THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

COURSE SCHEME

FOR

B.E. – ELECTRONICS AND COMPUTER ENGINEERING

2016

SEMESTER-I

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCB008	APPLIED CHEMISTRY	3	1	2	4.5
2	UEC001	ELECTRONIC ENGINEERING	3	1	2	4.5
3	UEN002	ENERGY AND ENVIRONMENT	3	0	0	3.0
4	UES009	MECHANICS	2	1	2*	2.5
5	UMA003	MATHEMATICS - I	3	1	0	3.5
6	UTA007	COMPUTER PROGRAMMING - I	3	0	2	4.0
		TOTAL	**17**	**4**	**6**	**22.0**

SEMESTER-II

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEE001	ELECTRICAL ENGINEERING	3	1	2	4.5
2	UHU003	PROFESSIONAL COMMUNICATION	2	0	2	3.0
3	UMA004	MATHEMATICS - II	3	1	0	3.5
4	UPH004	APPLIED PHYSICS	3	1	2	4.5
5	UTA008	ENGINEERING DESIGN - I	2	4	0	4.0
6	UTA009	COMPUTER PROGRAMMING - II	3	0	2	4.0
		TOTAL	**16**	**7**	**8**	**23.5**

*** Each student will attend one Lab Session of 2 hrs in a semester for a bridge project in this course. (Mechanics)**

SEMESTER-III

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEC403	CIRCUIT ANALYSIS AND SYNTHESIS	3	1	0	3.5
2	UEC404	SIGNALS & SYSTEMS	3	1	2	4.5
3	UEC407	MICROPROCESSORS AND THEIR APPLICATIONS	3	1	2	4.5
4	UES012	ENGINEERING MATERIALS	3	1	2	4.5
5	UMA007	NUMERICAL ANALYSIS	3	1	2	4.5
6	UTA010	ENGINEERING DESIGN – II (6 SELF EFFORT HOURS)	1	0	2	5.0
		TOTAL	**16**	**5**	**10**	**26.5**

SEMESTER-IV

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEC301	ANALOG ELECTRONIC CIRCUITS	3	1	2	4.5
2	UES010	SOLIDS AND STRUCTURES	3	1	2	4.5
3	UES011	THERMO-FLUIDS	3	1	2	4.5
4	UMA031	OPTIMIZATION TECHNIQUES	3	1	0	3.5
5	UTA002	MANUFACTURING PROCESSES	2	0	3	3.5
6	UTA019	ENGINEERING DESIGN – III (6 SELF EFFORT HOURS)	1	0	4	6.0
		TOTAL	**15**	**4**	**13**	**26.5**

SEMESTER-V

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCS303	OPERATING SYSTEMS	3	0	2	4.0
2	UCS406	DATA STRUCTURES AND ALGORITHMS (2 SELF EFFORT HOURS)	3	0	4	6.0
3	UEC401	ANALOG COMMUNICATION SYSTEMS	3	1	2	4.5
4	UEC502	DIGITAL SIGNAL PROCESSING	3	1	2	4.5
5	UEC509	COMPUTER ARCHITECTURE	3	1	0	3.5
6	UEC612	DIGITAL SYSTEM DESIGN	3	1	2	4.5
		TOTAL	**18**	**4**	**12**	**27.0**

SEMESTER-VI

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCS304	INFORMATION MANAGEMENT SYSTEM (2 SELF EFFORT HOURS)	3	0	4	6.0
2	UCS611	MACHINE LEARNING	3	0	2	4.0
3	UEC607	DIGITAL COMMUNICATION	3	0	2	4.0
4	UEC608	EMBEDDED SYSTEMS	2	0	2	3.0
5	UEC609	MOS CIRCUIT DESIGN	3	0	2	4.0
6	UTA012	INNOVATION AND ENTREPRENEURSHIP (5 SELF EFFORT HOURS)	1	0	2	4.5
7	UEC797	CAPSTONE PROJECT – START (4 SELF EFFORT HOURS)	-	-	2	-
		TOTAL	**15**	**0**	**16**	**25.5**

SEMESTER-VII

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEC705	IMAGE PROCESSING AND COMPUTER VISION	3	1	0	3.5
2	UEC706	DATA COMMUNICATION AND COMPUTER NETWORKS	3	0	2	4.0
3	UEC722	SOFT COMPUTING	3	0	2	4.0
4	UEC797	CAPSTONE PROJECT (8 SELF EFFORT HOURS)	-	-	2	8.0
5	UHU005	HUMANITIES FOR ENGINEERS	2	0	2	3.0
6		ELECTIVE – I	3	0	2	4.0
7		ELECTIVE - II	3	1	2	4.5
8		GENERIC ELECTIVE	3	0	0	3.0
		TOTAL	**20**	**2**	**12**	**34.0**

SEMESTER-VIII

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEC892	PROJECT SEMESTER*	-	-	-	20.0
		TOTAL	**-**	**-**	**-**	**20.0**

*TO BE CARRIED OUT IN INDUSTRY/RESEARCH INSTITUTION

OR

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEC893	PROJECT	-	-	-	10.0
2		ELECTIVE - III	3	1	0	3.5
3		ELECTIVE – IV	2	1	2	3.5
4		ELECTIVE – V	-	-	-	3.0
		TOTAL	**-**	**-**	**-**	**20.0**

OR

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEC896	START- UP SEMESTER**	-	-	-	20.0
		TOTAL	**-**	**-**	**-**	**20.0**

****** BASED ON HANDS ON WORK ON INNOVATIONS AND ENTREPRENEURSHIP

LIST OF PROFESSIONAL ELECTIVES

ELECTIVE – I

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UEC709	FIBER OPTICS COMMUNICATION	3	0	2	4.0
2.	UEC804	WIRELESS AND MOBILE COMMUNICATIONS	3	0	2	4.0
3.	UCS508	GRAPHICS AND VISUAL COMPUTING	3	0	2	4.0
4.	UEC747	ANTENNA &WAVE PROPAGATION	3	0	2	4.0
5.	UEC512	LINEAR INTEGRATED CIRCUIT ANALYSIS	3	0	2	4.0

ELECTIVE – II

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UCS727	NETWORK SECURITY	3	1	2	4.5
2.	UCS728	SOFTWARE ENGINEERING	3	1	2	4.5
3.	UEC622	DSP PROCESSORS	3	1	2	4.5
4.	UEC748	VIDEO SIGNAL PROCESSING	3	1	2	4.5
5.	UCS729	PARALLEL & DISTRIBUTED COMPUTING	3	1	2	4.5
6.	UCS730	MOBILE APPLICATION DEVELOPMENT	3	1	2	4.5

ELECTIVE – III

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UCS736	CLOUD COMPUTING	3	1	0	3.5
2	UEC854	ASIC AND FPGA	3	1	0	3.5
3	UEC741	ARTIFICIAL INTELLIGENCE	3	1	0	3.5

ELECTIVE – IV

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1	UEI718	VIRTUAL INSTRUMENTATION ENGINEERING	2	1	2	3.5
2	UMA062	GRAPH THEORY AND APPLICATIONS	2	1	2	3.5
3	UEC855	SPEECH PROCESSING	2	1	2	3.5

ELECTIVE – V

SR. NO.	COURSE NO.	TITLE	L	T	P	CR
1.	UEC862	IC FABIRICATION TECHNOLOGY	3	0	0	3.0
2.	UEC863	VLSI INTERCONNECTS	3	0	0	3.0
3.	UEC858	MODERN CONTROL THEORY	3	0	0	3.0
4.	UEC859	INTEGRATED SYSTEM DESIGN	2	0	2	3.0

SEMESTER WISE CREDITS FOR BE (ELECTRONICS AND COMPUTER ENGINEERING)

SEMESTER	**CREDITS**
FIRST	22.0
SECOND	23.5
THIRD	26.5
FOURTH	26.5
FIFTH	27.0
SIXTH	25.5
SEVENTH	34.0
EIGHTH	20.0
TOTAL CREDITS	**205.0**

UCB008 : APPLIED CHEMISTRY

L	T	P	Cr
3	1	2	4.5

Course objective: The course aims at elucidating principles of applied chemistry in industrial systems, water treatment, engineering materials and analytical techniques.

Electrochemistry: Specific, equivalent and molar conductivity of electrolytic solutions, Migration of ions, Transference number and its determination by Hittorf`s method, Conductometric titrations, types of electrodes, concentration cells, Liquid junction potential.

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

Water Treatment and Analysis: Hardness and alkalinity of water: Units and determination,External and internal method of softening of water: carbonate, phosphate, calgon and colloidal conditioning,Lime-soda Process, Zeolite process,Ion exchange process, mixed bed deionizer, Desalination of brackish water.

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

Chemistry of Polymers: Overview of polymers, types of polymerization, molecular weight determination, tacticity of polymers, catalysis in polymerization, conducting, biodegradable polymers and inorganic polymers.

Atomic spectroscopy: Introduction to atomic spectroscopy, atomic absorption spectrophotometry and flame photometry.

Molecular Spectroscopy: Beer-Lambert`s Law, molecular spectroscopy, principle, instrumentation and applications of UV-Vis and IR spectroscopy.

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.

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

Course Learning Outcomes: The students will be able to reflect on:

1. concepts of electrodes in electrochemical cells, migration of ions, liquid junction potential and conductometrictitrations.
2. atomic and molecular spectroscopy fundamentals like Beer`s law, flame photometry,atomic absorption spectrophotometry, UV-Vis andIR.
3. water and its treatment methods like lime soda and ionexchange.
4. concept of phase rule, fuel quality parameters and alternativefuels.
5. polymerization, molecular weight determination and applications as biodegradable and conductingpolymers.
6. laboratory techniques like pH metry, potentiometry, colourimetry, conductometry and volumetry.

Text Books

1. *Ramesh, S. and Vairam S. Engineering Chemistry, Wiley India (2012)1st ed.*
2. *Puri, B.R., Sharma,L.R., and Pathania, M.S. Principles of Physical Chemistry, Vishal Publishing Co.(2008).*
3. *Aggarwal, S. Engineering Chemistry: Fundamentals and Applications, Cambridge University Press (2015).*

Reference Books

1. *Brown, H., Chemistry for Engineering Students, Thompson,1st ed*
2. *Sivasankar, B., Engineering Chemistry, Tata McGraw-Hill Pub. Co. Ltd, New Delhi(2008).*
3. *Shulz, M.J. Engineering Chemistry, CengageLearnings (2007)1st ed.*

Evaluation Scheme

S.No	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	40
3.	Sessionals (Quizzes/assignments/group presentations)	35

UEC 001: Electronic Engineering

L	T	P	Cr
3	1	2	4.5

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, Karnaughmaps.

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 of CRO and Electronic Components, Diodes characteristics Input-Output and Switching characteristics, BJT and MOSFET Characteristics, Zener diode as voltage regulator, Transistorized Series voltage regulator. Half and Full wave Rectifiers with and without filter circuit, Half and full adder circuit implementation, Decoder, DMUX and MUX, Binary/BCD up/down counters.

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

1. Demonstrate the use of semiconductor diodes in variousapplications.
2. Discuss and Explain the working of transistors and operational Amplifiers, theirconfigurations andapplications.
3. Recognize and apply the number systems and BooleanAlgebra.
4. Reduce Boolean Expressions and implement them with LogicGates.
5. Analyze, design and Implement combinational and sequentialcircuits.
6. Analyze and differentiate logic families, TTL andCMOS.

Text Books:

1. *M. M. Mano and M.D. Ciletti, Digital Design, Pearson, Prentice Hall,2013.*
2. *Milliman, J. and Halkias, C.C., Electronic Devices and Circuits, Tata McGraw Hill,2007.*
3. *Donald D Givone, Digital Principles and Design, McGraw-Hill,2003.*

Reference Books:

- *John F Wakerly, Digital Design: Principles and Practices, Pearson,(2000).*
- *N Storey, Electronics: A Systems Approach, Pearson, Prentice Hall,(2009).*
- *Boylestad, R.L. and Nashelsky, L., Electronic Devices & Circuit Theory, Perason(2009).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEN002: ENERGY AND ENVIRONMENT

L	T	P	Cr
3	**0**	**0**	**3.0**

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 andenvironment.

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

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

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 naturalresources

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

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 solidwaste 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:

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

1. Correlate major local and regional environmental issues with changes in ecology and human health
2. Monitor and document the development and dynamics of ecosystems in experimental or naturalmicrocosms
3. Define and document local resource consumption patterns and conservationstrategies
4. Define opportunities available for energy conservation and for use of renewable energy resources in local and regionalentities.

Text Books:

- *Bharucha, E., Textbook of Environmental Studies, Universities Press(2005).*
- *Chapman, J.L. and Reiss, M.J., Ecology- Principles and Application, Cambridge University Press (LPE)(1999).*
- *Joseph, B., Environmental Studies, Tata McGraw-Hill(2006).*

- *Eastop, T.P. and Croft, D.R. Energy Efficiency for Engineers and Technologists, Longman and Harow(2006)*

Reference Books:

1. *Miller, G.T., Environmental Science- Working with Earth, Thomson(2006).*
2. *Wright, R.T., Environmental Science-Towards a sustainable Future, Prentice Hall (2008) 9th ed.*
3. *O'Callagan, P.W., Energy Management, McGraw Hill Book Co. Ltd.(1993).*

Evaluation Scheme:

S.No	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	50
3.	Sessionals (Quizzes/assignments/group presentations)	20

UES 009: MECHANICS

L	T	P	Cr
2	**1**	**2***	**2.5**

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 bepredicted.

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.

Dynamics of Rigid Bodies: Newton's Laws, D'Alembert's Principle, Energy Principles.

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):

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

7. Determine resultants in plane forcesystems.
8. Identify and quantify all forces associated with a staticframework.
9. Solve problems in kinematic and dynamicsystems.

Text Books

2) *Shames, I. H. Engineering Mechanics: Dynamics, Pearson Education India(2002).*
3) *Beer, Johnston, Clausen and Staab, Vector Mechanics for Engineers, Dynamics, McGraw-Hill Higher Education(2003).*

Reference Books

1) *Hibler, T.A., Engineering Mechanics: Statics and Dynamics, Prentice Hall(2012).*
2) *Timoshenko and Young, Engineering Mechanics, Tata McGraw Hill Education Private Limited(2000).*

Evaluation Scheme

Sr. No.	**Evaluation Elements**	**Weights (%)**
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizzes)	25

UMA003: Mathematics - I

L	T	P	Cr
3	1	0	3.5

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 engineeringprofession.

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.

Sequences and Series: Introduction to sequences and Infinite series, Tests for convergence/divergence, Limit comparison test, Ratio test, Root test, Cauchy integral test, Alternating series, Absolute convergence and conditionalconvergence.

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

1. apply the knowledge of calculus to plot graphs of functions and solve the problem of maximaand minima.
2. determine the convergence/divergence of infinite series, approximation of functions using power and Taylor's series expansion and errorestimation.
3. evaluate multiple integrals and their applications to engineeringproblems.
4. examine functions of several variables, define and compute partial derivatives, directional derivatives and their use in finding maxima andminima.
5. analyze some mathematical problems encountered in engineeringapplications.

Text Books:

1)Thomas, G.B. and Finney, R.L., Calculus and Analytic Geometry, Pearson Education (2007), 9th ed.

2)Stewart James, Essential Calculus; Thomson Publishers (2007), 6thed.

Reference Books:

1)Wider David V, Advanced Calculus: Early Transcendentals, Cengage Learning(2007).

2)Apostol Tom M, Calculus, Vol I and II, John Wiley(2003).

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include assignments/quizzes)	25

UTA007: COMPUTER PROGRAMMING – I

L	T	P	Cr
3	0	2	4.0

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(), Standardstreams.

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 computerprogram.
3. design programs involving decision control statements, loop control statements and case controlstructures.
4. understand the implementation of arrays, pointers and functions and apply the dynamics of memory by the use ofpoiners.
5. comprehend the concepts of structures and classes: declaration, initialization and implementation.
6. apply basics of object oriented programming, polymorphism andinheritance.
7. use the file operations, character I/O, string I/O, file pointers, pre-processor directives and create/update basic datafiles.

Text Books:

- *Kanetkar Y., Let Us C++, BPB Publications,2nded.*
- *Balaguruswamy E., Object Oriented Programming with C++, McGraw Hill,2013.*

Reference Books:

4) *Brian W. Kernighan, Dennis M. Ritchie, The C++ Programming Language, Prentice Hall)*

Schildt H., C++: The Complete Reference, Tata Mcgraw Hill,2003

SEMESTER -II

UEE001: ELECTRICAL ENGINEERING

L	T	P	Cr.
3	1	2	4.5

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.

Steady state analysis of DC Circuits: The ideal capacitor, permittivity; the multi-plate capacitor, variable capacitor; capacitor charging and discharging, current-voltage relationship, time-constant, rise-time, fall-time; inductor energisation and de-energisation, inductance current-voltage relationship, time-constant; Transient response of RL, RC and RLC 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 supplysystems.

Electromagnetism: Electromagnetic induction, Dot convention, Equivalent inductance, Analysis of Magnetic circuits, AC excitation of magnetic circuit, Iron Losses, Fringing and stacking, applications: solenoids andrelays.

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, energy transfer, speed- torque relationship, conversion efficiency, applications, DC generator operating principle, reversal of energy transfer, emf and speed relationship, 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 DCgenerator.

Course Learning Outcome (CLO):

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

1. Learn about applications of networks laws and theorems to solve electriccircuits.
2. Represent AC quantities through phasor and compute AC system behaviour during steady state.
3. Learn about principle, construction, characteristics and application of Electro-Mechanical energy conversiondevices**.**

Text Books:

1. *Hughes, E., Smith, I.M., Hiley, J. and Brown, K., Electrical and Electronic Technology, Prentice Hall(2008).*
2. *Nagrath, I.J. and Kothari, D.P., Basic Electrical Engineering, Tata McGraw Hill(2002).*
3. *Naidu, M.S. and Kamashaiah, S., Introduction to Electrical Engineering, Tata McGraw Hill(2007).*

Reference Books:

1. *Chakraborti, A., Basic Electrical Engineering, Tata McGraw Hill(2008).*
2. *Del Toro, V., Electrical Engineering Fundamentals, Prentice Hall of IndiaPrivate Limited(2004)*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UHU 003: Professional Communication

L	T	P	Cr
2	-	2	3

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.

Detailed Contents:

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

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. Needs-assessment of spoken and written communication andfeedback.
2. Training for Group Discussions through simulations and roleplays.
3. Training for effectivepresentations.
4. Project based teampresentations.
5. Proposals and papers-review andsuggestions.

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

Course learning outcome (CLO):

1.Understand and appreciate the need of communicationtraining.
2.Use different strategies of effectivecommunication.
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:

1. *Lesikar R.V and Flately M.E., Basic Business Communication Skills for the Empowering the Internet Generation. Tata Mc Graw Hill. New Delhi(2006).*

2. *Raman,M & Sharma, S.,Technical Communication Principles and Practice, Oxford University Press NewDelhi.(2011).*

3. *Mukherjee H.S.,Business Communication-Connecting at Work,Oxford University Press New Delhi, (2013).*

Reference Books:

- *Butterfield, Jeff.,Soft Skills for everyone,Cengage Learning NewDelhi,(2013).*

- *Robbins, S.P., & Hunsaker, P.L.,Training in Interpersonal Skills,Prentice Hallof India New Delhi,(2008).*
- *DiSianza,J.J & Legge,N.J.,Business and Prfofessional Communication,Pearson Education India NewDelhi,(2009).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (Group Discussions; professional presentations;panel discussions;public speaking;projects,quizzes)	40

UMA004 Mathematics - II

L	T	P	Cr
3	1	0	3.5

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.

Ordinary Differential Equations: Review of first order differential equations, Exact differential equations, Second and higher order differential equations, Solution techniques using one known solution, Cauchy - Euler equation, Method of undetermined coefficients, Variation of parameters method, Engineering applications of differential equations.

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

6. solve the differential equations of first and 2nd order and basic application problems described by theseequations.
7. find the Laplace transformations and inverse Laplace transformations for various functions. Using the concept of Laplace transform students will be able to solve the initial value and boundary valueproblems.
8. find the Fourier series expansions of periodic functions and subsequently will be able to solve heat and waveequations.
9. solve systems of linear equations by using elementary rowoperations.
10. identify the vector spaces/subspaces and to compute their bases/orthonormal bases. Further, students will be able to express linear transformation in terms of matrix and find the eigen values and eigenvectors.

Text Books:

1. Simmons, G.F., Differential Equations (With Applications and Historical Notes), Tata McGraw Hill(2009).
2. Krishnamurthy, V.K., Mainra, V.P. and Arora, J.L., An introduction to Linear Algebra, Affiliated East West Press(1976).

Reference Books:

1. Kreyszig Erwin, Advanced Engineering Mathematics, John Wiley (2006), 8th ed.Jain, R.K. a
2. nd Iyenger, S.R.K , Advanced Engineering Mathematics, Narosa Publishing House(2011), 11th ed.

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include assignments/quizzes)	25

UPH004: APPLIED PHYSICS

L	T	P	Cr
3	1	2	4.5

Prerequisite(s): None Course
Objectives:

To introduce the student to the basic physical laws of oscillators, acoustics of buildings, ultrasonics, electromagnetic waves, wave optics, lasers, and quantum mechanics and demonstrate their applications in technology. To introduce the student to measurement principles and their application to investigate physical phenomena

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 - skindepth.

Optics: ***Interference:*** Parallel and wedge-shape thin films, Newton rings, Applications as Non-reflecting coatings, Measurement of wavelength and refractive index. ***Diffraction:*** Single and Double slit diffraction, and Diffraction grating, Applications - Dispersive and Resolving Powers. ***Polarization:*** Production, detection, Applications – Anti-glare automobile headlights, Adjustable tint windows. ***Lasers:*** Basic concepts, Laser properties,Ruby, HeNe, and Semiconductor lasers, Applications – Optical communication and Optical alignment.

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 variousmedia.
2. Determination of velocity of ultrasonic waves in liquids by stationary wavemethod.
3. Determination of wavelength of sodium light using Newton's ringsmethod.
4. Determination of dispersive power of sodium-D lines using diffractiongrating.
5. Determination of specific rotation of cane sugarsolution.
6. Study and proof of Malus' law inpolarization.
7. Determination of beam divergence and beam intensity of a givenlaser.
8. Determination of displacement and conducting currents through adielectric.
9. Determination of Planck'sconstant.

Micro project: Students will be given physics-based projects/assignments using computer simulations, etc.

Course Outcomes:

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

1. Understand damped and simple harmonic motion, the role of reverberation in designinga hall and generation and detection of ultrasonicwaves.
2. Use Maxwell's equations to describe propagation of EM waves in amedium.
3. Demonstrate interference, diffraction and polarization oflight.
4. Explain the working principle ofLasers.
5. Use the concept of wave function to find probability of a particle confined in abox.

Text Books

1. *Beiser, A., Concept of Modern Physics, Tata McGraw Hill (2007) 6thed.*
2. *Griffiths, D.J., Introduction to Electrodynamics, Prentice Hall of India (1999) 3rded.*
3. *Jenkins, F.A. and White, H.E., Fundamentals of Optics, McGraw Hill (2001) 4thed.*

Reference Books

1 *Wehr, M.R, Richards, J.A., Adair, T.W., Physics of The Atom, Narosa Publishing House (1990) 4thed.*

2 *Verma, N.K., Physics for Engineers, Prentice Hall of India (2014)1sted.*

3 *Pedrotti, Frank L., Pedrotti, Leno S., and Pedrotti, Leno M., Introduction to Optics, Pearson Prentice Hall^{TM} (2008) 3rded.*

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include assignments/quizzes)	25

UTA008 ENGINEERING DESIGN - I

L	T	P	Cr
2	**4**	**0**	**4.0**

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 toleranced 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 projectionsystem
3. IsometricProjections
4. AuxiliaryProjections
5. PerspectiveProjections
6. Introduction to MechanicalDrawing
7. Sketching engineeringobjects
8. Sections, dimensions andtolerances

AutoCAD

1. Management of screen menuscommands
2. Introduction to drawing entities
3. Co-ordinate systems: Cartesian, polar and relativecoordinates
4. Drawing limits, units of measurement andscale
5. Layering: organizing and maintaining the integrity ofdrawings
6. Design of prototype drawings astemplates.
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 todrawing

1. **Micro Projects /Assignments:**
2. Completing the views - Identification and drawing of missing lines in the projectionof objects
3. Missing views – using two views to draw the projection of the object in the thirdview, primarily restricting to Elevation, Plan and Profileviews
4. Projects related to orthographic and isometricprojections
    a. Using wax blocks or soap bars to develop three dimensional object from given orthographicprojections
    b. Using wax blocks or soap bars to develop three dimensional object, section it and color thesection
    c. Use of AUTOCAD as a complementary tool for drawing the projections ofthe objects created in (1) and(2).
5. Develop the lateral surface of different objects involving individual or a combinationof solids like Prism, Cone, Pyramid, Cylinder, Sphereetc.

6. 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 engineeringobjects
2. draw dimensioned orthographic and isometric projections of simple engineeringobjects.
3. interpret the meaning and intent of toleranced dimensions and geometric tolerance symbolism;
4. create the engineering drawings for simple engineering objects usingAutoCAD
5. manage screen menus and commands usingAutoCAD
6. operate data entry modes and define drawings geometrically in terms of Cartesian, polar and relative coordinates inAutoCAD
7. create and edit drawings making selections of objects, discriminating by layering and using entities, object snap modes, editing commands, angles and displacements using AutoCAD

Text Books:

1. *Jolhe, D.A., Engineering Drawing, Tata McGraw Hill,2008*
2. *Davies, B. L., Yarwood, A., Engineering Drawing and Computer Graphics,* Van Nostrand Reinhold *(UK),1986*

Reference Books:

1. *Gill, P.S., Geometrical Drawings, S.K. Kataria & Sons, Delhi(2008).*
2. *Gill, P.S., Machine Drawings, S.K. Kataria & Sons, Delhi(2013).*
3. *Mohan, K.R., Engineering Graphics, Dhanpat Rai Publishing Company (P) Ltd, Delhi (2002).*
4. *French, T. E., Vierck, C. J. and Foster, R. J., Fundamental of Engineering Drawing & Graphics Technology, McGraw Hill Book Company, New Delhi(1986).*
5. *Rowan, J. and Sidwell , E. H., Graphics for Engineers, Edward Arnold, London(1968).*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	Mid semester test (formal written test)	25
2	End semester test (formal written test)	40
3	Sessional: (may include the following) Continuous evaluation of drawing assignments in tutorial/ regular practice of AutoCAD tutorial exercises & Individual independent project work/drawing and AutoCAD assignment	35

UTA009: COMPUTER PROGRAMMING – II

L	T	P	Cr
3	0	2	4

Course Objective: Understand fundamentals as well as advanced topics of object oriented programming in java. To help students understand fundamentals of programming such as variables, conditional and iterative execution, methods, I/O and thread communication followed by data structure implementation.

Introduction to Java: History and evolution of Java, Java vs other popular languages, Java programming environment, fundamental of Java programming language, primitive data types and variables, floating point types, literals, variables, type conversion and casting, arithmetic operators, bit wise operators, relational, Boolean expressions, statements and blocks, control flow statements selection, iteration and jump statements.

ObjectOrientedProgrammingConceptsinJava: Objectsandclasses,declaringobjects,constructors, this keyword, method overloading and constructor overloading, nestedclasses.

Inheritance and Exception Handling: Defining, applying and implementing interfaces; method overriding, super and final keywords, polymorphism, generics, defining, finding and importing packages, exceptions handling with try, catch, throw, throws and finally keywords, wrapper classes.

I/O and Threads: Binary I/O, file handling, thread model, creating a thread, synchronization, inter thread communication, thread lifecycle.

DataStructuresinJava: Arrays,theuseofclassestoencapsulatedatastoragestructuresandtheclass interface.Searching,insertion,anddeletioninarraysandorderedarrays.Linearsearchingandbinary searching. Simple Sorting: the bubble sort, selection sort, and insertion sort. Stacks and Queues: the stack, queue, and priority queue. Linked Lists: linked lists, including doubly linked lists and double- ended lists. Recursion: Towers of Hanoi puzzle and the mergesort.

Laboratory Work:

Main focus is on implementing basic concepts of object oriented programming and to enhance programming skills to solve specific problems.

Course Learning Outcomes (CLO):

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

1. comprehend the concepts of Object Oriented Computing inJava.
2. implement decision statements and loopingstatements.
3. grasp the concepts of input and output handling from console andfiles.
4. develop applications to demonstrate use of datastructures.

Text Books:

1. Deitel H. and Deitel P., JAVA - How to Program, Pearson Education(2003).

2. Hortsmann CS., Cornell G., Core Java Volume I-Fundamentals, Prentice Hall,(2012).
3. Data Structures & Algorithms in Java. RobertLafore.

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include assignments/quizzes)	25

SEMSETER – III

UEC403: CIRCUIT ANALYSIS AND SYNTHESIS

L	T	P	Cr
3	1	0	3.5

Introduction: Circuit components, Network graph, KCL, KVL, Circuit analysis and methods, Mutualinductance, Co-efficient of coupling (Dot analysis), Network Classification.

Network Theorems and Two Port Network Descriptions: Thevenins theorem, Nortons theorem,Maximum power transfer theorem, Superposition theorem, Tellengens 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 oneport & two port networks.

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

Attenuators: Image impedances-Image transfer coeff, Iterative impedances, Ladder network, Latticenetwork, Bridged T-network conversion, Insertion loss, Design of symmetrical-T & L section Attenuators.

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 palimonies 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. understand the basics of different types of circuit components and their analysis procedures.
2. do analysis based on network theorems and to determine the current, voltage and power.
3. analyze two port networks and to analyze time response of the circuit.
4. check stability of a circuit and to design the circuit using foster and cauer forms

Text Books:

1. *Vanvalkenberg, M.E., Networks Analysis, Prentice Hall of India (2007) 3rd ed.*
2. *Arshad, M., Network Analysis and Synthesis, Laxmi Publications (2008) 2nd ed.*

Reference Books:

1. *Kuo, F., Network Analysis and Synthesis, John Wiley (2003) 2nd ed.*
2. *Anderson, B.D.O., Vongpanitlerd, S., Network Analysis and Synthesis, Dover Publications (2006) 3rd ed.*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessionals (May include assignments/quizzes)	25

UEC404: SIGNALS ANDSYSTEMS

L	T	P	Cr
3	1	2	4.5

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 Time signals, 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, Introduction to Sampling theorem of sinusoidal and random signals, Quantization.

FourierAnalysis: Continuous and discrete time Fourier series, Trigonometric & exponential Fourier series, Properties of Fourier series, Parseval's theorem, Line spectrum, Rate of conversion of Fourier spectra, Continuous and discrete time Fourier transforms and its properties, Analysis of discrete time signals and systems, Correlation, Autocorrelation, Relation to Laplace transform.

Z-Transform: Definition of Z-transform and Z-transform theorems, Relation between Z.T. and F.T., Transfer function, Inverse Z-transform, Discrete time convolution, Stability, Time domain and frequency domain analysis, Solution of difference equation.

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-4FFT, Linear Convolution, Circular Convolution, Power spectrum and correlation with FFT.

Random Signals: Probability, Random variables, Gaussian distribution, Transformation of random variables, Random processes, Stationary processes, Correlation and Covariance Functions, Regularity and Ergodicity, Gaussian Process, Transmission of deterministic and undeterministic signals through a linear time invariant system, Spectral density.

Laboratory work:
Signal generation, Solving difference equation, Calculating Z-transform, Linear and Circularconvolution, 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.

5. Analyze random phenomena and compute probabilities of random events and moments of random variables.

Text Books:

1. *Oppenheim, A.V. and Willsky, A.S., Signal&Systems, PrenticeHallofIndia(1997).*
2. *Proakis, J.G. and Manolakis, D.G., Digital Signal Processing Principles Algorithm&Applications, PrenticeHall(2007).*

Reference Books:

1. *Lathi,B.P.,ModernDigitalandAnalogCommunicationSystems,OxfordUniv.Press, 1998*
2. *Papoulis,A.,ProbabilityRandomVariablesandStochasticProcesses,McGrawHill, 2008*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC407: MICROPROCESSORS AND THEIR APPLICATIONS

L	T	P	Cr
3	1	2	4.5

Course Objective: To Introduce the basics of microprocessors and microcontrollers technology and related applications. Study of the architectural details and programming of 16 bit 8086 microprocessor and its interfacing with various peripheral ICs; Study of architecture and programming of ARM processor.

Introduction to Microprocessors: Need for Flexible Logic and Evolution of Microprocessors, Applications, Generic Architecture of a Microprocessor. Overview of 8085 microprocessor, Architecture, Instruction Set, Interrupts and Programming Examples

INTEL 8086 Microprocessor: Pin Functions, Architecture, Characteristics and Basic Features of Family, Segmented Memory, Interrupt Structures. INTEL 8086 System Configuration, Description of Instructions. Addressing Modes, Assembly directives. Assembly software programs with algorithms, Loops, Nested loops, Parameter Passing etc.

Interfacing with 8086: Interfacing of RAMs and ROMs along with the explanation of timing diagrams. Interfacing with peripheral ICs like 8255, 8254, 8279, 8259, 8251 etc.

ARM Processor Fundamentals: ARM core data flow model, Architecture, ARM General purpose Register set and GPIO's, CPSR, Pipeline, Exceptions, Interrupts, Vector Table, ARM processors family, ARM instruction set and Thumb Instruction set.

ARM Programming in Assembly: Writing code in assembly, Instruction Scheduling, Register Allocation, Conditional Execution, Looping Constructs, Bit Manipulation, Efficient Switches, Optimized Primitives: Double-Precision Integer Multiplication, Integer Normalization and Count Leading Zeros, Division, Square Roots, Transcendental Functions like log, exp, sin, cos, Endian Reversal and Bit Operations, Saturated and Rounded Arithmetic, Random Number Generation, Exception and Interrupt Handling.

Laboratory Work:
Introduction to INTEL kit, Programming examples of 8086 and ARM based processors. Interfacing of LED seven segment display, ADC, DAC, stepper motor etc. Microprocessor based projects.

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

Course Learning Outcome (CLO):
The student will be able to:

1. acquire knowledge about Microprocessors and its need.
2. write the programs using 8086 microprocessor

3. understand the internal architecture and interfacing of different peripheral devices with 8086 microprocessor.
4. design the system using ARM processors.
5. understand the internal architecture and interfacing of different peripheral devices with 8086 and ARM processors.

Text Books:

1. *Gaonkar, Ramesh., Microprocessor Architecture, Programming and Applications with the 8085, Penram International Publishing India PVT.LTD. (2005)*
2. *Hall, D.V., Microprocessor and Interfacing, Tata McGraw Hill Publishing Company, (2006)*
3. *Steve Furber, ARM System on chip Architecture* Addison Wesley (2000)

Reference Books:

1. *Gibson, Glenn A., Liu, Yu-Cheng., Microcomputer Systems: The 8086/8088 Family Architecture Programming And Design, Pearson, (2001)*
2. *Andrew N. Sloss, ARM System Developer's Guide, Morgan Kaufmann publications (2004).*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	25
2	EST	35
3	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UES 012:Engineering Materials

L	T	P	Cr
3	1	2	4.5

Prerequisite(s): None

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.

Mechanical properties of materials: Elastic, Anelastic and Viscoelastic behaviour, Engineering stress and engineering strain relationship, True stress - true strain relationship, review of mechanical properties, Plastic deformation by twinning and slip, Movement of dislocations, Critical shear stress, Strengthening mechanism, and Creep.

Equilibrium diagram: Solids solutions and alloys, Gibbs phase rule, Unary and binary eutecticphase diagram, Examples and applications of phase diagrams like Iron - Iron carbide phase diagram.

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.

Corrosion process: Corrosion, Cause of corrosion, Types of corrosion, Protection against corrosion.

Materials selection: Overview of properties of engineering materials, Selection of materials for different engineering applications.

Laboratory Work and Micro-Project:

Note: The micro-project will be assigned to the group(s) of students at the beginning of the semester. Based on the topic of the project the student will perform any of the six experiments from the following list:

1. To determine Curie temperature of a ferrite sample and to study temperature dependence of permeability in the vicinity of Curie temperature.
2. To study cooling curve of a binary alloy.
3. Determination of the elastic modulus and ultimate strength of a given fiber strand.
4. To determine the dielectric constant of a PCB laminate.
5. Detection of flaws using ultrasonic flaw detector (UFD).
6. To determine fiber and void fraction of a glass fiber reinforced composite specimen.
7. To investigate creep of a given wire at room temperature.
8. To estimate the Hall coefficient, carrier concentration and mobility in a semiconductorcrystal.
9. To estimate the band-gap energy of a semiconductor using four probe technique.
10. To measure grain size and study the effect of grain size on hardness of the given metallic specimens.

Course Outcomes: Student will be able to:

1. classify engineering materials based on its structure.
2. draw crystallographic planes and directions.
3. distinguish between elastic and plastic behavior of materials.
4. Distinguish between Isomorphous and eutectic phase diagram.
5. classify materials based on their electrical and magnetic properties.
6. propose a solution to prevent corrosion.

Text Books:

1. W.D. Callister , Materials Science and Engineering; John Wiley & Sons, Singapore, 2002.
2. W.F. Smith, Principles of Materials Science and Engineering: An Introduction; Tata Mc-Graw Hill, 2008.
3. V. Raghavan, Introduction to Materials Science and Engineering; PHI, Delhi, 2005.

Reference Books:

1. S. O. Kasap, Principles of Electronic Engineering Materials; Tata Mc-Graw Hill, 2007.
2. L. H. Van Vlack, Elements of Material Science and Engineering; Thomas Press, India, 1998.
3. K. G. Budinski, Engineering Materials – Properties and selection, Prentince Hall India, 1996

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include assignments/quizzes)	25

UMA007 Numerical Analysis

L	T	P	Cr
3	1	2	4.5

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:

1) Curtis F. Gerald and Patrick O. Wheatley, Applied Numerical Analysis, Pearson, (2003) 7th Edition,
2) M. K. Jain, S .R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International Publishers (2012), 6th edition.
3) Steven C. Chappra, Numerical Methods for Engineers, McGraw-Hill Higher Education; 7 edition (1 March 2014)

References Books:

1) J. H. Mathew, Numerical Methods for Mathematics, Science and Engineering, Prentice Hall, (1992) 2nd edition,
2) Richard L. Burden and J. Douglas Faires, Numerical Analysis, Brooks Cole (2004), 8th edition.

3) K. Atkinson and W. Han, Elementary Numerical Analysis, John Willey & Sons (2004), 3rd Edition.

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	25
2.	EST	40
3.	Sessionals (May include assignments/quizzes)	15
4.	Laboratory Evaluation	20

UTA010 ENGINEERING DESIGN – II

L	T	P	Cr
1	0	2	5

(6 Self effort hours)

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.

Course learning outcomes (CLOs):
After the completion of the course, the student 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:

1. *McRoberts M., Beginning Arduino, APress (2013) 2nd Edition.*
2. *Smith G. A., Introduction to Arduino: a piece of cake, CreateSpace Independent Publishing Platform (2011)*

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include assignments/quizzes)	25

SEMESTER – IV

UEC301: ANALOG ELECTRONIC CIRCUITS

L	T	P	Cr
3	**1**	**2**	**4.5**

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.

Transistor Biasing and Thermal Stabilization: The Operating Point, Biasing Stability, Self-Biasing or Emitter Bias, Stabilization against Variations in I_{co}, V_{BE}, and β, General Remarks on Collector-Current Stability, Bias Compensation, Biasing Techniques for Linear Integrated Circuits, Thermistor and Sensistor Compensation, Thermal Runaway, Thermal Stability, The FET Small-Signal Model, The metal-oxide-semiconductor FET (MOSFET), The low-frequency common-source and common-drain amplifiers, Biasing FET

The Transistor at High Frequencies: The Hybrid-pi (II) Common-emitter Transistor Model, Hybrid-II conductances, The Hybrid-II Capacitances, Validity at Hybrid-II Model, Variation of Hybrid-II parameters, The CE short-circuit current gain, Current gain with resistive load, Single-stage CE transistor amplifier response, The gain-bandwidth product, Emitter follower at high frequencies

Multistage Amplifiers: Classification of amplifiers, Distortion in amplifiers, Frequency response of an amplifier, Bode plots, Step Response of an amplifier, Bandpass of cascaded stages, The RC-coupled amplifier, Low-frequency response of an RC-coupled stage, Effect of an emitter Bypass capacitor on low-frequency response, High-frequency response of two cascaded CE Transistor stages, Multistage CE amplifier cascade at high frequencies, Noise , Tuned Amplifiers.

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

Stability and Oscillators: Sinusoidal Oscillator, The phase-shift oscillator, Resonant-circuit oscillators, A General form of oscillator circuit, The Wien Bridge oscillator, Crystal oscillator, Frequency Stability

Wave shaping circuits: Multi-vibratotrs (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.

Laboratory Work: *Frequency response analysis of RC coupled amplifier, Tuned amplifiers, Push-pull amplifier, Feedback amplifier.Hartley and Colpitts Oscillator. RC Phase shift oscillator. Study of Multi-vibrators (Astable, Mono-stable, Bi-stable Multi-vibrator). Clipper and Clamper circuit, Schmitt Trigger.*

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:

1. *Milliman, J. and Halkias, C.C., Intergrated Electronics, Tata McGraw Hill (2007).*
2. *Milliman, J. &Taub, H., Pulse, Digital and switching waveforms, Tata McGraw Hill (2007).*

Reference Books

1. *Malvino, L., Electronic principles, Tata McGraw Hill (1998).*
2. *Cathey, J. J., 2000 Solved Examples in Electronics, McGraw Hill (1991).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UES010: SOLID AND STRUCTURES

L	T	P	Cr
3	1	2	4.5

Course Objectives: This subject aims to develop an understanding of the stresses and strains that develop in solid materials when they are subjected to different types of loading and to develop an understanding of the conditions at failure of such materials. Further to this subject aims at to introduce the fundamental concepts of structural mechanics.

Elastic Plastic Behavior

Axial Stress and Strain: Concept of stress, strain, elasticity and plasticity; one-dimensional stress-strain relationships; Young's modulus of elasticity, shear modulus and Poisson's ratio; two-dimensional elasticity; isotropic and homogeneous materials; ductile and brittle materials; statically determinate and indeterminate problems, compound and composite bars; thermal stresses. Torsion of shafts; buckling of struts, concept of factor of safety.

Shear Force and Bending Moment Diagrams: Types of load on beams, classification of beams; axial, shear force and bending moment diagrams: simply supported, overhang and cantilever beams subjected to any combination of point loads, uniformly distributed and varying load and moment, equation of condition, load function equation,

Bending & Shear Stresses in beams: Derivation of flexural formula for straight beams, concept of second moment of area, bending stress calculation for beams of simple and built up sections, Flitched beams. Shear stress formula for beams, shear stress distribution in beams

Transformation of Stress and Strain: Transformation equations for plane stress and plane strain, Mohr's stress circle, relation between elastic constants, strain measurements, strain rosettes.

Deformations: Governing differential equation for deflection of straight beams having constant flexural rigidity, double integration and Macaulay's methods for slopes and deflection, unit load method for deflection of trusses

Laboratory Work: The following experiments will be performed in the lab:

1. Calculation of tensile strength
2. Experimental verification of Theory of bending (Calculation of bending stress and deflections at various points in the beam theoretically and verifying the same experimentally) and indirect evaluation of the modulus of elasticity.
3. Torsion: Study the behavior of circular shafts under torsion and analysis of failure and indirect evaluation of the modulus of rigidity.

Experimental project assignment: Students in groups of 4/5 will do a project covering any of the following topics:

1. Tensile strength of bars
2. Flexural strength of beams
3. Torsion of shafts

Course Learning Outcomes (CLO):
After completion of this course, thestudents will be able to:

1. Evaluate axial stresses and strains in various determinate and indeterminate structural systems
2. Draw Shear Force Diagram and Bending Moment Diagram in various kinds of beams subjected to different kinds of loads
3. Evaluate various kinds of stresses (axial, bending, torsional and shearing) in various structural elements due to different type of external loads.
4. Determine deformations and deflections in various kinds of beams and trusses
5. Evaluate the principal stresses/strains and maximum shear stresses/strains for generalized stress element

Text Books:

1. *Popov, E.P. and Balan, T.A., Engineering Mechanics of Solids, Prentice Hall of India (2012).*
2. *Singh, D.K., Mechanics of Solids, Pearson Education (2008).*

Reference Books:

1. *Shames, I. H. and Pitarresi, J. M., Solid Mechanics, Prentice Hall of India (1996).*
2. *Crandall, S.H., Dahl, N.C. and Lardner, T.J., An Introduction to Mechanics of Solids, McGraw Hill International, Tokyo(1969).*

Evaluation Scheme

Sr. No.	**Evaluation Elements**	**Weights (%)**
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quiz/Lab evaluations)	40

UES011:THERMO-FLUIDS

L	T	P	Cr
3	**1**	**2**	**4.5**

Course Objective
To understand basic concepts of fluid flow and thermodynamics and their applications in solving engineering problems

Fluid Mechanics
- **Introduction**: Definition of a fluid and its properties
- **Hydrostatics**: Measurement of pressure, thrust on submerged surfaces
- **Principles of Fluid Motion**: Description of fluid flow; continuity equation; Euler and Bernoulli equations; Pitot total head and static tubes, venturi-meter, orifice-meter, rotameter; Momentum equation and its applications
- **Pipe Flow**: Fully developed flow; laminar pipe flow; turbulent pipe flow, major and minor losses; Hydraulic gradient line (HGL) and total energy line (TEL)
- **Boundary Layer**: Boundary layer profile; displacement, momentum and energy thickness

Thermodynamics
- **Introduction**: Properties of matter, the state postulate, energy, processes and thermodynamic systems;
- **Properties of Pure Substances**: property tables, property diagrams, phase change, equations of state (ideal gas);
- **Energy**: Energy transfer by heat, work and mass;
- **First Law of Thermodynamics**: Closed system, open system, steady-flow engineering devices;
- **Second Law of Thermodynamics**: Statements of the Second Law, heat engines, refrigeration devices, reversible versus irreversible processes, the Carnot cycle.

Laboratory/Project programme

List of Experiments
1. Verification of Bernoulli's theorem
2. Determination of hydrostatic force and its location on a vertically immersed surface
3. Determination of friction factor for pipes of different materials
4. Determination of loss coefficients for various pipe fittings
5. Verification of momentum equation
6. Visualization of laminar and turbulent flow, and rotameter
7. Calibration of a venturi-meter
8. Boundary layer over a flat plate

Sample List of Micro-Projects
Students in a group of 4/5 members will be assigned a micro project.
1. Design a physical system to demonstrate the applicability of Bernoulli's equation

2. Determine the pressure distribution around the airfoil body with the help of wind tunnel
3. Demonstrate the first law of thermodynamics for an open system, for example: a ordinary hair dryer
4. Develop a computer program for solving pipe flow network.

Course Learning Outcomes (CLO):

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

1. analyze and solve problems of simple fluid based engineering systems including pressures and forces on submerged surfaces
2. analyze fluid flow problems with the application of the mass, momentum and energy equations
3. evaluate practical problems associated with pipe flow systems
4. conceptualize and describe practical flow systems such as boundary layers and their importance in engineering analysis
5. estimate fluid properties and solve basic problems using property tables, property diagrams and equations of state
6. analyze and solve problems related to closed systems and steady-flow devices by applying the conservation of energy principle
7. analyze the second law of thermodynamics for various systems and to evaluate the performance of heat engines, refrigerators and heat pumps.

Textbooks

1. *Kumar, D. S, Fluid Mechanics and Fluid Power Engineering, S. K. Kataria (2009)*
2. *Cengel and Boles, Thermodynamics: an Engineering Approach, McGraw-Hill (2011)*

Reference Books

1. *Jain, A. K. , Fluid Mechanics: including Hydraulic Machines, Khanna Publishers (2003)*
2. *Rao, Y.V. C, An Introduction to Thermodynamics, Universities Press (2004*

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include assignments/quizzes)	25

UMA031 OPTIMIZATION TECHNIQUES

L	T	P	Cr
3	1	0	3.5

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:

1) Chandra, S., Jayadeva, Mehra, A., Numerical Optimization and Applications, Narosa Publishing House, (2013).

2) Taha H.A., Operations Research-An Introduction, PHI (2007).

Recommended Books:

1) Pant J. C., Introduction to optimization: Operations Research, Jain Brothers (2004)
2) Bazaarra Mokhtar S., Jarvis John J. and Shirali Hanif D., Linear Programming and Network flows, John Wiley and Sons (1990)
3) Swarup, K., Gupta, P. K., Mammohan, Operations Research, Sultan Chand & Sons, (2010).

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May includeassignments/quizzes)	25

UTA002: MANUFACTURING PROCESSES

L	T	P	Cr
2	0	3	3.5

Course Objectives: To introduce basic manufacturing processes used in industry. To identify, analyze, and solve problems related to basic manufacturing processes both independently and as a part of a team.

Introduction: Common engineering materials and their important mechanical and manufacturing properties, General classification of manufacturingprocesses.

Metal Casting: Principles of metal casting, Patterns, Their functions, Types, Materials and pattern allowances, Characteristics of molding sand, Types of cores, Chaplets and chills, their materials and functions, Moulds and their types, Requisites of a sound casting, Introduction to DieCasting.

Metal Forming and Shearing: Forging, Rolling, Drawing, Extrusion, Bending, Spinning, Stretching, Embossing and Coining, Die and Punch operation in press work, Shearing, Piercing and blanking, Notching, Lancing.

Machining Processes: Principles of metal cutting, Cutting tools, their materials and applications, Geometry of single point cutting tool, Cutting fluids and their functions, Basic machine tools and their applications, Introduction to non-traditional machining processes (EDM, USM, CHM, ECM, LBM, AJM, andWJM).

Joining Processes: Electric arc, Gas, Resistance and Thermit welding, Soldering, Brazing and Braze welding, Adhesive bonding, Mechanical fastening (Riveting, Screwing, Metal stitching, Crimping etc.).

Plastic Processing: Plastics, their types and manufacturing properties, Compression molding, Injection molding and Blow molding, Additives in Plastics.

Modern Trends In Manufacturing: Introduction to numerical control (NC) and computerized numerical control (CNC) machines.

Laboratory Work:
Relevant shop floor exercises involving practice in pattern making, Sand casting, Machining, Welding, Sheet metal fabrication techniques, Fitting work and surface treatment of metals, Demonstration of Forge welding, TIG/MIG/GAS/Spot/Flash butt welding, Demonstration on Shaper, Planer and Milling machine.

Course Outcomes:
The students will be able to
1. Identify and understand the basic manufacturing processes like single and multipoint machining, forming, welding, castingetc.
2. Acquire basic operational skills in different manufacturing processes like machining, forming, welding, casting, sheet metal operations, pattern makingetc.

Text Books

1. *Degarmo, E. P., Kohser, R. A. and Black, J. T., Materials and Processes in Manufacturing, Prentice Hall of India (2002).*
2. *Kalpakjian, S. and Schmid, S. R., Manufacturing Processes for Engineering Materials, Pearson Education Asia (2000).*

Reference Books

1. *Chapman, W. A. J. , Workshop Technology, Vol.1 & II, Arnold Publishers (2001).*

2. *Zimmer E. W. and Groover, M. P., Computer Aided Designing and Manufacturing, Prentice Hall of India (2008).*
3. *Pandey, P. C. and Shan, H. S., Modern Machining Processes, Tata McGraw Hill (2004).*
4. *Mishra, P. K., Non Conventional Machining, Narosa Publications (2006).*
5. *Campbell, J. S., Principles of Manufacturing, Materials and Processes, Tata McGraw Hill Company (1995).*
6. *Lindberg, A. R., Process and Materials of Manufacture, Prentice Hall of India (1998).*

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include assignments/quizzes)	25

UTA019:ENGINEERING DESIGN- III (10 SELF EFFORT HOURS)

L	T	P	Cr
1	0	4	8

Course Objective: Understanding of Arduino microcontroller architecture and programming, Interfacing of Arduino board with various I/O devices. Serial data transmission using Arduino board.Learning of ARM processor Instruction set and programming concepts.

Arduino Microcontroller:

Features of Ardunio Microcontroller, Architecture of Arduino, Different boards of Arduino, Arduino Interfacing and Applications, Anatomy of an Interactive Device like Sensors and Actuators, A to D converters and their comparison, Blinking an LED, LCD Display, Driving a DC and stepper motor, Temperature sensors, Serial Communications, Sending Debug Information from Arduino to Your Computer, Sending Formatted Text and Numeric Data from Arduino, Receiving Serial Data in Arduino, Sending Multiple Text Fields from Arduino in a Single Message, Receiving Multiple Text Fields in a Single Message in Arduino. Light controlling with PWM.

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

Programming of Arduino: The Code designing step by step. Taking a Variety of Actions Based on a Single Variable, Comparing Character and Numeric Values, Comparing Strings, Performing Logical Comparisons, Performing Bitwise Operations, Combining Operations and Assignment, Using Embedded techniques to program Arduino microcontroller, Understanding the libraries of Arduino programming language and applying for circuit design

TASK 1:

1. Introduction to Uno board and interfacing of Uno board with PC and Interfacing of LED and I/O ports of Uno board.
2. Interfacing of DC motor with Uno Board, speed and direction control of motors and interfacing of keyboard with Arduino.
3. Interfacing of IR Sensor and Ultrasonic sensor with Arduino board on inclined surface.
4. Interfacing of Gyro sensor, Accelerometer Sensor and Ultrasonic sensor with Arduino board on inclined surface.
5. Control of buggy through Zig-bee transmission and reception using PC.

TASKS 2:

1. To make buggy move in circular defined patron at given speed and radius without any sensors through programming only.
2. To make buggy intelligent to sense path and follow that path using IR sensor.
3. The buggy should able to sense Obstacles in the path and should stop without colliding with the obstacle and able to follow different path by bypassing the obstacle.
4. To make buggy climb an inclined path with given speed using accelerometer and gyro sensor and come down on the same inclined surface with given speed.
5. Make the buggy’s five in number to move front, back, right and left together by taking command from PC through Zig-bee sensor.

Course Learning Outcomes: The student should be able to:

1. Apply the engineering process of problem solving.
2. Clearly demonstrate group working, including task sub-division and integration of individual contributions from the team.
3. Develop practical experimental skills in electronic circuit testing.
4. Develop practical experimental skills in software system testing.
5. Recognize issues to be addressed in a combined hardware and software system design.
6. Implement project tracking and code version control.

Text Books:

1. *Michael McRoberts, Beginning Arduino, Technology in action publications.*
2. *Alan G. Smith, Introduction to Arduino: A piece of cake, CreateSpace Independent Publishing Platform (2011)*

Reference Book:

1. *John Boxall, Arduino Workshop - A Hands-On Introduction with 65 Projects, No Starch Press; 1 edition (2013.*

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include assignments/quizzes)	25

SEMESTER – V

UCS303: OPERATING SYSTEMS

L	T	P	Cr
3	0	2	4.0

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.

Deadlock: Introduction, Analysis of conditions, Prevention & avoidance, Detection & recovery.

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 outcomes (CLOs):
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:
1. *Silberschatz, A., Galvin, P.B. and Gagne, G., Operating System Concepts, John Wiley (2013).*
2. *Stallings, Willam, Operating Systems Internals and Design Principles, Prentice Hall (2014).*

Reference Books:
1. *Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, 3rd Ed., O'Reilly Media, November(2005).*
2. *Michael Kifer, Scott Smolka, Introduction to Operating System Design and Implementation: The OSP 2 Approach, Springer(2007).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1	MST	20
2	EST	40
3	Sessionals (Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UCS406: DATA STRUCTURES AND ALGORITHMS (WITH 2 SELF EFFORT HOURS)

L	T	P	Cr
3	0	4	6.0

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 behaviours 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.

Algorithmic Strategies with examples and problem solving: Brute-force algorithms with examples, Greedy algorithms with examples, Divide-and-conquer algorithms with examples, Recursive backtracking, Dynamic Programming with examples, Branch-and-bound with examples, Heuristics, Reduction: transform-and-conquer with examples.

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 (CLO):
On completion of this course, 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:

1. *Corman, Leiserson & Rivest, Introduction to Algorithms, MIT Press (2009), 3rd Ed.*
2. *Narasimha Karumanchi, Data Structures and Algorithms Made Easy" (2014), 2nd Ed.*

Reference Books:

1. *Sahni, Sartaj, Data Structures, Algorithms and Applications in C++, Universities Press (2005), 2nd ed.*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	20
2	EST	40
3	Sessionals (Assignments/Projects/ Tutorials/Quizzes/Lab Evaluations)	40

UEC401: ANALOG COMMUNICATION SYSTEMS

L	T	P	Cr
3	1	2	4.5

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.

Angle Modulation: Concept of instantaneous frequesncy, bandwidth of angle modulated waves, Theory of frequency modulation, Mathematical analysis of FM, Spectra of FM signals, Narrow band FM, Wide band FM, Phase modulation, Phase modulation obtained from frequency modulation, FM allocation standards, Generation of FM by direct method, Indirect generation of FM, The Armstrong method RC phase shift method,, Noise triangle. Comparison of AM, FM and PM

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 seely 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:

1. Kennedy, G., Electronic Communication Systems, McGraw-Hill (2008) 4th ed.
2. Lathi.B.P.,Modern Digital and Analog Communications Systems 3rd ed.

Reference Books:

1. Taub, H., Principles of Communication Systems, McGraw-Hill (2008) 3rd ed.
2. Haykin, S., Communication Systems, John Willey (2009) 4th ed.
3. Proakis, J. G. and Salehi, M., Fundamentals of Communication Systems, Dorling Kindersley (2008) 2nd ed.

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC502: DIGITAL SIGNAL PROCESSING

L	T	P	Cr
3	1	2	4.5

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.

Design of IIR Filters: Butterworth and Chebyshev approximation, Design of Butterwoth (Type 1 and II) Lowpass filters using approximation of Derivative, Impulse invariance and Bilinear Transformation, Frequency warping effect, Prewarping, Frequency transformation in both analog and digital domain. Difference between IIR and FIR filters, Structure for realizing digital IIR 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.

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.

Mini Project :

Implementationof the different filters studied in the duration of course of varying order and length of moving template. Also, analyse the effect of the designed filter after applying it on the,

a) Sinusoidal signal having multiple frequencies, different amplitude and different phases added with artificially generated noise of different types of distribution.
b) Real signal such as echo signal which is already noisy and analyse the effect of the changing in the length or order of the filter.
c) Two-dimensional noisy signal with different distribution and comment on the effect of the varying parameters and different types of the filters after applying. Two dimensional real data which is already noisy. Comment on the effect of the different filters.

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

1. Understand 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. Understand the concept of multi-rate signal processing and sampling rate conversion.
4. Design a filtering algorithm for the real time application.

Text Books:

1. *J.G. Proakis, D.G. Manolakis and D. Sharma, Digital Signal Processing, Pearson, 3rd edition, (2013).*
2. *A.V. Oppenheim, and R.W. Schafer, Discrete-Time Signal Processing, Pearson, (2002).*

Reference Books:

1. *Li Tan, Digital Signal Processing: Fundamentals and Applications, Elsevier, (2008).*
2. *Tamal Bose, Digital Signal and Image Processing, Wielly, (2004).*
3. *S. K. Mitra, Digital Signal Processing: A computer based approach, Tata McGraw Hill, 2nd edition.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	35
3.	Sessional (May include Assignments/Projects/Tutorials/ Quizes/Lab Evaluations)	40

UEC509: COMPUTER ARCHITECTURE

L	T	P	Cr
3	1	0	3.5

Course objective: Focus is on the architecture and organization of the basic computer modules viz controls unit, central processing unit, input-output organization and memory unit.

Basics of Computer Architecture: Codes, Number System, Logic gates, Flip flops, Registers, Counters, Multiplexer, Demultiplexer, Decoder, Encoder etc.

Register Transfer and Micro operations: Register transfer Language, Register transfer, Bus & memory transfer, Logic micro operations, Shift micro operation.

Basic Computer Organization: Instruction codes, Computer instructions, Timing & control, Instruction Cycles, Memory reference instruction, Input/output and Interrupts, Complete computer description & design of basic computer.

Introduction to Microprocessors: Need for Flexible Logic and Evolution of Microprocessors, Applications, Generic Architecture of a Microprocessor. Overview of 8085 and 8086 microprocessor, Interfacing with peripheral ICs like 8255, 8254, 8279, 8259, 8251 etc.

ARM Processor Fundamentals: ARM core data flow model, Architecture, ARM General purpose Register set, Exceptions, Interrupts, Vector Table, ARM processors family.

Central Processing Unit: General register organization, Stack organization, Instruction format, Data transfer & manipulation, Program control, RISC, CISC.

Computer Arithmetic: Addition & subtraction, Multiplication Algorithms, Division algorithms.

Input-Output Organization: Peripheral devices, I/O interface Data transfer schemes, Program control, Interrupt, DMA transfer, I/O processor.

Memory Unit: Memory hierarchy, Processor vs. memory speed, High-speed memories, Cache memory, Associative memory, Interleave, Virtual memory, Memory management.

Introduction to Parallel Processing: Pipelining, Characteristics of multiprocessors, Interconnection structures, Interprocessor arbitration, Interprocessor communication & synchronization.

Laboratory work: Installing software development toolkit for ARM processor-based microcontrollers, Assembly language programming for ARM processors.

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

1. Acquire knowledge about Microprocessors and its need and foster ability to understand the internal architecture and interfacing of different peripheral devices with 8086 and ARM processors.
2. Illustrate various elementary concepts of computer architecture including, syntax of register transfer language, micro operations, instruction cycle, and control unit.
3. Describe the design of basic computer with instruction formats & addressing modes
4. Explore various memory management techniques and algorithms for performing addition, subtraction and division etc.
5. Interpret the concepts of pipelining, multiprocessors, and inter processor communication.

Text Books:

1. *Mano, Morris M., Computer System Architectue, Prentice Hall (1992), 3rd ed.*
2. *Hayes, J.P., Computer Architecture and Organization, McGraw Hill (1998), 3rd ed.*

Reference Books:

1. Hennessy, J.L., Patterson, D.A, and Goldberg, D., Computer Architecture A Quantitative Approach, Pearson Education Asia (2006), 5th ed.

2. Leigh, W.E. and Ali, D.L., System Architecture: software and hardware concepts, South Wester Publishing Co. (2000).

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	20
2	EST	40
3	Sessionals(Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UEC612: DIGITAL SYSTEM DESIGN

L	T	P	Cr
3	1	2	4.5

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.

Prerequisite(s): Electronics Engineering

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

Combinational circuits: Q. M. Method, Variable Map Method, Ripple carry adder, BCD adder, High speed adder, Subtractor, Code conversion, Magnitude comparators, Applications of Encoders, Decoders, MUX, DEMUX, Implementations using ROM, PLA, PAL. Standard ICs and their applications. Using combinational modules to design digital systems, Iterative networks.

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 analyzing Datasheets, 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:

Upon completion of this course, 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

1. *Fletcher, W.I., Engineering Approach to Digital Design, Prentice Hall of India (2007) 4th ed.*
2. *Wakerly, J.F., Digital Design Principles and Practices, Prentice Hall of India (2013) 5thed.*

Reference Books

1. *Givone D. D., Digital Principles and Design, Tata McGraw Hill (2007) 2nd ed.*
2. *Tocci, R.J., Digital Systems: Principles and Applications, Prentice-Hall (2006) 10th ed.*
3. *Mano, M.M. and Clitti M. D., Digital Design, Prentice Hall (2001) 3rd ed.*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/ Quizes/Lab Evaluations)	40

ELECTIVE - VI

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

L	T	P	Cr
3	0	4	6.0

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:

1. *H. F. Korth & Silverschatz, A., Database System Concepts, Tata McGraw Hill (2010), 6th ed.*
2. *Elmasri & Navathe, Fundamentals of Database Systems, Addison-Wesley (2011), 6th ed.*

Reference Books:

1. *Hoffer, Prescott, Mcfadden, Modern Database Management, Paperback International (2012), 11th ed.*
2. *Martin Gruber, Understanding SQL, BPB Publication (1994), Revised ed.*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	20
2	EST	30
3	Sessionals (May include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	50

CS611: MACHINE LEARNING

L	T	P	Cr
3	0	2	4.0

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: Well-Posed learning problems, Basic concepts, Designing a learning system, Issues in machine learning. Types of machine learning: Learning associations, Supervised learning (Classification and Regression Trees, Support vector machines), Unsupervised learning (Clustering), Instance-based learning (K-nearest Neighbor, Locally weighted regression, Radial Basis Function), Reinforcement learning (Learning Task, Q-learning, Value function approximation, Temporal difference learning).

Decision Tree Learning: Decision tree representation, appropriate problems for decision tree learning, Univariate Trees (Classification and Regression), Multivariate Trees, Basic Decision Tree Learning algorithms, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

Bayesian Learning: Bayes theorem and concept learning, Bayes optimal classifier, Gibbs algorithms, Naive Bayes Classifier, Bayesian belief networks, The EM algorithm.

Artificial Neural Network: Neural network representation, Neural Networks as a paradigm for parallel processing, Linear discrimination, Pairwise separation, Gradient Descent, Logistic discrimination, Perceptron, Training a perceptron, Multilayer perceptron, Back propagation Algorithm. Recurrent Networks, Dynamically modifying network structure.

Genetic Algorithms: Basic concepts, Hypothesis space search, Genetic programming, Models of evolution and learning, Parallelizing Genetic Algorithms.

Inductive and Analytical Learning: Learning rule sets, Comparison between inductive and analytical learning, Analytical learning with perfect domain theories: Prolog-EBG. Inductive-Analytical approaches to learning, Using prior knowledge to initialize hypothesis (KBANN Algorithm), to alter search objective (Tangent Prop and EBNN Algorithm), to augment search operators (FOCL Algorithm).

Design and Analysis of Machine Learning Experiments: Guidelines for machine learning experiments, Factors, Response, and Strategy of experimentation, Cross-Validation and Resampling methods, measuring classifier performance, Hypothesis testing, Assessing a classification algorithm's performance, Comparing two classification algorithms, Comparing multiple algorithms: Analysis of variance, Comparison over multiple datasets.

Laboratory Work: It is concerned with the design, analysis, implementation, and applications of programs that learn from experience. Learning algorithms can also be used to model aspects of human and animal learning.

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

1. 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.
2. Apply decision tree learning, bayesian learning and artificial neural network in real world problems.
3. Demonstrate the use of genetic algorithms and genetic programming.
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:

1. *Mitchell T.M., Machine Learning, McGraw Hill (1997) 2nd ed.*
2. *Alpaydin E., Introduction to Machine Learning, MIT Press (2010) 2nd ed.*

Reference Books:

1. *Bishop C., Pattern Recognition and Machine Learning, Springer-Verlag (2006) 2nd ed.*
2. *Michie D., Spiegelhalter D. J., Taylor C. C., Machine Learning, Neural and Statistical Classification. Overseas Press (2009) 1st ed.*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	20
2	EST	40
3	Sessionals (Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UEC607: DIGITAL COMMUNICATION

L	T	P	Cr
3	0	2	4.0

Course objective: The aim of this course is to build the foundation for communication systems design focusing on the challenges of digital communications. It will help to discuss the different types of digital pulse and band pass signalling techniques. It will give the idea to understand the statistical analysis from estimation and detection theory. Course will help to analyze error performance of a digital communication system in presence of noise and other interferences and it will help to improve the performance of the system. The course will also build fundamental understanding of information theory and coding.

Introduction: Elements of digital communication systems, continuous and discrete random variables, variance and expected value of a random variable, covariance, probability distribution and probability density functions, binomial, poisson, Gaussian and uniform distributions, central limit theorem, Sampling, quantization, reconstruction filter, PCM, Delta Modulation, Adaptive delta modulation, bandpass and low pass signal and system representations, Low pass equivalent of bandpass signals and systems, signal-space representation of waveforms.

Digital Modulation Schemes without memory

Unipolar and bipolar, Duo binary signaling, Modified duo binary signaling, NRZ, RZ, Manchester Coding,

Signal design or pu lse shaping for band-limited channels for no inter-symbol interference and controlled ISI, Nyquist theorem for zero ISI, equalizers, Transmit pulse shaping, raised cosine spectrum, filter roll-off factors,

ASK, PSK,QPSK, M-ary modulation schemes, pulse amplitude modulation (PAM), correlator and matched filter, Additive white Gaussian noise channel model, MAP and ML receivers, decision regions, probability of error calculations for M-ary PAM, M-ary PSK and M-QAM, Receiver structures, correlation receivers, matched filter receivers, design issues in receiver structures, Minimum shift keying (MSK), continuous phase modulation (CPM), CPFSK, multi-dimensional signalling.

Information Theory and Coding

Concept of information and entropy of a source, Rate of information Joint entropy, conditional entropy, mutual entropy, capacity of channel, Symmetric channel, BSC, BEC, Cascaded channel, Shannon theorem, Continuous channel, Shannon-Hartley theorem, Bandwidth-S/N trade-off.
Source coding: Shannon-Fano coding, Huffman coding.
Channel coding: Linear block codes, convolution codes.

Uniquely decodable and instantaneous codes, prefix codes, Kraft and mcmillan inequality, source coding theorem, Huffman and Hamming code, , Shannon channel coding theorem, Block codes,syndrome testing,covolutional codes, , (zero memory and markov sources), Baye's theorem, a-priori and a-posteriori information measures, chain rule, non-singular codes,viterbi algorithm for decoding convolutional codes.

Laboratory work: Practical's based upon hardware using communication kits and simulation with the help of simulation packages.

Course learning outcome (CLO):

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

1. Identify, analyze, design (prototype) and simulate the pulse modulation systems working under the various capacity constraints.
2. Incorporate digital formats and m-ary baseband modulations for interference suppression /excision to enhance the signal to noise ratio.
3. Perform statistical analysis of transmitted and received modulated waveforms from estimation and detection point of view
4. evaluate different digital modulation techniques under non-zero probability of symbol error floor in the presence of AWGN and other channel characteristics
5. Improve the overall performance of digital communication systems by implementing signal to noise ratio enhancement techniques.
6. Design various receiver structures based on the principles of correlation and matched filtering.
7. Understand the concept of source coding for compression and channel coding to mitigate the effects of noise in the channel.

Text Books:

1. *Proakis John G.,Salehi M. Digital Communication System, McGraw, (2008) 5th ed.*
2. *Simon Haylein, Digital Communication Systems, Wiley India edition, (2009) 2nd ed.*
3. *Singh R P, Sapre S D. Communication Systems: Analog and Digital, Tata Mcgraw-Hill, 2007.*

Reference Books:

1. *Taub& Schilling, Principles of Communication Systems, McGraw Hill Publications, (1998) 2nd ed.*
2. *Simon Haykin, Communication Systems, John Wiley Publication, 3rd ed.*
3. *Sklar, Digital Communications, Prentice Hall-PTR, (2001) 2nd ed.*
4. *Lathi B. P., Modern Analog and Digital Communication, , Oxford University Press, (1998) 3rd*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	40
3	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	35

UEC608: EMBEDDED SYSTEMS

L	T	P	Cr
2	0	2	3.0

Course objective: The course provides ability to understand the basic concepts of embedded system its firmware design approaches, communication tasks such as Message Passing, Remote Procedure Call, and synchronization issues for embedded systems. Some of the topics to be covered include architecture and programming of Arduino Microcontroller and study of RTOS based embedded systems.

Prerequisites: Familiarity with basic concepts of programming (algorithms) and the ability to write program algorithms in a language of your choice (e.g., C++ or Matlab) in a windows environment.

Embedded System: Introduction to Embedded Systems, Definition, Embedded Systems Vs General Computing Systems, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems, Memory Shadowing, Memory selection for Embedded Systems.

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages.

Advanced Embedded Systems Architectures: Features of Arduino Microcontroller, Architecture of Arduino, Different boards of Arduino. Fundamental of Arduino Programming, in built functions and libraries. Serial Communication between Arduino hardware and PC and Arduino Interrupt Programming. Experimental embedded platform like Raspberry Pi.

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Exceptions, Interrupts and Timers Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers.

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization, Techniques, Device Drivers, How to Choose an RTOS.

Laboratory Work:
Introduction to Kiel Software, Programming examples of ARM processor, programs based on Arduino microcontroller, Raspberry Pi processor and Red Pitaya.

Micro Project:

The students shall work on micro projects based on ARM processor, Arduino microcontroller, Raspberry Pi processor and Red Pitaya kit. Each student will submit his/her micro project report to the course coordinator for its evaluation.

Course Learning Outcomes (CLOs):

Upon completion of this course, the students should be able to

1. Understand the Embedded system, Embedded Systems on a Chip (SoC) and the use of VLSI designed circuits.
2. Program the modules of Arduino Microcontroller with various interfaces like memory & I/O devices and Raspberry Pi based embedded platform.
3. Analyze the need of Real time Operating System (RTOS) in embedded systems.
4. Study the Real time Operating system with Task scheduling.
5. Understand the concept to communicate information through embedded system.

Text Books

1. *Raj Kamal, Embedded System Architecture, Programming and Design, Tata McGraw Hill, (2004).*
2. *Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill.*
3. *Simon, D.E., An Embedded Software Primer, Dorling Kindersley (2005).*

Reference Books

3. *Embedded System Design - Frank Vahid, Tony Givargis, John Wiley*
4. *Embedded Systems – Lyla, Pearson, 2013.*
5. *Michael McRoberts, Beginning Arduino, Technology in action publications, 2nd Edition.*
6. *User manual of Raspberry pi and Red Pitaya embedded board.*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UEC609: MOS CIRCUIT DESIGN

L	T	P	Cr
3	**0**	**2**	**4.0**

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.

MOS Transistor Theory: MOS Structure and its operation, I-V Characteristics, Threshold Voltage Equation, Body Effect, Second Order Effects, Scaling Theory and Limitations of Scaling, Short-Channel Effects, MOS Device Models, Small Signal operation and Equivalent Circuit of MOS Transistor, MOS Capacitors, MOS switch, Noise in MOS transistors.

NMOS & CMOS Process technology: Evolution of ICs. Masking sequence of NMOS and CMOS Structures, Latch up in CMOS, Electrical Design Rules, Stick Diagram, Layout Design.

Circuit Characterization: Resistive Load & Active Load MOS Inverters, NMOS Inverters, CMOS Inverters : Static Characteristics, Switching Characteristics, Interconnect Parasitics, Propagation Delay, Static and Dynamic Power Dissipation, Noise Margin, Logic Threshold Voltage, Logical effort, Driving large loads.

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 gateswith given constraints.
5. Implement various CMOS logic circuits.
6. Design simple circuits to meet stated operating specifications.

Text Books:

1. *Kang ,Sung-Mo (Steve) &Leblebici, Yusuf., CMOS Digital Integrated Circuits Analysis & Design, McGraw Hill, (1999) 2nd ed.*
2. *A. S. Sedra and K. C. Smith, Microelectronic Circuits. 4th ed. New York, NY: Oxford University Press, 1998.*

Reference Books:

1. *Gregorian, R. and Temes, G.C., Analog MOS Integrated Circuits for Signal Processing, John Wiley (2004).*
2. *Jan Rabaey, A. Chandrakasan&Nikolic, B., Digital Integrated Circuits – A Design Perspective, Pearson, (2003) 2nd ed.*
3. *CMOS VLSI Design: A Circuits and Systems Perspective, 4th ed., Neil Weste and David Harris, Pearson Addison Wesley, 2011.*
4. *Pucknell D. A., &Eshraghian, K., Basic VLSI Design, Prentice Hall of India, (2007) 3rd ed.*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UTA012: INNOVATION AND ENTREPRENEURSHIP

L T P Cr

1 0 2* 4.5

[*] 2 hours every alternate week.
6– Self Effort Hours.

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:

1. *Ries, Eric(2011), The lean Start-up: How constant innovation creates radically successful businesses, Penguin Books Limited.*
2. *Blank, Steve (2013), The Startup Owner's Manual: The Step by Step Guide for Building a Great Company, K&S Ranch.*
3. *S. Carter and D. Jones-Evans, Enterprise and small business- Principal Practice and Policy, Pearson Education (2006)*

Reference Books:

1. *T. H. Byers, R. C. Dorf, A. Nelson, Technology Ventures: From Idea to Enterprise, McGraw Hill (2013)*
2. *Osterwalder, Alex and Pigneur, Yves (2010) Business Model Generation.*
3. *Kachru, Upendra, India Land of a Billion Entrepreneurs, Pearson*
4. *Bagchi, Subroto, (2008), Go Kiss the World: Life Lessons For the Young Professional, Portfolio Penguin*
5. *Bagchi, Subroto, (2012). MBA At 16: A Teenager's Guide to Business, Penguin Books*
6. *Bansal, Rashmi, Stay Hungry Stay Foolish, CIIE, IIM Ahmedabad*
7. *Bansal, Rashmi, (2013). Follow Every Rainbow, Westland.*
8. *Mitra, Sramana (2008), Entrepreneur Journeys (Volume 1), Booksurge Publishing*
9. *Abrams, R. (2006). Six-week Start-up, Prentice-Hall of India.*
10. *Verstraete, T. and Laffitte, E.J. (2011). A Business Model of Entrepreneurship, Edward Elgar Publishing.*
11. *Johnson, Steven (2011). Where Good Ideas comes from, Penguin Books Limited.*
12. *Gabor, Michael E. (2013), Awakening the Entrepreneur Within, Primento.*
13. *Guillebeau, Chris (2012), The $100 startup: Fire your Boss, Do what you love and work better to live more, Pan Macmillan*
14. *Kelley, Tom (2011),The ten faces of innovation, Currency Doubleday*
15. *Prasad, Rohit (2013), Start-up sutra: what the angels won't tell you about business and life, Hachette India.*

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include assignments/quizzes)	25

SEMESTER – VII

UEC705: IMAGE PROCESSING AND COMPUTER VISION

L	T	P	Cr
3	**1**	**0**	**3.5**

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.

Digital Image fundamentals: A Simple Image Model, Sampling and Quantization, Relationship between Pixel, Image Formats, Image Transforms.

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

Image Compression: Fundamentals, Image Compression Models, Elements of Information Theory, Error-Free Compression, Lossy Compression, Recent Image Compression Standards.

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.

Minor Project: *Image Compression and Facial Feature Detection with FPGA/ASIC/ARM/ DSP Processors.*

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:

1. Gonzalez, R.C., and Woods, R.E., Digital Image Processing, Dorling Kingsley (2009) 3rd ed.
2. Jain A.K., Fundamentals of Digital Image Processing, Prentice Hall (2007).
3. Sonka M., Image Processing and Machine Vision, Prentice Hall (2007) 3rd ed.
4. D. Forsyth and J. Ponce, Computer Vision - A modern approach, Prentice Hall.
5. B. K. P. Horn, Robot Vision, McGraw-Hill.
6. E. Trucco and A. Verri, Introductory Techniques for 3D Computer Vision, Prentice Hall.
7. Richard Szeliski, Computer Vision: Algos and Applications, Springer.

Reference Books:

1. Tekalp A.M., Digital Video Processing, Prentice Hall (1995).
2. Ghanbari M., Standard Codecs: Image Compression to Advanced Video Coding, IET Press (2003).

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	20
2	EST	40
3	Sessional (May include Assignments/Projects/Tutorials/ Quizes/Lab Evaluations)	40

UEC706: DATA COMMUNICATION AND COMPUTER NETWORKS

L	T	P	Cr
3	0	2	4.0

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.

Overview of Data Communication and Networking: Data communications, Networks, The Internet, Protocols and standards, Layered tasks, OSI model, TCP /IP protocol Architecture.

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.

Switching: Circuit Switching Networks, Concepts, Control Signaling, Softswitch Architecture, Packet switching, Packet size, X.25, Frame Relay, ATM, Message Switching.

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:

1. *Ferouzan, Behrouz A., Data Communications and Networking, TATA McGraw Hill (2002) 2nd ed.*
2. *Stallings William, Data and Computer Communication, Pearson Education (2000) 7th ed.*

Reference Books:

1. *Black, Ulylers D., Data Communication and Distributed Networks, PHI (1999) 3rd ed.*
2. *Tanenbaum, Andrew S., Computer Networks, PHI (2000) 2nd ed.*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/ Quizes/Lab Evaluations)	40

UEC722: SOFT COMPUTING

L	T	P	Cr
3	1	2	4.5

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

1. *Jang, J.S.R., Sun, C.T., and Mizutani, E., Neuro-Fuzzy and Soft Computing, Pearson Education (2004) 2nd ed.*
2. *Eberhart, R., Simpson, P., and Dobbins, R., Computational Intelligence - PC Tools, AP Professional (1996) 3rd ed.*

Reference Books:

1. *Jacek M. Zurada – Introduction to Artificial Neural Systems*
2. *S N Sivanandam, S N Deepa – Principles of Soft Computing, Wiley Publications*
3. *John Yen, Reza Langari – Fuzzy Logic Intelligence, Control, and Information*
4. *Goldberg, Davis E., Genetic Algorithms: Search, Optimization and Machine Learning, Wesley Addison (1989) 3rd ed*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	40

UHU005: HUMANITIES FOR ENGINEERS

L	T	P	Cr
2	0	2	3.0

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.

Motivational and Affective basis of Behaviour: Basic Motives and their applications at work. Components of emotions, Cognition and Emotion. Emotional Intelligence.

Group Dynamics and Interpersonal relationships.

Development of self and personality.

Transactional Analysis.

Culture and Mind.

Practicals:

1. Experiments on learning and behaviour modification.
2. Application of Motivation Theories: Need based assessment.
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

Values: Introduction to Values, Allport-Vernon Study of Values, Rokeach Value Survey, Instrumental and Terminal Values.
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.

Macroeconomic Issues: Gross domestic product (GDP), Inflation and Financial Markets.

Globalisation: Meaning, General Agreement on Trade and tariffs (GATT), World Trade Organisation (WTO). Global Liberalisation and its impact on Indian Economy.

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:

1. *Morgan, C.T., King, R.A., Weisz, J.R., & Schopler, J. Introduction to Psychology, McGraw Hill Book Co(International Student (1986).*
2. *A. N. Tripathi**,** Human Values**,** New Age International (P) Ltd (2009).*
2. *Krugman, Paul and Wells Robin, Economics, W.H. Freeman & Co Ltd. Fourth Edition (2015).*
3. *Rubinfeld Pindyck. Microeconomic Theory and application, Pearson Education New Delhi (2012).*
4. *Samuelson, Paul, A. and Nordhaus, William, D. Economics, McGraw Hill, (2009).*
5. *Mankiw, Gregory N. Principles of Macroeconomics, South-Western College Pub., (2014).*
6. *Gregory, Paul R. and Stuart, Robert C. The Global Economy and Its Economic Systems, 2013 South-Western College Pub (2013).*

Reference Books:

1. *Atkinson, R.L., Atkinson, R.C., Smith, E.E., Bem, D.J. and Nolen-Hoeksema, S. (2000). Hilgard's Introduction to Psychology, New York: Harcourt College Publishers.*
2. *Berne, Eric (1964). Games People Play – The Basic Hand Book of Transactional Analysis. New York: Ballantine Books.*
3. *Ferrell, O. C and Ferrell, John Fraedrich Business Ethics: Ethical Decision Making & Cases, Cengage Learning (2014).*
4. *Duane P. Schultz and Sydney Ellen Schultz, Theories of Personality, Cengage Learning, (2008).*
5. *Saleem Shaikh. Business Environment, Pearson (2007).*
6. *Chernilam, Francis International Buisness-Text and Cases, Prentice Hall (2013).*
7. *Salvatore, Dominick, Srivastav, Rakesh., Managerial Economics: Principles with Worldwide Applications, Oxford, 2012.*
8. *Peterson H. Craig. and. Lewis, W. Cris. Managerial Economics, Macmillan Pub Co; (1990).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	45
3	Sessionals (Include Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	30

ELECTIVE – I

UEC709: FIBER OPTIC COMMUNICATION

L	T	P	Cr
3	0	2	4.0

Course Objectives: To understand the optical fiber communication system, transmitter section, medium- the optical fiber, reciever 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.

Optical fibers and Their characteristics: Introduction to High frequency communication, Nature of light, Advantages of Optical communication, Fiber Structures, Wave guiding, Basic optical laws and Definition, Optical fiber modes and Configuration, Mode theory for circular waveguides, Single mode fibers, Graded index fiber, Fiber materials, Fabrication and mechanical properties, Fiber optic cables; Joints, Splices, Connectors, Attenuation, Signal distortion, Nonlinear properties, Dispersion and Polarization mode dispersion in optical fibers, Mode coupling, Specialty optical fibers, Design optimization of single mode fibers.

Optical sources and Amplifiers: Light emitting diodes, Semiconductor Laser, Various configurations of Semiconductor Laser, Performance parameters of LEDs and Semiconductor Lasers, Light source linearity, Modal partition and reflection noise, Reliability consideration; Power launching and coupling, Optical amplifiers: erbium doped fiber amplifier, semiconductor optical amplifier, Raman amplifier.

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, Preamplifier 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.

Advanced Optoelectronics: Integrated Optoelectronics, Fundamentals of Photonic Crystals, Photonic Crystal fiber, Nonlinear optical effects and their applications, Optical modulation technologies, Photonic switching.

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:

1. *Senior, John M., and Yousif Jamro, M., Optical fiber communications: principles and practice, Prentice Hall, (2009) 2nded.*
2. *Keiser, Gred, Optical Fiber Communications, Tata McGraw-Hill, (2008) 2nded.*

Reference Books:

1. *Ajoy Kumar Ghatak and K. Thyagarajan, Optical Electronics, Cambridge University Press (2001) 2nded.*
2. *Bahaa E. A. Saleh, Malvin C. Teich, Fundamentals of Photonics, John Wiley & Sons, (2013) 2nded.*

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	40
3.	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	35

UEC804: WIRELESS AND MOBILE COMMUNICATION

L	T	P	Cr
3	0	2	4.0

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.

Introduction to Wireless Communication Systems: History of Wireless Communication and Future Trends, Narrowband, Wideband, Ultra-Wideband Communication Systems, Description of 2G, 3G, 4G and Hybrid Communication Systems, Brief Introduction of Digital Modulation Techniques Like M-ary QAM and GMSK.

Cellular Concepts and System Design Fundamentals: Introduction to Cellular Concepts and Cellular System Design Fundamentals, Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of Service, Cell Splitting, Sectoring, Repeaters and Microcell Zone Concepts.

Mobile Radio Propagation and Fading: Introduction to Radio Wave Propagation, Free Space Propagation Model, Large-Scale Path Loss due to Reflection, Diffraction and Scattering, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings, Ray-Tracing and Site Specific Modelling; Small-Scale Fading and Multipath Propagation, Impulse Response Model of Multipath Channels, Parameters and Statistics, Doubly-Selective Wireless Fading Channels and Theory of Multipath Shape Factors, Nakagammi-m Fading Channel Model.

Multiple Access Techniques for Wireless Communications: Time-Division Multiple Access, Frequency-Division Multiple Access, Code-Division Multiple Access (DS-CDMA, WCDMA, Frequency-Hopped Spread Spectrum), Orthogonal-Frequency-Division Multiple Access, Space-Division Multiple Access and Multi-Carrier Communication Systems. Capacity and Probability of Symbol Error Calculations.

Equalization, Diversity and Channel Coding: Linear and Nonlinear Equalizers (Zero-Forcing and MMSE), Fractionally Spaced Equalizers, Wireless Diversity Techniques, RAKE Receiver, Brief Introduction of Channel Coding- Trellis Coding and Turbo-Coding, Interleaving and Viterbi Decoder.

Advanced Wireless Communication Systems: Brief Introduction of GSM Architecture, MIMO, STBC, STTC, BLAST Architectures, Cognitive Radio, Software Defined Radio and Reconfigurable-Hardware Applications in Wireless Communication Systems.

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:

1. *Rappaport, T.S., Wireless Communication-Principles and Practice, Pearson, (2000) 2nd Edition.*
2. *Haykin S & Moher M., Modern Wireless Communication, Pearson, (2005) 3rd Edition.*

Reference Books:

1. *Lee, William C. Y., Mobile Communication Design and Fundamentals, (1999) 4th Edition.*
2. *Pandya, R., Mobile and Personal Communication System, PHI (2002) 5th Edition.*
3. *IEEE Journal on Selected Areas in Communications*
4. *IEEE Communications Magazine*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	40
3	Sessional (May include Assignments/Projects/Quizes/Lab Evaluations)	35

UCS508: GRAPHICS AND VISUAL COMPUTING

L	T	P	Cr
3	**0**	**2**	**4.0**

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 (planetry 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:

1. *Donald D Hearn, M. Pauline Baker, Computer Graphics C version, Pearson Education.*
2. *Dave Shreiner, Mason Woo, Jackie Neider, Tom Davis, OpenGL Programming Guide: The Official Guide to Learning OpenGL, (2013).*

Reference Books:

1. *James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes, Computer Graphics: Principles & Practice in C, Addison Wesley Longman.*
2. *Zhigang Xiang, Roy A Plastock, Computer Graphics, Schaums Outline, TMH.*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	20
2	EST	40
3	Sessionals(Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UEC747: ANTENNA AND WAVE PROPAGATION

L	T	P	Cr
3	0	2	4.0

Course Objective: Students will be able to understand vector theory, antenna basic parameters, linear wire antennas, antenna arrays and their patterns, folded dipole, Yagi Uda, loop and Microstrip antenna, wave propagation over ground, through troposphere and ionosphere.

Review of vector theory: Vector algebra, Cartesian coordinate system, dot product, cross product, other coordinate systems.

Introduction to Basic Antenna parameters: Radiation pattern, Radiation intensity, Beam width, Gain, Directivity, Polarization, Bandwidth, Efficiency, Side lobes, Side lobe level, Antenna Vector Effective Length and Equivalent Areas, Maximum Directivity and Maximum Effective Area, Friss Transmission Equation and Radar Range Equation, Plane wave and Properties of uniform plane waves.

Radiation Integrals and Auxiliary Potential Functions: Retarded vector and scalar potential, Vector Potential A for an Electric Current Source J, Vector Potential F for a Magnetic Current Source M, Electric and Magnetic Fields for Electric (J) and Magnetic (M) Current Sources.

Linear Wire Antennas: Radiation from an infinitesimal small current element, Radiation from an elementary dipole (Hertzian dipole), Small Dipole, Finite length dipole, Half wave dipole,Linear Elements Near or on Infinite Perfect Conductors, Monopole antenna, Folded dipole and Yagi Uda antenna.

Antenna Arrays: Two-Element Array, Broadside arrays, End fire arrays. N-Element Linear Array: Uniform Amplitude and Spacing, N-Element Linear Array: Directivity, N-Element Linear Array: Uniform Spacing, Non uniform Amplitude, Binomial Array, Chebyshev Arrays, Principle of pattern multiplication. Array pattern Synthesis.

Microstrip Antennas: Microstrip Antennas & their advantages, Media: Dielectric effect, Dielectric Loss Tangent- tan δ, Substrates,

Propagation of Radio Waves: Different modes of propagation: Ground waves, Space waves, Space wave propagation over flat and curved earth, Surface waves and Troposphere waves, Wave propagation in the Ionosphere, Critical frequency, Maximum usable frequency (MUF), Skip distance, Virtual height

Laboratory Work: Drive antenna by voltage, Radiation pattern of half wave dipole, Radiation pattern of monopole, Effective height of antenna, Radiation pattern of capacitance and inductive loaded antenna, Directional radiation from two composite antennas, Radiation from conducting sheet with slot, Matching stub in antenna, Measure the SWR, Radiation polar diagram of directional antenna.

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

1. identify basic antenna parameters
2. design and analyze wire antennas
3. design and analyze antenna arrays
4. to identify characteristics of radio wave propagation
5. perform various antenna measurements

Text Books:

1. *Antenna Theory, Ballanis, John Wiley & Sons, 2003.*
2. *Antennas and Radio Propagation, Collins, R. E, McGraw-Hill,1987.*

Reference Books:

1. *Antennas, Kraus and Ronalatory Marhefka, John D., Tata McGraw-Hill, 2002.*
2. *Microwave & RF Design, Michael Steer, Sci.Tech Publishing, 2009.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/ Quizes/Lab Evaluations)	40

UEC512: LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

L	T	P	Cr
3	0	2	4.0

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

Operational amplifier: various characteristics of op-amp, CMRR, PSRR, Internal structure of Op-amp, Ideal Op-amp.Inverting and Non-Inverting Configuration, Ideal Open-Loop and CLO ssed-Loop Operation of Op-Amp, Feedback Configurations: Voltage-Series Feedback Amplifier, Voltage-Shunt Feedback Amplifier, Differential Amplifiers with One & Two Op-Amps

Frequency Response of an Op-Amp: Introduction to Frequency Response, Compensating Networks, Frequency Response of Internally Compensated Op-Amp, Frequency response of Non-compensated Op-Amp, CLO ssed-Loop Frequency Response.

General Applications: DC & AC Amplifiers, Peaking Amplifier, Summing, Scaling and Averaging amplifier, Instrumentation Amplifier, The Integrator, The Differentiator, Log and Antilog Amplifier, Comparator, Zero Crossing Detector, Schmitt Trigger, Sample and Hold Circuit, Clippers and Clampers etc.

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.

Specialized IC Applications: Introduction, The 555 Timer, Monostable and Astable Multivibrator using IC 555, Phase-Locked Loop (PLL), Voltage Regulators.

Laboratory Work: Inverting and Non Inverting Characteristics of an Op-Amp,Measurement of Op-amp parameters, Op-amp as integrator & differentiator, comparator, Schmitt trigger, Converter (ADC, DAC), square wave generator, Sawtooth waveform generator, precision half wave and full wave rectifiers, log-antilog amplifier, 555 as an astable, monostable and bi-stable multivibrators, active filters.

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.

Text Books:

1. *Ramakant A. Gayakwad, 'OP-AMP and Linear IC's', Prentice Hal, 1999.*
2. *Sergio Franco, 'Design with operational amplifiers and analog integrated circuits', McGraw-Hill, 2002.*

Reference Books:

1. *D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000.*
2. *J. Michael Jacob, 'Applications and Design with Analog Integrated Circuits', Prentice Hall of India, 2002.*

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	40
3.	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	35

ELECTIVE – II

UCS727: NETWORK SECURITY

L	T	P	Cr
3	1	2	4.5

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:
Introduction: Security Attacks, Security Services, Security Mechanisms and Principles, Security goals, malicious software, Worms, Viruses, Trojans, Spyware, Botnets

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

Security Vulnerabilities: DoS attacks, Buffer Overflow, Race Conditions, Access Control Problems, Spoofing and Sniffing attacks, ARP Poisoning, Social Engineering and countermeasures.

Internet Security: TCP/IP Security, Secure Sockets Layer (SSL), Transport Layer Security (TLS), HTTPS, Secure Shell (SSH), IPsec, Email Security, DNS Security, DNSSEC, Authentication Protocols

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

System Security: Firewalls, Types: Packet filter (stateless, stateful), Application layer proxies, Firewall Location and Configurations, Intruders, Intrusion Detection System, Anomaly and misuse detection.

Wireless Network Security: IEEE 802.11i Wireless LAN Security, Wireless Application Protocol Overview, Wireless Transport Layer Security, WAP End-to-End 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:

1. Network Security Essentials, William Stallings, Prentice Hall (2013), 5th Ed.

Reference Books:

1. Firewalls and Internet Security, William R. Cheswick and Steven M. Bellovin, Addison-Wesley Professional (2003), 2nd Ed.

2. *Cryptography and Network Security, W. Stallings, Prentice Hall (2010), 5th Ed.*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	20
2	EST	40
3	Sessionals(Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UCS728: SOFTWARE ENGINEERING

L	T	P	Cr
3	1	2	4.5

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 Engineering and Processes: Introduction to Software Engineering, Software Evolution, Software Characteristics, Software Crisis: Problem and Causes, Software process models (Waterfall, Incremental, and Evolutionary process models and Agile), Software quality concepts, process improvement, software process capability maturity models, Personal Software process and Team Software Process, Overview of Agile Process.

Requirements Engineering: Problem Analysis, Requirement elicitation and Validation, Requirements modeling: Scenarios, Information and analysis classes, flow and behavioral modeling, documenting Software Requirement Specification (SRS).

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 Verification and Validation: Levels of Testing, Functional Testing, Structural Testing, Test Plan, Test Case Specification, Software Testing Strategies, Verification & Validation, Unit, Integration Testing, Top Down and Bottom Up Integration Testing, Alpha & Beta Testing, White box and black box testing techniques, System Testing and Debugging.

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.

Advanced Topics: Formal specification, CASE Tools, Software Business Process Reengineering, Configuration Management.

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.

Text Books:

1. *Pressman R., Software Engineering, A Practitioner's Approach, McGraw Hill International (2014), 8th ed.*
2. *Sommerville I., Software Engineering, Addison-Wesley Publishing Company (2010) 9th ed.*

Reference Books:

1. *Jalote P., An integrated Approach to Software Engineering, Narosa(2005).*
2. *Booch G.,Rambaugh J., Jacobson I., The Unified Modeling Language User Guide (2005), 2nd ed.*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	20
2	EST	40
3	Sessionals(Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UEC622: DSP PROCESSORS

L	T	P	Cr
3	1	2	4.5

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.

Processors: Architecture and instruction set of TMS320C3X, TMS320C5X, TMS320C67XX, some example programs. Development tools for Programmable DSPs, An introduction to Code Composer Studio.

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

1. *Lapsley, P., Bier, J., Shoham, A. and Lee, E.A., DSP Processor Fundamentals: Architecture and Features, IEEE Press Series on Signal Processing, IEEE (2000).*
2. *Venkataramani, B. and Bhaskar, M., Digital Signal Processor: Architecture, Programming and Applications, Tata McGraw Hill (2003).*
3. *TI DSP reference set (www.ti.com).*

Reference Books:

1. *Padmanabhan, K., Ananthi, S. and Vijayarajeswaran, R., A practical Approach to Digital Signal Processing, New Age International Pvt. Ltd (2001).*
2. *Babast, J., Digital Signal Processing Applications using the ADSP-2100 family, PHI (1992).*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/ Quizes/Lab Evaluations)	40

UEC748: VIDEO SIGNAL PROCESSING

L	T	P	Cr
3	1	2	4.5

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 (CLO):

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:

1. Iain E. Richardson, THE H.264 ADVANCED VIDEO COMPRESSION STANDARD, John Wiley and Sons, Ltd., 2003.

Reference Books:

1. *Alan C. Bovik, The Essential Guide to Video Processing, Academic Press; 2009*
2. *J. W. Woods, Multidimensional Signal, Image, and Video Processing and Coding, Academic Press, 2011.*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessional (May include Assignments/Projects/Tutorials/ Quizes/Lab Evaluations)	25

UCS729: PARALLEL & DISTRIBUTED COMPUTING

L	T	P	Cr
3	1	2	4.5

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:

1. *C Lin, L Snyder. Principles of Parallel Programming. USA: Addison-Wesley (2008).*
2. *A Grama, A Gupra, G Karypis, V Kumar. Introduction to Parallel Computing, Addison Wesley (2003), 2nd Ed.*

Reference Books:

1. *B Gaster, L Howes, D Kaeli, P Mistry, and D Schaa. Heterogeneous Computing With Opencl. Morgan Kaufmann and Elsevier (2011).*
2. *T Mattson, B Sanders, B Massingill. Patterns for Parallel Programming. Addison-Wesley (2004).*
3. *Quinn, M. J.,Parallel Programming in C with MPI and OpenMP, McGraw-Hill (2004).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	20
2	EST	40
3	Sessionals(Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

UCS730: MOBILE APPLICATION DEVELOPMENT

L	T	P	Cr
3	1	2	4.5

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**.**

Naïve 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 Multimodial 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:

1. *Jeff Mcwherter, Scott Gowell, Professional Mobile Application Development, Wrox Publisher (2012), 1st Ed.*

Reference Books:

1. *Lauren Darcy, Shane Conder, Sams Teach Yourself Android Application Development in 24 Hrs, 1st ed.*
2. *Himanshu Dwivedi, Chris Clark, David Thiel, Mobile Application Security, Tata McGraw Hill (2010), 1st Ed.*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	20
2	EST	30
3	Sessionals (Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	50

ELECTIVE - III

UCS736: CLOUD COMPUTING

L	T	P	Cr
3	1	0	3.5

Course objective: At the end of the course the student should be able to appreciate the benefits of cloud computing and apply cloud paradigms for evolving businesses. He should be familiar 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.

Cloud Computing delivery Models: Cloud based services: Iaas , PaaS and SaaS Infrastructure as a Service (IaaS):Introduction to IaaS, Resource Virtualization i.e. Server, Storage and Network virtualization Platform as a Service (PaaS):Introduction to PaaS, Cloud platform & Management of Computation and Storage, Azure, Hadoop, and Google App. Software as a Service (SaaS):Introduction to SaaS, Cloud Services, Web services, Web 2.0, Web OS Case studies related to IaaS, PaaS and SaaS.

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 (CLO):
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.

Text Books:

1. *Rajkumar Buyya, James Broberg and Goscinski Author Name, Cloud Computing Principles and Paradigms, John Wiley and Sons 2012, Second Edition*
2. *Gerard Blokdijk, Ivanka Menken,The Complete Cornerstone Guide to Cloud Computing Best Practices, Emereo Pvt Ltd, 2009, Second Edition*

Reference Books:

1. *Anthony Velte, Toby Velte and Robert Elsenpeter , Cloud Computing: A practical Approach Tata McGrawHill, 2010, Second Edition*
2. *Judith Hurwitz, Robin Bllor, Marcia Kaufmann, Fern Halper, Cloud cOmputing for Dummies, 2009, Third Edition*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	30
2	EST	45
3	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

UEC854: ASIC and FPGA

L	T	P	Cr
3	1	0	3.5

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.

Detail contents:
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).

Combinational Circuit Design: Components of Combinational Design - Multiplexer and Decoder, Multiplexer Based Design of Combinational Circuits, Implementation of Full Adder using Multiplexer, Decoder Implementation of Full Adder using Decoder.

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 Clocked 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 Clock, XSV FPGA Board Features, Testing of FPGA Board, Setting the XSV Board Clock Oscillator Frequency, Downloading Configuration Bit Streams.

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

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

1. Utilize the top-down design methodology in the design of complex digital devices such as fpgas/ asics.
2. Learn modern hardware/software design tools to develop modern digital Systems
3. Design and verification of integrated circuits chips
4. Design and implement different Field Programmable Gate Array (FPGA)
5. Learn architectures and their applications to real life

Text Book:

1. Smith, Michael., Application-Specific Integrated Circuits, Addison-Wesley Professional, (2008) 1st ed.
2. Wolf, W., FPGA-based System Design, PH/Pearson, (2004) Cheap ed.

Reference Books:

1. *Steve Kilts, Advanced FPGA Design, Wiley Inter-Science, Jhon weilly & sons, (2007) 4th ed.*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	20
2	EST	30
3	Sessionals (Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	50

UEC741: ARTIFICIAL INTELLIGENCE

L	T	P	Cr
3	1	0	3.5

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:

1. *Rich E., Artificial Intelligence, Tata McGraw Hills (2009) 3rd ed.*
2. *George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education Asia (2009) 6th ed.*

Reference Books:

1. *Patterson D.W, Introduction to AI and Expert Systems, Mc GrawHill (1998), 1st ed.*
2. *Shivani Goel, Express Learning- Artificial Intelligence, Pearson Education India (2013), 1st ed.*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	20
2	EST	40
3	Sessionals (Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

ELECTIVE – IV

UEI718 - VIRTUAL INSTRUMENTATION ENGINEERING

L	T	P	Cr
2	1	2	3.5

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, SCXl, 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:

1. *Johnson, G., LabVIEW Graphical Programming, McGraw-Hill (2006).*
2. *Sokoloft, L., Basic Concepts of LabVIEW 4, Prentice Hall Inc. (2004).*
3. *Wells, L.K. and Travis, J., LabVIEW for Everyone, Prentice Hall Inc. (1996).*

Reference Book:

1. *Gupta, S. and Gupta, J.P., PC Interfacing for Data Acquisition and Process Control, Instrument Society of America (1988*

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional (May include Assignments//Quizes/Lab Evaluations)	40

UMA062 Graph Theory and Applications

L	T	P	Cr
2	1	2	3.5

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.

Application of Graphs and Trees: Konigsberg bridge problem, Utilities problem, Electrical network problem, Seating problem, Chinese postman problem, Shortest path problem, Job sequence problem, Travelling salesman problem, Ranking the participant in a tournament, Graph in switching and coding theory, Time table and exam scheduling, Applications of tree and graph in computer science.

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).
2) West, D. B., Introduction to Graph Theory, Pearson Education (2008)

Reference Books:

1) Bondy, J. A. and Murty, U.,S.,R., Graph Theory with Applications, North Holland Publication (2000).
2) Rosen, K. H., Discrete Mathematics and its Applications, Tata McGraw Hill (2007).

Evaluation Scheme:

Sr.No.	Evaluation Elements	Weight age (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include assignments/quizzes)	25

UEC855: SPEECH PROCESSING

L	T	P	Cr
2	1	2	3.5

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.

Introduction: Review of digital signal and systems, Transform representation of signal and systems, STFT, Goertzel algorithm, Chirp algorithm, Digital filters and filter banks.

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 toemerging 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:

1. *L. R. Rabiner and R. W. Schaffer, "Digital Processing of Speech signals", Prentice Hall, 2010.*
2. *B. Gold and N. Morgan, "Speech and Audio Signal Processing", John Wiley and Sons Inc., 2011.*

Reference Books:

1. *T.F.Quatieri, "Discrete-Time Speech Signal Processing", Prentice Hall, 2002.*
2. *L.R. Rabiner and B. H. Juang, "Fundamentals of speech recognition", Prentice Hall, 1993.*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	20
2	EST	40
3	Sessional (May include Assignments/Projects/Tutorials/ Quizes/Lab Evaluations)	40

ELECTIVE – V

UEC862: IC FABRICATION TECHNOLOGY

I	T	P	Cr
3	0	0	3.0

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, MOCVDDefects in epitaxial layers and their removal.

Diffusion: Impurity diffusion in a semiconductor crystal. Fick's Laws, Gaussian and Complementary Error Function Distribution of Impurities.Properties of diffusion.

Subsequent Processes: Oxidation, Ion-implantation, Photolithography, Electron beam and X-Ray lithography, Different printing techniques, +ve& -ve Photo resist, dry and wet Etching, Metallization, and Clean room: Standards, Exposure Tools.

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

Passive Components for IC's: Analog, Linear and Non-linear I.C's. Digital I.C's. Digital I.C's like TTL, ECL, HTL, Video I.C's, Tuners like 555 and 556: internal circuits and their operation.

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:

1. *Sze, S. M., VLSI Technology, Wiley Eastern, USA (1999) 2nd ed.*
2. *Sze, S. M., Semiconductor Devices, Physics & Technology, (2001) 3rd ed.*

Reference Books:

1. *Pucknell and Eshraghian, Basic VLSI Design, (2000) 2nd edition*
2. *Nagchoudhri, D., Principles of Microelectronics Technology (2002) 4th edition.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	50
3.	Sessional (May include Assignments/Projects/Tutorials/ Quizes)	20

UEC863: VLSI INTERCONNECTS

L	T	P	Cr
3	0	0	3.0

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

Introduction: Technology trends, Device and interconnect scaling ,Interconnect Models: RC model and RLC model, Effect of capacitive coupling, Effect of inductive coupling, Transmission line model, Power dissipation, Interconnect reliability.

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.

Interconnect Analysis: Time domain analysis: RLC network analysis, RC network analysis and responses in time domain, S domain analysis, circuit reduction via matrix approximation, Analysis using moment matching, transmission lines: step input response.

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:

1. *Chung-Kang Cheng,John Lillis,Shen Lin and Norman H.Chang, "Interconnect Analysis and Synthesis",A wiley Interscience Publication(2000).*
2. *Sung-Mo (Steve) Kang, Yusuf Leblebigi, "CMOS Digital integrated circuits analysis and design", by Tata Mcgraw-Hill, (2007).*

Reference Books:

1. *L.O.Chua,C.A.Desoer,and E.S.Kuh, "Linear and Non linear circuits",McGraw-Hill,1987.*
2. *R.E.Matrick, "Transmission lines for digital and communication networks", IEEE press,1995.*
3. Mauricio Marulanda, *"Electronic properties of Carbon Nanotubes",InTech publisher 2011.*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	50
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	20

UEC858: MODERN CONTROL THEORY

L	T	P	Cr
3	0	0	3.0

Course Objective: This course provides the insight of the fundamentals of modern control theory by analysing time and frequency response of open and CLO ssed 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.

System Stability: Conditions for stability of linear systems, Algebraic Stability criteria - Hurwitz criterion, Routh criterion, Root locus techniques, Frequency domain analysis, Correlation between frequency response and transient response, Polar plots, Nyquist plots, Bode plots.

Classical Controller Design Methods: General aspects of the CLO ssed-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 (CLO S): 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:

1. *Nagrath, I. J., and Gopal, M., Control Systems Engineering, New Age International Publishers, 2006, 4th ed.*
2. *Benjamin C. Kuo, Automatic Control Systems, Pearson education, 2003*
3. *G F Franklin, J D Powell and M Workman 'Digital Control of Dynamic Systems', 1997, 3rd ed.*
4. *M. Gopal, Digital Control and State Variable Methods, McGraw-Hill, 2008.*

Reference Books:

1. *Ogata, Katsuhiko, Modern Control Engineering, Prentice-Hall, (2010) 5th ed.*
2. *Warwick, Kevin, An Introduction to Control Systems, World Scientific Publishing Co. Ptv. Ltd, (1996) 2nd ed.*
3. *Levine, W. S., Control System Fundamentals, CRC Press, (2000) 3rd ed.*
4. *Mutambara, Arthur G. O., Design and Analysis of Control Systems, CRC Press, (1999) 2nd ed.*

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	50
3.	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	20

UEC859: INTEGRATED SYSTEM DESIGN

L	T	P	Cr
2	0	2	3.0

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 Elementsand 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 Poject: 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:

1. *Bhaskar, J., A VHDL Primer, Pearson Education/ Prentice Hall (2006)3rd Ed.*
2. *Palnitkar, Samir, Verilog HDL, Prentice Hall, 2nd Edition,*

Reference Books:

1. *Ashenden, P., The Designer's Guide To VHDL, Elsevier (2008) 3rd Ed.*

2. *Donald E. Thomas, Philip R. Moorby, Donald B. Thomas, The Verilog HDL, Kluwer Academic Publication, 5th Edition, 2002,*
3. *Chu Pong P., FPGA Prototyping by VHDL / Verilog Examples, Wiley (2008)*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional (May include Assignments/Projects/Tutorials/ Quizes/Lab Evaluations)	40

GENERIC ELECTIVES

UPH063 NANOSCIENCE AND NANOMATERIALS

L	T	P	Cr
3	0	0	3.0

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:

1. *Booker, R., Boysen, E., Nanotechnology, Wiley India Pvt, Ltd, (2008)*
2. *Rogers, B., Pennathur, S., Adams, J., Nanotechnology, CRS Press (2007)*
3. *Bandyopadhyay, A,K., Nano Materials, New Age Int,, (2007)*
4. *Niemeyer, C. N., and Mirkin, C, A., Nanobiotechnology: Concepts, Applications and Perspectives, Wiley VCH, Weinhein, Germany (2007)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
	EST	55

UEN004 TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT

L	T	P	Cr
3	0	0	3.0

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

1. *Kirkwood, R,C, and Longley, A,J, (Eds,), Clean Technology and the Environment, Chapman & Hall, London (1995),*
2. *World Bank Group; Pollution Prevention and Abatement Handbook – Towards Cleaner Production, World Bank and UNEP; Washington DC (1998),*
3. *Modak, P,, Visvanathan, C, and Parasnis, M,, Cleaner Production Audit, Course Material on Cleaner Production and Waste Minimization; United Nations Industrial Development Organization (UNIDP) (1995),*
4. *Rao, S, and Parulekar, B,B,, Energy Technology: Non-conventional; Renewable and Conventional; Khanna Pub,(2005) 3rd Ed,*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UHU009 INTRODUCTION TO COGNITIVE SCIENCE

L	T	P	Cr
3	0	0	3.0

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.
Cognitive architectures: Tripartite architecture, Integration, ACT-R Architecture Modularity.

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
1. *Bermúdez, J.L., Cognitive Science: An Introduction to the Science of the Mind (2nd Ed,), Cambridge, UK: Cambridge (2014).*

2. *Friedenberg ,J,D, and Silverman,G, Cognitive Science: An Introduction To The Study Of Mind, Sage Publications:, London* (2014)
3. *Thagard, P., Mind: An introduction to Cognitive Science, MIT Press, (2005)*
4. *Thagard, P., (1998) Mind Readings: Introductory Selections on Cognitive Science, MIT Press, Cambridge, Mass,*

Evaluation Scheme:

Sr. No.	**Evaluation Elements**	**Weightage (%)**
1	MST	45
2	EST	55

UHU008 INTRODUCTION TO CORPORATE FINANCE

L	T	P	Cr
3	0	0	3.0

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.
Security valuation: Bond features, bond valuation, bond yields, bond risks, stock features, common stock valuation, and dividend discount & dividend growth models. Common stock yields, preferred stock valuation.

Recommended Books:

1. *Brealey, R. A., Myers. S.C., Allen, F., Principles of Corporate Finance (9th edition), The McGraw-Hill, London, (2006).*
2. *Ehrhardt, M.C., Brigham, E.F., Financial Management: Theory and Practice (10th edition) South Western-Cengage, New York (2011)*
3. *Van Horne, J.C., Wachowicz, J.M., Kuhlemeyer, G.A., 2005, Fundamentals of Financial Management, Pearson, Vancouver (2010)*
4. *Pandey, I. M., Financial management, Vikas Publishing House Pvt. Ltd., Noida (2011)*
5. *Elton, E.J. and Gruber, M.J., Modern Portfolio Theory and Investment Analysis, (7th Edition), John Wiley and Sons, New York (2007)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UMA062 GRAPH THEORY AND APPLICATIONS

L	T	P	Cr
3	**0**	**0**	**3.0**

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.
Application of Graphs and Trees: Konigsberg bridge problem, Utilities problem, Electrical network problem, Seating problem, Chinese postman problem, Shortest path problem, Job sequence problem, Travelling salesman problem, Ranking the participant in a tournament, Graph in switching and coding theory, Time table and exam scheduling, Applications of tree and graph in computer science.

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)*
2. *West, D. B., Introduction to Graph Theory, Pearson Education, London (2008)*
3. *Bondy, J. A. and Murty, U.S.R., Graph Theory with Applications, North Holland Publication, London (2000)*
4. *Rosen, K. H., Discrete Mathematics and its Applications, Tata-McGraw Hill, New Delhi (2007)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UMA061 ADVANCED NUMERICAL METHODS

L	T	P	Cr
3	0	0	3.0

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 - Vitae 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
1) *Gerald, C.F. and Wheatley, P.O., Applied Numerical Analysis, Pearson Education (2008) 7th ed.*
2) *Gupta, S.R., Elements of Numerical Analysis, MacMillan India (2009).*
1) *Atkinson, K.E., An introduction to Numerical Analysis, John Wiley (2004) 2nd ed.*
2) *S.D. Conte, S.D. and Carl D. Boor, Elementary Numerical Analysis: An Algorithmic Approach, Tata McGraw Hill (2005).*
3) *Jain M. K., Iyengar. S.R.K. and Jain, R.K. Numerical Methods for Scientific and Engineering Computation, New Age International (2008) 5th ed.*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UHU006 INTRODUCTORY COURSE IN FRENCH

L	T	P	Cr
3	0	0	3.0

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.

Grammar : Pronouns: Pronom sujets (Je/ Tu/Il/Elle/Nous/Vous/Ils/Elles), Nouns: Genders, Articles: Definite article and Indefinite articles, Verbs: Regular verbs (-er, -ir ending) Irregular verbs (-re ending), Auxiliary verbs (avoir, être, aller). Adjective: Description, Adjective possessive, Simple Negation, Tense: Present, Future, Questions, Singular & plural.

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.
5. Write simple messages, letters, composition and dialogues. Complete simple forms and documents.
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*
3. *Version Originale-1: Méthode de français by Monique Denyer, Agustin Garmendia.*
4. *Marie-Laure Lions-Olivieri, Editions Maison des Langues, Paris 2009*
5. *Latitudes-1 : Méthode de français by Régine Mérieux, Yves Loiseau, Editions Didier*
6. *Campus-1 : Méthode de français by Jacky Girardet, Jacques Pécheur, Editions CLE International.*
7. *Echo-1 : Méthode de français by J. Girardet, J. Pécheur, Editions CLE International.*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UBTxxx BIOLOGY FOR ENGINEERS

L T P Cr
3 0 0 3.0

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:
Characteristics of life: Living versus non-living organisms, origin of life, theory of evolution, diversity of life, classification of life into animals, plants, fungi, protists, archea and bacteria. Phylogenetics and its relationship with evolution.
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:

1. *Nelson, D.L., Cox, M.M., Lehninger: Principles of Biochemistry, WH Freeman (2008) 5th ed.*
2. *Dhami, P.S., Srivastava, H.N. Chopra, G., A Textbook of Biology, Pradeep Publications (2008).*
3. *Das, H.K., Textbook of Biotechnology, John Wiley & Sons (2004) 3rd Edition.*
4. *Gardner, E.J., Simmons, M., Peter, S.D., Principles of Genetics, John Wiley & Sons (2008)*
5. *Albert, B., Essential Cell Biology, Taylor & Francis, London (2009)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
	MST	45
2	EST	55

UCS001 INTRODUCTION TO CYBER SECURITY

L	T	P	Cr
3	0	0	3.0

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.

Introduction: Introduction to Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control, and Cryptography, Authentication, Access Control, Cryptography
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
Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Rootkit
Network Security: Network Concepts, Threats to Network Communications, Wireless Network Security, Denial of Service, Distributed Denial-of-Service Strategic Defenses: Security Countermeasures, Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management
Cloud Computing and Security: Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS
Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, Where the Field Is Headed
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
Emerging Topics: The Internet of Things, Economics, Computerized Elections, Cyber Warfare.

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:

1. *Pfleeger, C.P., Security in Computing, Prentice Hall, 5th edition (2010)*
2. *Schneier, B., Applied Cryptography, Second Edition, John Wiley & Sons (1996)*
3. *Rhodes-Ousley, M., Information Security: The Complete Reference, Second Edition, Information Security Management: Concepts and Practice. New York, McGraw-Hill, (2013).*
4. *Whitman, M.E. and Herbert J. M., Roadmap to Information Security for IT and Infosec Managers, Course Technology, Boston, MA (2011).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55

UHU007 EMPLOYABILITY DEVELOPMENT SKILLS

L	T	P	Cr
0	3	3	3.0

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:

1. *Harvard Business Essentials; Creating Teams with an Edge; Harvard Business School Press (2004)*
2. *Edward de B., Six Thinking Hats; Penguin Life (2016)*
3. *Daniel, G., Working with Emotional Intelligence; Bantam Books (2000)*
4. *Aggarwal, R.S., Quantitative Aptitude for Competitive Examinations; S Chand (2017)*
5. *Agarwal, A., An expert guide to problem solving: with practical examples; CreateSpace Independent Publishing Platform (2016)*
6. *William, D., The Logical Thinking process; American Society for Quality (2007)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55