THAPAR UNIVERSITY

Revised

Course Scheme

&

Syllabus

For

B.E.

Electronics

&

Computer Engineering

2015

ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT

SEMESTER-I

Sr. No.	Course No.	Title	L	T	P	Cr
1	UMA003	MATHEMATICS-I	3	1	0	3.5
2	UTA007	COMPUTER PROGRAMMING – I	3	0	2	4.0
3	UCB008	APPLIED CHEMISTRY	3	1	2	4.5
4	UES009	MECHANICS	2	1	0	2.5
5	UEC001	ELECTRONIC ENGINEERING	3	1	2	4.5
6	UEN002	ENERGY & ENVIRONMENT	3	0	0	3.0
		TOTAL	**17**	**4**	**6**	**22.0**

SEMESTER-II

Sr. No.	Course No.	Title	L	T	P	Cr
1	UMA004	MATHEMATICS-II	3	1	0	3.5
2	UPH004	APPLIED PHYSICS	3	1	2	4.5
3	UEE001	ELECTRICAL ENGINEERING	3	1	2	4.5
4	UHU003	INTRODUCTION TO PROFESSIONAL COMMUNICATION	2	0	2	3.0
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**

SEMESTER-III

Sr. No.	Course No.	Title	L	T	P	Cr
1	UEC301	ANALOG ELECTRONIC CIRCUITS	3	1	2	4.5
2	UMA007	NUMERICAL ANALYSIS	3	1	2	4.5
3	UES012	ENGINEERING MATERIALS	3	1	2	4.5
4	UHU005	HUMANITIES FOR ENGINEERS	2	0	2	3.0
5	UEC404	SIGNALS AND SYSTEMS	3	1	2	4.5
6	UTA010	ENGINEERING DESIGN-II (6 SELF EFFORT HOURS)	1	0	2	5.0
		TOTAL	**15**	**4**	**12**	**26.0**

SEMESTER-IV

Sr. No.	Course No.	Title	L	T	P	Cr
1	UES010	SOLIDS AND STRUCTURES	3	1	2	4.5
2	UMA031	OPTIMIZATION TECHNIQUES	3	1	0	3.5
3	UES011	THERMO-FLUID	3	1	2	4.5
4	UTA002	MANUFACTURING PROCESSES	2	0	3	3.5
5	UEC405	MICROPROCESSORS AND THEIR APPLICATIONS (WITH PROJECT) (7 SELF EFFORT HOURS)	3	1	2	8.0
6	UTA011	ENGINEERING DESIGN-III (8 SELF EFFORT HOURS)	2	0	4	8.0
7	UEC591	SIX WEEKS SUMMER TRAINING	-	-	-	4.0
		TOTAL	**16**	**4**	**13**	**36.0**

SEMESTER-V

Sr. No.	Course No.	Title	L	T	P	Cr
1	UEC502	DIGITAL SIGNAL PROCESSING	3	1	2	4.5
2	UCS303	OPERATING SYSTEMS	3	0	2	4.0
3	UEC510	COMPUTER ARCHITECTURE	3	1	0	3.5
4	UEC401	ANALOG COMMUNICATION SYSTEMS	3	1	2	4.5
5	UCS406	DATA STRUCTURES AND ALGORITHMS (WITH 2 SELF EFFORT HOURS)	3	0	4	6.0
6	UEC612	DIGITAL SYSTEM DESIGN	3	1	2	4.5
		TOTAL	**18**	**5**	**10**	**27.0**

SEMESTER-VI

Sr. No.	Course No.	Title	L	T	P	Cr
1	UCS611	MACHINE LEARNING	3	0	0	3.0
2	UTA012	INNOVATION AND ENTREPRENEURSHIP (5 SELF EFFORT HOURS)	1	0	2	4.5
3	UCS304	INFORMATION MANAGEMENT SYSTEMS (WITH 2 SELF EFFORT HOURS)	3	0	4	6.0
4	UEC607	DIGITAL COMMUNICATION	3	0	2	4.0
5	UEC608	EMBEDDED SYSTEMS	2	0	2	3.0
6	UEC609	MOS CIRCUIT DESIGN	3	0	2	4.0
7	UEC797	CAPSTONE PROJECT (STARTS) (4 SELF EFFORT HOURS)	-	-	2	-
		TOTAL	**15**	**0**	**14**	**24.5**

SEMESTER-VII

Sr. No.	Course No.	Title	L	T	P	Cr
1	UEC722	SOFT COMPUTING	3	1	2	4.5
2	UEC705	IMAGE PROCESSING AND COMPUTER VISION	3	1	0	3.5
3	UEC706	DATA COMMUNICATION AND PROTOCOL	3	1	0	3.5
4		ELECTIVE –I	3	0	2	4.0
5		ELECTIVE –II	3	1	2	4.5
6	UEC797	CAPSTONE PROJECT (COMPLETION) (8 SELF EFFORT HOURS)	-	-	2	8.0
		TOTAL	**15**	**3**	**8**	**28.0**

SEMESTER-VIII

Sr. No.	Course No.	Title	L	T	P	Cr
1	UEC892	PROJECT SEMESTER				20.0
	OR					
1		ELECTIVE –III	3	1	0	3.5
2		ELECTIVE –IV	2	1	2	3.5
3	UEC893	PROJECT	-	-	20	13.0
		Total				**20.0**
		OR				
	UEC896	START-UP SEMESTER	0	0	0	20.0

List of Electives

Department Elective –I

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1	UEC709	FIBER OPTICS COMMUNICATION	3	0	2	4.0
2	UCS508	GRAPHICS AND VISUAL COMPUTING	3	0	2	4.0
3	UEC747	ANTENNA & WAVE PROPAGATION	3	0	2	4.0
4	UEC512	LINEAR INTEGRATED CIRCUIT ANALYSIS	3	0	2	4.0

Department Elective –II

Sr. No.	Course No.	Course Name	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
7	UEC804	WIRELESS AND MOBILE COMMUNICATIONS	3	1	2	4.5

Department Elective –III

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1	UEC854	ASIC and FPGA	3	1	0	3.5
2	UEC742	MEMS	3	1	0	3.5
3	UCS736	CLOUD COMPUTING	3	1	0	3.5
4	UEC860	POWER ELECTRONICS	3	1	0	3.5

Department Elective –IV

Sr. No.	Course No.	Course Name	L	T	P	Cr.
1.	UEC855	SPEECH PROCESSING	2	1	2	3.5
2.	UEC862	IC FABRICATION	3	1	0	3.5

Total Credits: 207.0 (Including Self Effort Hours)

BE IN ELECTRONICS AND COMMUNICATION ENGINEERING

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 engineering profession.

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

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 conditional convergence.

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

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

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

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

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

Text Books:

1. *Thomas, G.B. and Finney, R.L., Calculus and Analytic Geometry, Pearson Education (2007).*
2. *Stewart James, Essential Calculus; Thomson Publishers (2007).*

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).*
3.

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
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(), Standard streams.

Laboratory Work:

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

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

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

Text Books:

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

Reference Books:

1. *Brian W. Kernighan, Dennis M. Ritchie, The C++ Programming Language, Prentice Hall)*
2. *Schildt H., C++: The Complete Reference, Tata Mcgraw Hill, 2003.*

Evaluation Scheme:

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

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.

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

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

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

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

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

Water Treatment and Analysis: Hardness and alkalinity of water: Units and determination, External and internal method of Softening of water: Lime-soda Process, Ion exchange process, Desalination of brackish water.

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

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

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

Laboratory Work:

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

Acid and Bases: Determination of mixture of bases

Spectroscopic techniques: Colorimeter, UV-Vis spectrophotometer.

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

Thermochemistry: Cloud point and pour point determination

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

Course Learning Outcomes (CLO):

The students will be able to:

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

Text Books:

1. *Ramesh, S. and Vairam S. Engineering Chemistry, Wiley India (2012).*
2. *Jain, P.C. and Jain, M. Engineering Chemistry, Dhanpat Rai Publishing Co. (2005).*
3. *Puri, B.R., Sharma and L.R., Pathania, M.S. Principles of Physical Chemistry, Vishal Publishing Co. (2008).*

Reference Books:

1. *Brown, Holme, Chemistry for engineering students, Thompson.*
2. *Shulz, M.J. Engineering Chemistry, Cengage Learnings, (2007).*

Evaluation Scheme:

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

UES009: MECHANICS

L	T	P	Cr
2	1	0	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 be predicted.

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

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

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

Friction: Sliding, belt, screw and rolling.

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

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

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

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):

The students will be able to:

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

Text Books:

1. *Shames, I. H. Engineering Mechanics: Dynamics, Pearson Education India (2006).*
2. *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, (2006).*

Evaluation Scheme:

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

UEC001: 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, Karnaugh maps.

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

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

Laboratory Work:

Familiarization 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 Outcomes (CLO):

The student will be able to:

1. analyze characteristics of semiconductor junctions.
2. differentiate between bipolar and unipolar devices.
3. reduce SOP and POS equations.
4. understand differences between logic families TTL and CMOS

5. analyze, design and implement combinational and sequential circuits.

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:

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

Evaluation Scheme:

Sr. 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 and environment.

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

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

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

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

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

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

Course Learning Outcomes (CLO):

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

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

Text Books:

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

4. *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).*
3. *O'Callagan, P.W., Energy Management, McGraw Hill Book Co. Ltd. (1993).*

Evaluation Scheme:

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

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

1. Solve differential equations of first and 2nd order using various analytical methods.
2. apply methods of Laplace transform and Fourier series to solve initial and boundary value problems, respectively.
3. Solve systems of linear equations using row reduction method
4. analyze vectors algebraically and geometrically in R^n

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).*
2. *Jain, R.K. and Iyenger, S.R.K, Advanced Engineering Mathematics, Narosa Publishing House(2011).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
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

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

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

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

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 various media.
2 Determination of velocity of ultrasonic waves in liquids by stationary wave method.
3 Determination of wavelength of sodium light using Newton's rings method.
4 Determination of dispersive power of sodium-D lines using diffraction grating.
5 Determination of specific rotation of cane sugar solution.
6 Study and proof of Malus' law in polarization.
7 Determination of beam divergence and beam intensity of a given laser.
8 Determination of displacement and conducting currents through a dielectric.
9 Determination of Planck's constant.

Micro Project: Students will be asked to solve physics based problems/assignments analytically or using computer simulations, etc.

Course Learning Outcomes (CLO):

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

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

Text Books:

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

Reference Books:

1. *Pedrotti, Frank L., Pedrotti, Leno S., and Pedrotti, Leno M., Introduction to Optics, Pearson Prentice Hall™ (2008).*
2. *Wehr, M.R, Richards, J.A., Adair, T.W., Physics of The Atom, Narosa Publishing House (1990).*
3. *Verma, N.K., Physics for Engineers, Prentice Hall of India (2014)*

Evaluation Scheme:

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

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.

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

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

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

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

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

Course Learning Outcome (CLO):
After the completion of the course the students will be able to:

1. Apply networks laws and theorems to solve electric circuits.
2. Represent AC quantities through phasor and compute AC system behaviour during steady state
3. Explain principle and characteristics of Electro-Mechanical energy conversion devices and apply them.

Text Books:

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 India Private 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

UHU003: INTRODUCTION TO PROFESSIONAL COMMUNICATION

L	T	P	Cr
2	0	2	3.0

Course Objective: To introduce the students to effective professional communication. The student will be exposed to effective communication strategies and different modes of communication. The student will be able to analyze his/ her communication behavior and that of the others. By learning and adopting the right strategies, the student will be able to apply effective communication skills, professionally and socially.

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

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

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

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

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

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

Laboratory Work:

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

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

Course Learning Outcomes (CLO):

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

Text Books:

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 New Delhi.(2011).*

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

Reference Books:

1. *Butterfield, Jeff.,Soft Skills for everyone,Cengage Learning New Delhi,(2013).*
2. *Robbins, S.P., & Hunsaker, P.L.,Training in Interpersonal Skills,Prentice Hall of India New Delhi,(2008).*
3. *DiSianza,J.J & Legge,N.J.,Business and Prfofessional Communication,Pearson Education India New Delhi,(2009).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	45
3	Sessionals (Group Discussions; professional presentations; panel discussions; public speaking; projects, quizzes)	30

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 projection system
3. Isometric Projections
4. Auxiliary Projections
5. Perspective Projections
6. Introduction to Mechanical Drawing
7. Sketching engineering objects
8. Sections, dimensions and tolerances

AutoCAD

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

Micro Projects /Assignments:

1. Completing the views - Identification and drawing of missing lines in the projection of objects
2. Missing views – using two views to draw the projection of the object in the third view, primarily restricting to Elevation, Plan and Profile views
3. Projects related to orthographic and isometric projections
    a. Using wax blocks or soap bars to develop three dimensional object from given orthographic projections
    b. Using wax blocks or soap bars to develop three dimensional object, section it and color the section
    c. Use of AUTOCAD as a complementary tool for drawing the projections of the objects created in (1) and (2).
4. Develop the lateral surface of different objects involving individual or a combination of solids like Prism, Cone, Pyramid, Cylinder, Sphere etc.
5. To draw the detailed and assembly drawings of simple engineering objects/systems with due sectioning (where ever required) along with bill of materials.
6. e.g. Rivet joints, simple bearing, wooden joints, Two plates connected with nut and bolt etc.

Course Learning Outcomes (CLO):

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

1. creatively comprehend geometrical details of common engineering objects
2. draw dimensioned orthographic and isometric projections of simple engineering objects.
3. interpret the meaning and intent of toleranced dimensions and geometric tolerance symbolism;
4. create the engineering drawings for simple engineering objects using AutoCAD
5. manage screen menus and commands using AutoCAD
6. operate data entry modes and define drawings geometrically in terms of Cartesian, polar and relative coordinates in AutoCAD
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)	30
2	End semester test (formal written test)	45
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	25

UTA009: COMPUTER PROGRAMMING – II

L	T	P	Cr
3	0	2	4.0

Course Objective: Understand fundamentals of object oriented programming in java. To help students understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.

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, arrays, arithmetic operators, bit wise operators, relational, Boolean expressions, statements and blocks, control flow statements selection, iteration and jump statements.

Object Oriented Programming Concepts in Java: Objects and classes, declaring objects, constructors, this keyword, method overloading and constructor overloading, nested classes.

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, communication with internet, thread model, creating a thread, synchronization, inter thread communication, thread lifecycle.

Building GUI in Java: Introductions to Applets, Building Java GUIs Using the Swing API, Describe the JFC Swing technology, identify the Swing packages, Describe the GUI building blocks: containers, components, and layout managers, Examine top-level, general-purpose, and special-purpose properties of container, Examine components, Examine layout managers, describe the Swing single-threaded model,
painting, using images, performing animations, borders, icons, Introduction to Event handling, implementation of Listeners for event handling.

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 in Java.
2. implement decision statements and looping statements.
3. grasp the concepts of input and output handling from console, files and internet in Java.
4. create frames, windows, containers, GUI components in Java and handle events for building GUI.
5. develop GUI applications

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).*

Reference Books:

1. *Naughton P., Schildt H., JAVA2 – The Complete Reference, Tata McGraw Hill (2002).*

Evaluation Scheme:

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

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. Analyze the methods of biasing transistors & Design simple amplifier circuits.

2. perform mid – band analysis of amplifier circuits using small - signal equivalent circuits.
3. determine gain input impedance and output impedance.
4. calculate cutoff frequencies and to determine bandwidth.
5. design power amplifiers, heat sinks, and wave shaping Circuits.
6. analyze and design oscillators.

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:

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

UES012: ENGINEERING MATERIALS

L	T	P	Cr
3	1	2	4.5

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, Yielding and yield strength, Tensile strength, Stiffness, Ductility, Brittleness, Resilience, Toughness, True stress - true strain relationship, Hardness, Shrinkage, 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, 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.

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

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

Laboratory Work:

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

Micro Project:
The micro-project will be assigned to the group(s) of students at the beginning of the semester. Based on the interest and branch of the student, he will carry out one of the followings:

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

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

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

Text Books:

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.*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional	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).*

L T P Cr

Evaluation Scheme:

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

UEC404: SIGNALS AND SYSTEMS

3 1 2 4.5

Course Objective: 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.

Fourier Analysis: 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.

The 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 infrequency, Radix-4 FFT, 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 Circular convolution, Correlation, DFT/IDFT, FFT algorithms using Matlab.

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

1. develop of analog as well as discrete signal generation and applications.
2. learn the physical significance of random signals and its applications in the emerging field of comnication engineering.
3. develop linear as well as nonlinear techniques for the conversion of discrete-time signals and systems to digital signals and systems.
4. apply Fourier series and Fourier transform, z-transform and Laplace transform.

5. design probabilistic statistical methods for signal analysis, estimation and detection.

Text Books:

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

Reference Books:

1. *Lathi, B.P., Modern Digital and Analog Communication Systems, Oxford Univ. Press, 1998*
2. *Papoulis, A., Probability Random Variables and Stochastic Processes, McGraw Hill, 2008*

Evaluation Scheme:

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

UTA010: ENGINEERING DESIGN – II (6 SELF EFFORT HOURS)

L	T	P	Cr
1	0	2	5

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-directing 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. 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.

Breakup of lecture details to be taken up by MED:

Lec No.	Topic	Contents
Lec 1	Introduction	The Mangonel Project. History.
Lec 2	CDIO	Conceive Design Implement and Operate.
Lec 3	Manufacturing	Manufacturing and assembling the Mangonel.
Lec 4		
Lec 5	Materials	How to choose the right Material
Lec 6	Modelling	The Role of Modelling in Engineering Design
Lec 7	Structures	Why things fail?
Lec 8	Dynamics	Dynamics of the Mangonel
Lec 9	Structures	Designing against structural failure
Lec 10	Kinematics/Software Modelling	Simulation as an Analysis Tool in Engineering Design

Breakup of lecture details to be taken up by ECED:

Lec No.	Topic	Contents
Lec 11-15	Digital Electronics	Prototype, Architecture, Using the Integrated Development Environment (IDE) to Prepare an Arduino Sketch, Structuring an Arduino Program, Using Simple Primitive Types (Variables), Simple programming examples. Definition of a sensor and actuator.

Laboratory Work:

Associated Laboratory/Project Programme:

Laboratory Title	Code
Dynamics of Mangonel - No Drag	L1
Dynamics of Mangonel - With Drag	L2
Design against failure under static actions	L3
Design against failure under dynamic actions	L4
Simulation	L5
Manufacturing components of the Mangonel	L6
Manufacturing components of the Mangonel	L7
Manufacturing components of the Mangonel	L8
Manufacturing components of the Mangonel	L9
Assembly of Mangonel	L10
Spring Test of Mangonel	L11
Distance Test of Mangonel	L12
Speed Test of Mangonel	L13
Mangonel redesign for competition	L14
Competition	L15

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

1. the manufacturing and assembly of a Mangonel from a Bill Of Materials (BOM),

detailed engineering drawings of parts, assembly instructions, and few prefabricated parts ;
2. the development of a software tool to allow the trajectory of a "missile" to be studied as a function of various operating parameters;
3. a structural analysis of certain key components of the Mangonel for static and dynamic stresses using values of material properties which will be experimentally determined;
4. the development of a micro-electronic system to allow the angular velocity of the throwing arm to be determined;
5. testing the Mangonel;
6. redesigning the throwing arm of the Mangonel to optimise for distance without compromising its structural integrity;
7. an inter-group competition at the end of the semester.

Course Learning Outcomes (CLO):

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

1. model trajectories of masses with and without aerodynamic drag;
2. develop a software tool to allow trajectories be optimised;
3. analyse the static and dynamic stresses of elements of an engineering mechanism;
4. optimally design structural elements of an engineering mechanism;
5. perform a test to acquire an engineering material property;
6. develop and test software code to process sensor data;
7. design and construct and test an electronic hardware solution to process sensor data;
8. construct a Roman catapult "Mangonel" using tools, materials and assembly instructions;
9. operate and evaluate the "Mangonel" for functional and structural performance;
10. validate theoretical models by comparison with experiments;
11. integrate skills to innovatively redesign an element of the "Mangonel";
12. participate and cooperate in a team.

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 (2013)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	-
2	EST	-
3	Sessional: Sessional: (may include the following) Regular progress evaluations of stages of the project assignment. Project (Design Report, Prototype competition, Daily diary and records) Final Presentation and viva-voce	 30 50 20

UES 010: SOLIDS 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, overhung and cantilever beams subjected to any combination of point loads, uniformly distributed and varying load and moment, equation of condition, load function equation, qualitative analysis for two-dimensional frames.

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:

Experimental Project Assignment: Students in groups of 4/5 will do projects:

1. Calculation of tensile strength using UTM
2. Buckling of struts
3. 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.
4. Torsion: Study the behavior of circular shafts under torsion and analysis of failure and indirect evaluation of the modulus of rigidity.

Course Learning Outcomes (CLO):

The student 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. Calculate load carrying capacity of columns and struts and their buckling strength
4. Evaluate various kinds of stresses (axial, bending, torsional and shearing) in various structural elements due to different type of external loads.
5. Determine deformations and deflections in various kinds of beams and trusses

Text Books:

1. *Popov, E.P. and Balan, T.A., Engineering Mechanics of Solids, Prentice Hall of India (2006).*
2. *Singh, D.K., Mechanics of Solids, Pearson Education (2002).*

Reference Books:

1. *Shames, I. H. and Pitarresi, J. M., Solid Mechanics, Prentice Hall of India (1999).*
2. *Crandall, S.H., Dahl, N.C. and Lardner, T.J., An Introduction to Mechanics of Solids, McGraw Hill International, Tokyo, (1994).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
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:

10% Weightage of total marks shall be given to the continuous assessment of the practical and on the technical reports of the 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
7. Flow measurement using a venturi-meter and rotameter
8. Boundary layer over a flat plate

Sample List of Micro-Projects:

Students in a group of 10 members will be assigned a micro project. 10% weightage of the total marks shall be given to the execution, technical report writing and presentation of the completed 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.

Research Assignments:
Besides the interactive tutorial sessions, students in a group of 4/5 will submit a research assignment on a related topic. The research assignment should be submitted in the form of a technical report followed by a power point presentation. 10% weightage of the total marks shall be given to this assignment.

Course Learning Outcomes (CLO):

1. Knowledge of basic principles of fluid mechanics
2. Capability to analyze, generate mathematical models, solve problems, and communicate the solutions of simple fluid based engineering problems including pressures and forces on submerged surfaces
3. Ability to analyze fluid flow problems with the application of the mass, momentum and energy equations
4. Ability to evaluate practical problems associated with pipe flow systems
5. Ability to conceptualize and describe practical flow systems such as boundary layers and their importance in engineering analysis
6. Capability to evaluate fluid properties and solve basic problems using property tables, property diagrams and equations of state
7. Ability to analyze, generate mathematical models, solve problems, and communicate the solutions to practical closed systems and steady-flow devices by applying the conservation of energy principle
8. Knowledge of the limitations of engineering devices and systems based on the 2nd law of thermodynamics
9. Knowledge of the concept of thermal efficiency and coefficient of performance and the environmental and socio-economic implications

Text Books:

1. *Munson, Young, Okiishi, Huebsch, Fundamentals of Fluid Mechanics, Wiley.*
2. *Cengel and Boles, Thermodynamics: an Engineering Approach, McGraw-Hill.*

Reference Books:

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

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional (may be tutorials/ quizs/ assignments/lab/ project)	40

UTA002: MANUFACTURING PROCESSES

L	T	P	Cr
2	0	3	3.5

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

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

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

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

Joining Processes: Electric arc, Resistance welding, Soldering, Brazing.

Laboratory Work:

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

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

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

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

Course Learning Outcomes (CLO):

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

1. analyse various machining processes and calculate relevant quantities such as velocities, forces, powers etc;
2. suggest appropriate process parameters and tool materials for a range of different operations and workpiece materials;
3. understand the basic mechanics of the chip formation process and how these are related to surface finish and process parameters;
4. recognise cutting tool wear and identify possible causes and solutions;
5. develop simple CNC code, and use it to produce components while working in groups.

6. perform calculations of the more common bulk and sheet forming, casting and welding processes and given a particular component.
7. select the most appropriate manufacturing process to achieve product quality through the efficient use of materials, energy and process.

Text Books:

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	Weightage (%)
1	MST	25
2	EST	40
3	Sessional: (may include the following) Assignment, Sessional (includes Regular Lab assessment and Quizzes Project (including report, presentation etc.)	35

UEC405: MICROPROCESSORS AND THEIR APPLICATIONS (WITH PROJECT)

(7 SELF EFFORT HOURS)

L	T	P	Cr
3	1	2	8.0

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

UTA 011: ENGINEERING DESIGN- III (8 SELF EFFORT HOURS)

L	T	P	Cr
2	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

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

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

Course Learning Outcomes: The student should be able to:

1. understand of features of Arduino board.
2. analyze of internal Architecture of Arduino board.
3. apply Arduino board programming concepts.
4. design and implement Buggy project based on different goals and challenges defined.

Text Books:

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	Weightage (%)
1	Mid Semester evaluation 1	20
2	Mid Semester evaluation 2	20
3	Mid Semester evaluation 3	20
4	End Semester Evaluation	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:

Implementation of 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 on this two dimensional real data which is already noisy. Also, comment on the effect of the different filters.

Course Learning Outcomes (CLO):
Upon completion of this course, 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:

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

UCS303: OPERATING SYSTEMS

L	T	P	Cr
3	1	0	3.5

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

1. Explain basic operating system concepts such as overall architecture, interrupts, APIs, user mode and kernel mode.

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

Text Books:

1. *Silberschatz, A., Galvin, P.B. and Gagne, G., Operating System Concepts, John Wiley (2013), 9th ed.*
2. *Stallings, Willam, Operating Systems Internals and Design Principles, Prentice Hall (2014), 7th ed.*

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:

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

UEC510: 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

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 frequency, 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,

Micro-Project:
To be decided by the faculty coordinator

Course learning outcome (CLO):
Upon completion of this course, 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:

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

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) 2nded.*
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

UCS 611: MACHINE LEARNING

L	T	P	Cr
3	0	0	3.0

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

UTA012: INNOVATION AND ENTREPRENEURSHIP (5 SELF EFFORT HOURS)

L	T	P	Cr
1	0	2*	4.5

[*] 2 hours every alternate week.

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

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

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

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

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

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

Course learning outcome (CLO):

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

1. Comprehend the role of bounded rationality, framing, causation and effectuation in entrepreneurial decision making.
2. Demonstrate an ability to design a business model canvas.
3. Evaluate the various sources of raising finance for startup ventures.
4. Understand the fundamentals of developing and presenting business pitching to potential investors.

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. *Osterwalder, Alex and Pigneur, Yves (2010) Business Model Generation.*
4. *T. H. Byers, R. C. Dorf, A. Nelson, Technology Ventures: From Idea to Enterprise, McGraw Hill (2013)*

Reference Books:

1. *Kachru, Upendra, India Land of a Billion Entrepreneurs, Pearson*
2. *Bagchi, Subroto, (2008), Go Kiss the World: Life Lessons For the Young Professional, Portfolio Penguin*
3. *Bagchi, Subroto, (2012). MBA At 16: A Teenager's Guide to Business, Penguin Books*
4. *Bansal, Rashmi, Stay Hungry Stay Foolish, CIIE, IIM Ahmedabad*
5. *Bansal, Rashmi, (2013). Follow Every Rainbow, Westland.*
6. *Mitra, Sramana (2008), Entrepreneur Journeys (Volume 1), Booksurge Publishing*
7. *Abrams, R. (2006). Six-week Start-up, Prentice-Hall of India.*
8. *Verstraete, T. and Laffitte, E.J. (2011). A Business Model of Entrepreneurship, Edward Elgar Publishing.*
9. *Johnson, Steven (2011). Where Good Ideas comes from, Penguin Books Limited.*
10. *Gabor, Michael E. (2013), Awakening the Entrepreneur Within, Primento.*
11. *Guillebeau, Chris (2012), The $100 startup: Fire your Boss, Do what you love and work better to live more, Pan Macmillan*
12. *Kelley, Tom (2011),The ten faces of innovation, Currency Doubleday*
13. *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	Weightage (%)
1	MST	20
2	EST	40
3	Sessionals(Assignments/Projects/Tutorials/Quizzes/Lab Evaluations)	40

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), 6thed.*
2. *Elmasri & Navathe, Fundamentals of Database Systems, Addison-Wesley (2011), 6thed.*

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

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

UEC615: 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

UEC704: SOFT COMPUTING

L	T	P	Cr
3	0	2	4.0

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

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 PROTOCOLS

L	T	P	Cr
3	1	0	3.5

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) 3rded.*
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

Department Elective –I

UEC745: FIBRE OPTIC COMMUNICATION

L	T	P	Cr
3	0	2	4.0

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

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

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 fibre amplifier, semiconductor optical amplifier, Raman amplifier.

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

Optical Communication System: 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 fibre 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 fibre, 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 fibre with low dispersion at telecom wavelength.

Course Learning Outcomes (CLOs):

Upon completion of this course, 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 fibre communications: principles and practice, Prentice Hall, (2009) 2nd ed.*
2. *Keiser, Gred, Optical Fibre Communications, Tata McGraw-Hill, (2008) 2nd ed.*

Reference books

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

Evaluation Scheme:

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

UEC746: 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, Nakagami-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 (CLO):

Upon completion of this course, 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:

Sr. 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 (CLO): 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:

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

Department 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 AND 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

Department Elective –III

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

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

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