. The basics of French language to the students. It assumes that the students have minimal or no prior knowledge of the language.
2. To help them acquire skills in writing and speaking in French, comprehending written and spoken French.
3. The students are trained in order to introduce themselves and others, to carry out short conversation, to ask for simple information, to understand and write short and simple messages, to interact in a basic way.
4. The main focus of the students will be on real life language use, integration of French and francophone culture, & basic phrases aimed at the satisfaction of needs of concrete type.
5. During class time the students are expected to engage in group & pair work.

Course Contents:
Communicative skills: Greetings and Its Usage, Asking for and giving personal information, How to ask and answer questions, How to talk over the phone, Exchange simple information on preference, feelings etc. Invite, accept, or refuse invitation, Fix an appointment, Describe the weather, Ask for/give explanations, Describe a person, an object, an event, a place.
Vocabulary: Countries and Nationalities, Professions, Numbers (ordinal, cardinal), Colours, Food and drinks, Days of the week, Months, Family, Places.
Phonetics: The course develops the ability, to pronounce words, say sentences, questions and give orders using the right accent and intonation. To express surprise, doubt, fear, and all positive or negative feelings using the right intonation. To distinguish voiced and unvoiced consonants. To distinguish between vowel sounds.

Course Outcomes:
Upon the completion of the course:
1. The students begin to communicate in simple everyday situations acquiring basic grammatical structure and vocabulary.
2. The course develops oral and reading comprehension skills as well as speaking and writing.
3. Students can demonstrate understanding of simple information in a variety of authentic materials such as posters, advertisement, signs etc.
4. Discuss different professions, courses and areas of specialisation.
6. Express feelings, preferences, wishes and opinions and display basic awareness of francophone studies.
7. Units on pronunciation and spelling expose students to the different sounds in the French language and how they are transcribed.
**Recommended Books:**

1. *Alter ego-1 : Méthode de français* by Annie Berthet, Catherine Hugot, Véronique M. Kizirion, Beatrix Sampsonis, Monique Waendendries, Editions Hachette français langue étrangère.
2. *Connexions-1 : Méthode de français* by Régine Mérieux, Yves Loiseau, Editions Didier
5. *Latitudes-1 : Méthode de français* by Régine Mérieux, Yves Loiseau, Editions Didier

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Course Objective: To learn about living world and basic functioning of biological systems. The course encompasses understanding of origin of life, its evolution and some of its central characteristics. It also aims to familiarize engineering students to some of the intricate biological phenomena and mechanisms.

Detailed Contents:
Introduction to biological systems: Cell as basic unit of life, cellular organelles and their functions, important biomacromolecules (carbohydrates, lipids, proteins and nucleic acids) and their properties.
Cell membrane: Membrane structure, selective permeability, transport across cell membrane, active and passive transport, membrane proteins, type of transport proteins, channels and pumps, examples of membrane transport in cell physiology.
Classical and molecular genetics: Heredity and laws of genetics, genetic material and genetic information, Structure and properties of DNA, central dogma, replication of genetic information, universal codon system, encoding of genetic information via transcription and translation.

Course Learning Outcomes (CLOs):
After completion of this course the students will be able to:
1. Describe living-systems and differentiate them from non-living systems
2. Explain the theory of evolution and apply it non-living world
3. Apply properties of nucleic acids in molecular recognition based diagnostics
4. Familiarized with various transport mechanisms across cell membranes
5. Explain how genetic information is stored, replicated and encoded in living organisms.

Recommended Books:

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Course Objectives: In this course, the student will learn about the essential building blocks and basic concepts around cyber security such as Confidentiality, Integrity, Availability, Authentication, Authorization, Vulnerability, Threat and Risk and so on.


Programs and Programming: Unintentional (Non-malicious) Programming Oversights, Malicious Code—Malware, Countermeasures

Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks


Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster

Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics


Course Learning Outcomes:

After completion of this course, the students will be able to:

1. Understand the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain security protection
2. Appreciate the vulnerabilities and threats posed by criminals, terrorist and nation states to national infrastructure
3. Understand the nature of secure software development and operating systems
4. Recognize the role security management plays in cyber security defense and legal and social issues at play in developing solutions.

Recommended Books:


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Course Objectives:
This course aims to sensitize students with the gamut of skills which facilitate them to enhance their employability quotient and do well in the professional space. These skills are imperative for students to establish a stronger connect with the environment in which they operate. An understanding of these skills will enable students to manage the placement challenges more effectively.

Course Contents:
**Emotional Intelligence:** Understanding Emotional Intelligence (EI); Daniel Goleman’s EI Model: Self Awareness, Self-Regulation, Internal Motivation, Empathy, Social Skills; Application of EI during Group Discussions & Personal Interview; Application of EI in personal life, student life and at the workplace

**Team Dynamics & Leadership:** Understanding the challenges of working within a team format in today’s complex organizational environments; Stages of team formation; Appreciating forces that influence the direction of a team's behaviour and performance; Cross-functional teams; Conflict in Teams- leveraging differences to create opportunity Leadership in the team setting & energizing team efforts; Situational leadership; Application of team dynamics & collaboration in Group Discussions; Application of team dynamics at the workplace

**Complex Problem Solving:** Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions; Understanding a working model for complex problem solving - framing the problem, diagnosing the problem, identifying solutions & executing the solutions; Appreciation of complex problem solving at the workplace through case studies

**Lateral Thinking:** Understanding lateral thinking & appreciating the difference between vertical & lateral thinking, and between convergent & divergent thinking; Understanding brain storming & mind-maps; Solving of problems by an indirect and creative approach, typically through viewing the problem in a new and unusual light; Application of lateral thinking during Group Discussions & Personal Interviews; Application of lateral thinking at the workplace

**Persuasion:** Role of persuasion in communication; Application of ethos-pathos-logos; Using persuasive strategies to connect with individuals & teams to create competitive advantage

**Quantitative Reasoning:** Thinking critically and applying basic mathematics skills to interpret data, draw conclusions, and solve problems; developing proficiency in numerical reasoning; Application of quantitative reasoning in aptitude tests

**Verbal Reasoning:** Understanding and reasoning using concepts framed in words; Critical verbal reasoning; Reading Comprehension; Application of verbal reasoning in aptitude tests
**Group Discussion (GD):** Illustrating the do’s and don’ts in Group Discussions; Specific thrust on types of GD topics; GD evaluation parameters; Understanding the challenge in a case discussion; SPACER model

**Personal Interview (PI):** Interview do’s and don’ts; PI evaluation parameters; The art of introduction; Managing bouncer questions; Leading the panel in a PI

**Course Learning Outcomes (CLOs):** The students will be able to
1. appreciate the various skills required for professional & personal success.
2. bridge the gap between current and expected performance benchmarks.
3. competently manage the challenges related to campus placements and perform to their utmost potential.

**Recommended Books:**
4. *Aggarwal, R.S., Quantitative Aptitude for Competitive Examinations; S Chand* (2017)

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UTA012: INNOVATION AND ENTREPRENEURSHIP (5 SELF EFFORT HOURS)

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[*] 2 hours every alternate week.

**Course Objectives:** This course aims to provide the students with a basic understanding in the field of entrepreneurship, entrepreneurial perspectives, concepts and frameworks useful for analysing entrepreneurial opportunities, understanding eco-system stakeholders and comprehending entrepreneurial decision making. It also intends to build competence with respect business model canvas and build understanding with respect to the domain of startup venture finance.

**Introduction to Entrepreneurship:** Entrepreneurs; entrepreneurial personality and intentions - characteristics, traits and behavioural; entrepreneurial challenges.

**Entrepreneurial Opportunities:** Opportunities - discovery/ creation, Pattern identification and recognition for venture creation: prototype and exemplar model, reverse engineering.

**Entrepreneurial Process and Decision Making:** Entrepreneurial ecosystem , Ideation, development and exploitation of opportunities; Negotiation, decision making process and approaches, - Effectuation and Causation.

**Crafting business models and Lean Start-ups:** Introduction to business models; Creating value propositions - conventional industry logic, value innovation logic; customer focused innovation; building and analysing business models; Business model canvas , Introduction to lean startups, Business Pitching.

**Organizing Business and Entrepreneurial Finance:** Forms of business organizations; organizational structures; Evolution of organisation, sources and selection of venture finance options and its managerial implications. Policy Initiatives and focus; role of institutions in promoting entrepreneurship.

**Course learning outcome (CLO):**

Upon successful completion of the course, the students should be able to:

6. Comprehend the role of bounded rationality, framing, causation and effectuation in entrepreneurial decision making.

7. Demonstrate an ability to design a business model canvas.

8. Evaluate the various sources of raising finance for startup ventures.
9. Understand the fundamentals of developing and presenting business pitching to potential investors.

**Text Books:**


**Reference Books:**

11. Guillebeau, Chris (2012), *The $100 startup: Fire your Boss, Do what you love and work better to live more*, Pan Macmillan

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<td>3</td>
<td>Sessionals(Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)</td>
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