MANAV RACHNA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

PROGRAM STRUCTURE

&

DETAILED SYLLABUS

B.Tech. Electronics & Computer Engineering

BATCH: 2019-2023

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

B.TECH IN ELECTRONICS AND COMPUTER ENGINEERING

150-160 CREDITS FOR DEGREE COURSE

B.TECH (ECU02) SESSION 2019-2020

SEMESTER - 1

SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	**OFFERING DEPARTMENT	*COURSE NATURE (HARD/SOFT / WORKSHOP/ NTCC)	COURSE TYPE (CORE/ELECTIVE / UNIVERSITY COMPULSORY)	L	T	P	O	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH144-T	CHEMISTRY-I	NA	CHEMISTRY	HARD	CORE	3	1	0	0	4	4
CHH144-P	CHEMISTRY-I LAB	NA	CHEMISTRY	HARD	CORE	0	0	2	0	2	1
MAH103B	MATHEMATICS – I (CALCULUS AND LINEAR ALGEBRA)	NA	MATHEMATICS	HARD	CORE	3	1	0	0	4	4
ECH101B-T	BASICS OF ELECTRICAL ENGINEERING	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH101B-P	BASICS OF ELECTRICAL ENGINEERING LAB	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	0	0	2	0	2	1
CSH101B-T	PROGRAMMING FOR PROBLEM SOLVING USING C	NA	COMPUTER SCIENCE	HARD	CORE	3	1	0	0	4	4
CSH101B-P	PROGRAMMING FOR PROBLEM SOLVING USING C LAB	NA	COMPUTER SCIENCE	HARD	CORE	0	0	2	0	2	1
MEW102B	ENGINEERING GRAPHICS & DRAWING	NA	MECHANICAL ENGINEERING	WORKSHOP	CORE	0	0	3	0	3	1.5
LWS324	INDIAN CONSTITUTION	NA	LAW	AUDIT	CORE	2	0	0	0	2	0
CDS101B	PROFESSIONAL COMMUNICATION-I	NA	CDC	SOFT	CORE	1	0	0	0	1	0.5
						14	4	9	0	27	21

SEMESTER - 2											
SUBJECT CODES	**SUBJECT NAME**	**PRE-REQUISITE**	****OFFERING DEPARTMENT**	***COURSE NATURE (HARD/SOFT / WORKSHOP/ NTCC)**	**COURSE TYPE (CORE/ELECTIVE / UNIVERSITY COMPULSORY)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
PHH102B-T	PHYSICS FOR ENGINEERS	NA	PHYSICS	HARD	CORE	3	1	0	0	4	4
PHH102B-P	PHYSICS FOR ENGINEERS LAB	NA	PHYSICS	HARD	CORE	0	0	2	0	2	1
MAH106B	MATHEMATICS – II (DIFFERENTIAL EQUATIONS)	MATHEMATICS-I	MATHEMATICS	HARD	CORE	3	1	0	0	4	4
ECH102B-T	BASIC ELECTRONICS	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH102B-P	BASIC ELECTRONICS LAB	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	0	0	2	0	2	1
CSW101B	USER INTERFACE-I (HTML5,CSS,JAVASCRIPT,JQUERY)	NA	COMPUTER SCIENCE	WORKSHOP	CORE	0	0	3	0	3	1.5
EDS288/ EDS289/ EDS290	APP. PHILOSOPHY/APP. PSYCHOLOGY/ APP. SOCIOLOGY	NA	EDUCATION	SOFT	ELECTIVE	2	0	0	0	2	2
HLS103B/ HLS104B	PROFESSIONAL ENGLISH ADVANCE/PROFESSIONAL ENGLISH BASIC	NA	HUMANITIES	SOFT	CORE	2	0	2	0	4	3
CHH137	ENVIRONMENTAL SCIENCE	NA	CHEMISTRY	SOFT	AUDIT	1	0	0	0	1	0
						14	3	9	0	26	20.5

SEMESTER - 3											
SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	OFFERING DEPARTMENT	COURSE NATURE	COURSE TYPE (CORE/ELECT	L	T	P	O	NO. OF CONTACT	NO. OF CREDITS
ECH202B-T	NETWORK THEORY	BASIC ELECTRICAL ENGINEERING	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH202B-P	NETWORK THEORY LAB	BASIC ELECTRICAL ENGINEERING	ELECTRONICS & COMMUNICATION	HARD	CORE	0	0	2	0	2	1
ECH203B-T	ANALOG ELECTRONICS	BASIC ELECTRONICS	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH203B-P	ANALOG ELECTRONICS LAB	BASIC ELECTRONICS	ELECTRONICS & COMMUNICATION	HARD	CORE	0	0	2	0	2	1
ECH204B	SIGNALS AND SYSTEMS	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
CSH103B-T	DATA STRUCTURE & ALGORITHMS	NA	COMPUTER SCIENCE	HARD	CORE	3	1	0	0	4	4
CSH103B-P	DATA STRUCTURE & ALGORITHMS LAB	NA	COMPUTER SCIENCE	HARD	CORE	0	0	2	0	2	1
CSW208B	PROGRAMMING FOR PROBLEM SOLVING USING PYTHON	PROGRAMMING FOR PROBLEM SOLVING USING C	COMPUTER SCIENCE	WORKSHOP	CORE	0	0	3	0	3	1.5
ECW205B	ELECTRONIC DESIGN WORKSHOP	NA	ELECTRONICS & COMMUNICATION	WORKSHOP	CORE	0	0	3	0	3	1.5
CDO201	PROFESSIONAL COMPETANCY ENHANCEMENT-I	NA	CDC	SOFT	CORE	0	0	1	0	1	0.5
RDO501	INTRODUCTION TO RESEARCH	NA	ELECTRONICS & COMMUNICATION	SOFT	CORE	0	0	1	0	1	0.5
FLS101	SPANISH-I	NA	FOREIGN LANGUAGE	AUDIT	ELECTIVE	1	1	0	0	2	0
FLS102	GERMAN-I										
FLS103	FRENCH-I										
						1	0	0	0	1	0
						14	5	14	0	33	23

SEMESTER - 4											
SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	OFFERING DEPARTMENT	COURSE NATURE	COURSE TYPE (CORE/ELECT	L	T	P	O	NO. OF CONTACT	NO. OF CREDITS
ECH206B	ELECTROMAGNETIC FIELD AND WAVES	PHYSICS FOR ENGINEERS	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH216B-T	ANALOG COMMUNICATION	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH216B-P	ANALOG COMMUNICATION LAB	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	0	0	2	0	2	1
ECH208B-T	DIGITAL ELECTRONICS	BASIC ELECTRONICS	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH208B-P	DIGITAL ELECTRONICS LAB	BASIC ELECTRONICS	ELECTRONICS & COMMUNICATION	HARD	CORE	0	0	2	0	2	1
ECH209B	VLSI DESIGN	ANALOG ELECTRONICS	ELECTRONICS & COMMUNICATION	HARD	CORE	3	0	0	0	3	3
CSH201B-T	OOPS USING JAVA	PROGRAMMING FOR PROBLEM SOLVING USING C	COMPUTER SCIENCE	HARD	CORE	3	0	0	0	3	3
CSH201B-P	OOPS USING JAVA LAB	PROGRAMMING FOR PROBLEM SOLVING USING C	COMPUTER SCIENCE	HARD	CORE	0	0	2	0	2	1
ECW210B	ALTAIR WORKSHOP	NA	ELECTRONICS & COMMUNICATION	WORKSHOP	CORE	0	0	2	0	2	1
CDO202	PROFESSIONAL COMPETANCY ENHANCEMENT-II	NA	CDC	SOFT	CORE	0	0	1	0	1	0.5
RDO502	RESEARCH & INNOVATION-I	NA	ELECTRONICS & COMMUNICATION	SOFT	CORE	0	0	1	0	1	0.5
FLS105	SPANISH-II	NA	FOREIGN LANGUAGE	AUDIT	ELECTIVE	1	1	0	0	2	0
FLS106	GERMAN-II										
FLS107	FRENCH-II										
						1	0	0	0	1	0
						17	4	10	0	31	23

SEMESTER - 5											
SUBJECT CODES	**SUBJECT NAME**	**PRE-REQUISITE**	****OFFERING DEPARTMENT**	***COURSE NATURE (HARD/SOFT / WORKSHOP/ NTCC)**	**COURSE TYPE (CORE/ELECTIVE / UNIVERSITY COMPULSORY)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	NO. OF CREDITS
ECH301B-T	MICROPROCESSORS & MICROCONTROLLERS	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH301B-P	MICROPROCESSORS & MICROCONTROLLERS LAB	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	0	0	2	0	2	1
ECH328B-T	DIGITAL COMMUNICATION	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH328B-P	DIGITAL COMMUNICATION LAB	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	0	0	2	0	2	1
ECH302B-T	DIGITAL SIGNAL PROCESSING	SIGNALS AND SYSTEMS	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH302B-P	DIGITAL SIGNAL PROCESSING LAB	SIGNALS AND SYSTEMS	ELECTRONICS & COMMUNICATION	HARD	CORE	0	0	2	0	2	1
ECH303B	COMPUTER ARCHITECTURE	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	0	0	0	3	3
ECH304B-T	CONTROL SYSTEMS	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH304B-P	CONTROL SYSTEMS LAB	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	0	0	2	0	2	1
ECH305B-T	INTERNET OF THINGS	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	2	0	0	0	2	2
ECH305B-P	INTERNET OF THINGS LAB	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	0	0	2	0	2	1
CDO301	PROFESSIONAL COMPETANCY ENHANCEMENT-III	NA	CDC	SOFT	CORE	0	0	1	0	1	0.5
RDO601	RESEARCH & INNOVATION-II	NA	ELECTRONICS & COMMUNICATION	SOFT	CORE	0	0	1	0	1	0.5
						17	4	12	0	33	27

SEMESTER - 6											
SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	OFFERING DEPARTMENT	COURSE NATURE	COURSE TYPE (CORE/ELECT	L	T	P	O	NO. OF CONTACT	NO. OF CREDITS
ECH307B-T	ANTENNA AND WAVE PROPOGATION	ELECTROMAGNETIC FIELD AND WAVE	ELECTRONICS & COMMUNICATION								
CSH211B-T	OPERATING SYSTEMS	NA	COMPUTER SCIENCE								
ECH309B-T	DIGITAL SYSTEM DESIGN	DIGITAL ELECTRONICS	ELECTRONICS & COMMUNICATION	HARD	ELECTIVE	3	1	0	0	4	4
ECH310B-T	INTRODUCTION TO NEURAL NETWORK	NA	ELECTRONICS & COMMUNICATION								
CSH202B-T	DATABASE MANAGEMENT SYSTEM	PROGRAMMING FOR PROBLEM SOLVING USING C	COMPUTER SCIENCE								
ECH307B-P	ANTENNA AND WAVE PROPOGATION LAB	ELECTROMAGNETIC FIELD AND WAVE	ELECTRONICS & COMMUNICATION								
CSH211B-P	OPERATING SYSTEMS LAB	NA	COMPUTER SCIENCE								
ECH309B-P	DIGITAL SYSTEM DESIGN LAB	DIGITAL ELECTRONICS	ELECTRONICS & COMMUNICATION	HARD	ELECTIVE	0	0	2	0	2	1
ECH310B-P	INTRODUCTION TO NEURAL NETWORK LAB	NA	ELECTRONICS & COMMUNICATION								
CSH202B-P	DATABASE MANAGEMENT SYSTEM LAB	PROGRAMMING FOR PROBLEM SOLVING USING C	COMPUTER SCIENCE								
MCS232	FUNDAMENTALS OF FINANCE	NA	MANAGEMENT	SOFT	ELECTIVE	1	0	2	0	3	2
MCS231	BASICS OF ECONOMICS	NA									
ECH311B-T	MICROWAVE AND RADAR ENGINEERING	ELECTROMAGNETIC FIELD AND WAVES	ELECTRONICS & COMMUNICATION								
ECH312B-T	WIRELESS COMMUNICATION	ANALOG & DIGITAL COMMUNICATION, ANTENNA AND WAVE PROPAGATION	ELECTRONICS & COMMUNICATION	HARD	ELECTIVE	3	1	0	0	4	4

CSH404B-T	CLOUD COMPUTING	NA	COMPUTER SCIENCE								
ECH313B-T	DIGITAL IMAGE PROCESSING AND COMPUTER VISION	NA	ELECTRONICS & COMMUNICATION								
ECH314B-T	CMOS VLSI DESIGN	VLSI DESIGN	ELECTRONICS & COMMUNICATION								
ECH311B-P	MICROWAVE AND RADAR ENGINEERING LAB	EMFW	ELECTRONICS & COMMUNICATION	HARD	ELECTIVE	0	0	2	0	2	1
ECH312B-P	WIRELESS COMMUNICATION LAB	ANALOG & DIGITAL COMMUNICATION, ANTENNA AND WAVE	ELECTRONICS & COMMUNICATION								
CSH404B-P	CLOUD COMPUTING LAB	NA	COMPUTER SCIENCE								
ECH313B-P	DIGITAL IMAGE PROCESSING AND COMPUTER VISION LAB	NA	ELECTRONICS & COMMUNICATION								
ECH314B-P	CMOS VLSI DESIGN LAB	VLSI DESIGN	ELECTRONICS & COMMUNICATION								
ECH315B	DATA COMMUNICATION	NA	ELECTRONICS & COMMUNICATION	HARD	ELECTIVE	3	1	0	0	4	4
CSH301B	COMPUTER NETWORKS	NA	COMPUTER SCIENCE								
ECH316B	WAVELETS AND MULTIRATE SYSTEMS	NA	ELECTRONICS & COMMUNICATION								
ECH317B	EMBEDDED AND REAL TIME SYSTEMS	MICROPROCESSOR & MICROCONTROLLER	ELECTRONICS & COMMUNICATION								
LWS323	CYBER LAW	NA	LAW	SOFT	ELECTIVE	2	0	0	0	2	2
LWS325	LAW RELATING TO INTELLECTUAL PROPERTY RIGHTS	NA									
ECW318B	VERILOG	NA	ELECTRONICS & COMMUNICATION	WORKSHOP	ELECTIVE	0	0	2	0	2	1
ECW319B	EDA FOR RF	AWP	ELECTRONICS & COMMUNICATION								
ECW320B	TANNER	VLSI DESIGN	ELECTRONICS & COMMUNICATION								
CSW213B	UNIX	NA	COMPUTER SCIENCE								

CDO302	PROFESSIONAL COMPETANCY RNHANCEMENT-IV	NA	CDC	SOFT	CORE	4	0	0	0	4	1
						1	0	0	0	1	0
						17	3	8	0	28	20

SEMESTER - 7

SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	**OFFERING DEPARTMENT	*COURSE NATURE (HARD/SOFT	COURSE TYPE (CORE/ELECTIVE /	L	T	P	O	NO. OF CONTACT HOURS	NO. OF CREDITS
ECH401B	INFORMATION THEORY AND CODING	NA	ELECTRONICS AND COMMUNICATION								
ECH402B	MIXED SIGNAL IC DESIGN	ANALOG ELECTRONICS, DIGITAL ELECTRONICS	ELECTRONICS AND COMMUNICATION								
ECH403B	WIRELESS SENSOR NETWORKS	NA	ELECTRONICS AND COMMUNICATION								
ECH404B	SECURITY IN WIRELESS AND MOBILE COMMUNICATION	EMFW	ELECTRONICS AND COMMUNICATION								
CSH423B	ARTIFICIAL INTELLIGENCE	NN AND FL	COMPUTER SCIENCE	HARD	ELECTIVE	3	1	0	0	4	4
ECH405B	SPEECH PROCESSING AND RECOGNITION	NA	ELECTRONICS AND COMMUNICATION								
CSH424B	MOBILE COMPUTING WITH ANDROID	NA	COMPUTER SCIENCE								
ECH406B	ASIC DESIGN AND FPGA	VLSI DESIGN	ELECTRONICS AND COMMUNICATION								
ECH408B	SATELLITE COMMUNICATION	ADC	ELECTRONICS AND COMMUNICATION								
ECH407B	RF SYSTEM DESIGN	ANALOG ELECTRONICS	ELECTRONICS AND COMMUNICATION								
ECH409B	ROBOTICS DESIGN	NA	ELECTRONICS AND COMMUNICATION								
ECH410B	STATISTICAL SIGNAL PROCESSING	DSP	ELECTRONICS AND COMMUNICATION	HARD	ELECTIVE	3	1	0	0	4	4
CSH425B	THEORY OF AUTOMATA AND COMPILER DESIGN	NA	COMPUTER SCIENCE								

ECH411B	VLSI TESTING	VLSI DESIGN	ELECTRONICS AND COMMUNICATION								
MCS368B	BASICS OF ENTRENEURSHIP	NA	MANAGEMENT	SOFT	ELECTIVE	1	0	2	0	3	2
	Digital Marketing	NA	MANAGEMENT								
MOOC-23E-ECS-304	Human Behaviour	NPTEL COURSE/MOOC COURSE								8 WEEKS	2
ECH412B	MEMS	NA	ELECTRONICS AND COMMUNICATION	HARD	ELECTIVE	3	1	0	0	4	4
ECH413B	NANOTECHNOLOGY	NA	ELECTRONICS AND COMMUNICATION								
ECH414B	MOBILE COMMUNICATION	NA	ELECTRONICS AND COMMUNICATION								
ECH415B	FIBRE OPTIC COMMUNICATION	NA	ELECTRONICS AND COMMUNICATION								
ECH416B	BIOMEDICAL SIGNAL PROCESSING	NA	ELECTRONICS AND COMMUNICATION								
ECH417B	MODERN DIGITAL COMMUNICATION TECHNIQUES	NA	ELECTRONICS AND COMMUNICATION								
CSH426B	BIG DATA	NA	COMPUTER SCIENCE								
CSH427B	MACHINE LEARNING	NA	COMPUTER SCIENCE								
ECN423	PROJECT PHASE-I	NA	ELECTRONICS AND COMMUNICATION	HARD	CORE	0	0	4	0	4	2
						2	0	0	0	2	0
						12	3	6	0	21	18

SEMESTER - 8											
SUBJECT CODES	**SUBJECT NAME**	**PRE-REQUISITE**	****OFFERING DEPARTMENT**	***COURSE NATURE (HARD/SOFT / WORKSHOP/**	**COURSE TYPE (CORE/ELECTIVE / UNIVERSITY COMPULSORY)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
ECN420	PROJECT PHASE-II/INDUSTRIAL TRAINING	NA	ELECTRONICS AND COMMUNICATION	HARD	CORE	320 TO 360 HOURS					8
											8

	SEMESTER	**CREDITS ASSIGNED**
	I	21
	II	20.5
	III	23
	IV	23
	V	27
	VI	20
	VII	18
	VIII	8
ECO105B	SUMMER TRAINING POST II SEM	2
ECO216B	SUMMER TRAINING POST IV SEM	2
ECO329B	SUMMER TRAINING POST VI SEM	3
	TOTAL CREDITS	**167.5**

Manav Rachna University

Faculty of Engineering

Department of

Electronics & Communication Engineering

Scheme & Syllabus

B. Tech (2019-2020)

MANAV RACHNA UNIVERSITY, FARIDABAD
FACULTY OF ENGINEERING
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
SYLLABUS & SCHEME (ECU02)

Semester-1

SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	**OFFERING DEPARTMENT	*COURSE NATURE (HARD/SOFT/ WORKSHOP/ NTCC)	COURSE TYPE (CORE/ELECTIVE / UNIVERSITY COMPULSORY)	L	T	P	O	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
CHH144B-T/P	CHEMISTRY	NA	CHEMISTRY	HARD	CORE	3	1	2	0	6	5
MAH103B-T/P	MATHEMATICS – I (CALCULUS AND LINEAR ALGEBRA)	NA	MATHEMATICS	HARD	CORE	3	1	0	0	4	4
ECH103B-T/P	BASICS OF ELECTICAL & ELECTRONICS ENGINEERING	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	2	0	6	5
CSH101B-T/P	PROGRAMMING FOR PROBLEM SOLVING USING C	NA	COMPUTER SCIENCE	HARD	CORE	3	1	2	0	6	5
MEW102B	ENGINEERING GRAPHICS & DRAWING	NA	MECHANICAL ENGINEERING	WORKSHOP	CORE	0	0	3	0	3	1.5
LWS324B	INDIAN CONSTITUTION	NA	LAW	AUDIT	CORE	2	0	0	0	2	0
CDS101B	PROFESSIONAL COMMUNICATION-I	NA	CDC	SOFT	CORE	1	0	0	0	1	0
						14	4	9	0	27	20.5

Course Title/ Code	Chemistry-1 (CHH144) T & P
Course Type	Core (Allied)
Course Nature	Soft
L-T-P-O Structure	(3-1-2)
Objectives	Student would be able to learn basic of atomic structure, intermolecular forces, and importance of pH, stereochemistry, learn basic of spectroscopic techniques and apply basic of these topics to industrial and domestic purpose.

Syllabus	Sections	Weightage
	A	28%
	B	28%
	C	28%
	D	16%
	TOTAL	**100%**

SECTION-A

Atomic Structure: Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ2. Quantum numbers and their significance.Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.

Periodic properties: Electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital, energies of atoms in the periodic table, polarizability and Polarization, Fajan's Rule, oxidation states and their stabilities.

SECTION-B

Intermolecular forces and potential energy surfaces : Ionic, dipolar and van der waals interaction, equations of state of real and gases and critical phenomenon.

Use of free energy in chemical equilibria : Thermodynamic functions: entropy and gibbs free energy;estimations of entropy and free energies.Relationship betweenFree energy and emf Cell potentials.Nernst equation and application.acid base,oxidation reduction and solubility equilibria,Water chemistry : Introduction - Use of water for Industrial and domestic purposes, sources of water supply,Hardness of water, degree of hardness and its estimation by EDTA methods). PH-value of water, disinfection of water Softening of hard water (Lime-Soda method, calgon methods.corrosion: introduction,cause and theories:Dry and wet theory and prevention methods,use of free energy consideration in metallurgy through Ellingham Diagram.

SECTION-C

Stereochemistry: Representations of three dimensional structures, introduction to the terms: achirality, chirality, enantiomers, diastereomers, optical activity, structural isomers and stereoisomers, relative and absolute configurations, conformational analysis of ethane and n-butane. Structural isomerism in transitional metal compounds.

Organic reactions and synthesis using conventional and green approach: Introduction to Green Chemistry, its 12 principles, Synthesis of a commonly used molecules: Aspirin, Ibuprofen, bio-diesel and bio-ethanol.

SECTION-D

Spectroscopic techniques and applications: Principles of spectroscopy and selection rules.Electronic spectroscopy.Fluorescence and its applications in medicine.Vibrational and rotational spectroscopy of diatomic molecules.Applications.Nuclear magnetic resonance and magnetic resonance imaging.

Text Books

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. (iii)Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin
5. and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Laboratory

1. Determination of chloride content of water
2. Colligative properties using freezing point depression
3. Determination of the rate constant of a reaction
4. Synthesis of a polymer (UF, Resol, PMMA).
5. Determination of surface tension and viscosity.
6. Determination of cell constant and conductance of solutions.
7. Saponification/acid value of oil.
8. Adsorption of acetic acid by charcoal.
9. Determination of the partition coefficient of a substance between two immiscible liquids.

Course Title	**MATHEMATICS 1 (Calculus and Linear Algebra)**(MAH103B-T & P)
Course Type	Core (Allied)
Course Nature	Hard
L-T-P structure	(3-1-0)
Course Objective	The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION –A

Calculus: Curvature (Cartesian, Parametric and Polar coordinates), Curvature at origin, Centre of curvature, Evolutes and involutes, Higher order partial order derivative, Homogeneous function and Euler's theorem, Differentiation of composite functions, Taylor's theorem for function of several variables, Maxima-Minima, Lagrange's method of multipliers

SECTION –B

Sequences and series: Tests for convergence of series (comparison, ratio, root, integral, Raabe's, logarithmic), Alternating series, Absolute convergence, Conditional convergence. Fourier series: Half range sine and cosine series, Parseval's theorem.

SECTION –C

Vector Calculus: Gradient, Directional Derivative, divergence, curl and their applications, line integral, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

SECTION –D

Matrices: Inverse and rank of a matrix, System of linear equations; Symmetric, skew-symmetric and orthogonal B.TECH 8 matrices; linear transformation, orthogonal transformation, Eigenvalues and eigenvectors, Diagonalization of matrices, Cayley-Hamilton Theorem.

Suggested Text/Reference Books

(i) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

(ii) Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

(iii) Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.

(iv) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

(v) D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

(vi) N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

(vii) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Title/Code	**BASICS OF ELECTRICAL & ELECTRONICS(ECH103B-T/P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0
Objective	

SECTION A

DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition Theorem, Thevenin and Norton Theorems.Time-domain analysis of first-order RL and RC circuits. AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel) resonance.Three-phase balanced circuits, voltage and current relations in star and delta connections.

SECTION B

Diodes and Applications covering, Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications.

SECTION C

Transistor Characteristics covering, Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations. Transistor Amplifiers and Oscillators, Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors. Feedback Amplifiers – Principle, Advantages of Negative Feedback, Topologies, Current Series and Voltage Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators.

SECTION D

Operational Amplifiers and Applications covering, Introduction to Op-Amp,Differential Amplifier Configurations,CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp,Concept of Virtual Ground.IC 555 and its applications as astable and mono-stable multi-vibrators.

Suggested Text / Reference Books

(i) D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
(ii) D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
(iii)L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
(iv) David. A. Bell (2003), Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India.
(v) SantiramKal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India 3. Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals by Pearson Education,
(vi) Paul B. Zbar, A.P. Malvino and M.A. Miller (2009), Basic Electronics – A Text-Lab. Manual, TMH 5

Basic Electrical Engineering Laboratory (1-Credit)

List of experiments/demonstrations:

1. Familiarization with the lab Equipment's.
2. To verify the Kirchhoff's Voltage Law and Kirchhoff's Current Law.
3. To experimentally verify Thevenin Theorem.
4. Introduction to CRO and measuring various parameters of Sine wave.
5. Characteristics of PN junction diode in Forward and reverse bias configuration using Zener diode.
6. Truth table Verification of AND and OR gate using diode.
7. To implement the diode in Half wave and full wave rectifier and analyse the circuit.
8. To plot the characteristics of Transistor in CE Configuration.
9. RC Phase Shift Oscillator.
10. Op Amp as Inverting and Non-Inverting Amplifier.
11. Minor project on 555 Timer Application.

Course Title/ Code	**Programming for Problem Solving Using C(CSH101B) T & P**
Course Type	Core (Allied)
Course Nature	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	Students are able to construct a program of moderate complexity from a specification

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

Programming and UNIX

Students will learn the basics of programming using Scratch, they will learn to use statements, expressions, conditions, selection, iteration, variables, functions, arrays, threads and events. In addition, they will be introduced to basic UNIX commands under Bash.

Introduction to Programming, test driven development, Scratch: Introduction, statements, expressions, conditions, selection, iteration, variables, functions, arrays.UNIX: Basic commands- pwd, ls, cd, rm, cat, less, mkdir, rmdir; permissions, root. C language: statements, expressions, conditions, selection iteration, variables, functions, arrays.

Section-B

Applying programming constructs

Students will learn how to write programs that satisfy unit tests. The instructor will build the unit tests, demonstrating how to break a problem down into smaller components. In the labs and homework, students will construct programs that satisfy the unit tests. Students become familiar with the constructs of the C programming language.

Moving to C: Data Types, constants, and variables, Statements, Expressions, Conditions, Selection, iteration, Functions and recursion

Decision making within a program, Conditions, Relational Operators, Logical Connectives, if statement, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement, structured Programming

Arrays; One dimensional arrays: Array manipulation; Searching, Insertion, Deletion of an element from an array; Finding the largest/smallest element in an array; Null terminated strings as array of characters, Standard library string functions

Introduction to Top-down approach of problem solving, Modular programming and functions, Standard Library of C functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, Passing arguments to a Function: call by reference, call by value, Recursive Functions, arrays as function arguments .

Section-C

Practical programming

During the third quarter of the class, students will begin building their own programs by decomposing problems into smaller tasks and writing unit tests that will check to see that the program accurately accomplishes the task using Test Driven Development. They will then write the program that satisfies their own unit tests. Students will learn to apply the constructs of the C programming language to create programs.

Students will learn to apply these programming techniques: Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions, Break, Continue and Goto, Type Conversion; Enumerations; Macros. Students will be able to use these techniques to develop programs

Section-D

Memory Management and Abstraction

During the final quarter, students will be introduced to dynamic memory allocation and dynamic data structures including: dynamic arrays. They will consolidate their ability to use the C programming techniques they have learned in the earlier sections.

Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays, pointers and structures, dynamic memory allocation,

Software Configuration Management, Modules, CUnit, GIT, SCRUM, MAKE. Dynamic Memory Allocation.

LIST OF EXPERIMENTS:

1. Scratch : Covering Concepts of
   I. Sequential Statements
   II. Variables
   III. Blocks
2. Unix Commands: pwd, mkdir, cd, ls, less, touch, cp,move, cat, rm, rmdir –r etc.
3. Moving to C Using nano and gcc.
4. Project on Calculator Using Agile Methodology, Nano, Cunit, Git, Scrum , Agile Methodology, Nano, Gcc, Make. Covering Conepts :
   I. Statements
   II. Functions
   III. Arrays
   IV. Structures
   V. Pointers
   VI. File Handling.

Books

1. The C Programming Language, Brian Kernighan and Dennis Ritchie
2. The Unix Programming Environment
3. Pro Git

Help Pages

1. Eclipse C/C++ Development Guide

Wikipedia Pages

1. Test-driven development, http://en.wikipedia.org/wiki/Test-driven_development
2. Unit testing, http://en.wikipedia.org/wiki/Unit_testing

Tool Web Sites

1. Eclipse, https://eclipse.org/users/
2. Git, http://git-scm.com/
3. GCC, https://gcc.gnu.org/onlinedocs/gcc-4.9.3/gcc/
4. Make
5. Unix

Web tutorials

1. Harvard's CS50, https://courses.edx.org/courses/HarvardX/CS50x3/2015/info

Course Title/ Code	**ENGINEERING DRAWING (MEW102B)**
Course Type:	Core (Allied)
Course Nature:	WORKSHOP
L-T-P-O Structure	(0-0-3-0)

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

Introduction to Engineering Drawing : Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Orthographic Projections: Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Section B

Projections of Regular Solids: Inclined to both the Planes- Auxiliary Views; Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Sections and Sectional Views of Right Angular Solids : Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Section C

Isometric Projections: Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions; Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, demonstrating knowledge of the theory of CAD software, Customization & CAD Drawing

Section D

Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models.Part editing and two-dimensional documentation of models.

Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; introduction to Building Information Modeling (BIM).

Text/Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
Corresponding set of) CAD Software Theory and User Manuals

Course Title/ Code	Indian Constitution (LWS324)
Course Type:	Audit(Allied)
Course Nature:	Basic
L-T-P-O Structure	2-0-0-0
Objectives	The objective of this paper is to orient the students about the Basic features and fundamental principles on the Constitution of India.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

- Meaning of the constitution law and constitutionalism
- Historical perspective of the Constitution of India
- Salient features and characteristics of the Constitution of India

SECIOTN-B

- Scheme of the fundamental rights
- The scheme of the Fundamental Duties and its legal status
- The Directive Principles of State Policy – Its importance and implementation

SECIOTN-C

- Federal structure and distribution of legislative and financial powers between the Union and the States
- Parliamentary Form of Government in India – The constitution powers andstatus of the President of India
- Local Self Government – Constitutional Scheme in India

SECIOTN-D

- Amendment of the Constitutional Powers and Procedure
- The historical perspectives of the constitutional amendments in India
- Emergency Provisions: National Emergency, President Rule, Financial Emergency

Semester-II

SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	**OFFERING DEPARTMENT	*COURSE NATURE (HARD/SOFT/ WORKSHOP/ NTCC)	COURSE TYPE (CORE/ELECTIVE/ UNIVERSITY COMPULSORY)	L	T	P	O	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
PHH102B-T/P	PHYSICS FOR ENGINEERS	NA	PHYSICS	HARD	CORE	3	1	2	0	6	5
MAH106B-T/P	MATHEMATICS – II (DIFFERENTIAL EQUATIONS)	MATHEMATICS-I	MATHEMATICS	HARD	CORE	3	1	0	0	4	4
ECH106B-T/P	ELECRONIC DEVICES & CIRCUITS	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	2	0	6	5
ECW107B	PROGRAMMIG FUNDAMENTALS USING LINUX	NA	COMPUTER SCIENCE	WORKSHOP	CORE	0	0	3	0	3	1.5
EDS288/ 289/290	APP. PHILOSOPHY/APP. PSYCHOLOGY/ APP. SOCIOLOGY	NA	EDUCATION	SOFT	ELECTIVE	2	0	0	0	2	2
HLS103B/ HLS104B	PROFESSIONAL ENGLISH ADVANCE/ PROFESSIONAL ENGLISH BASIC	NA	HUMANITIES	SOFT	CORE	2	0	2	0	4	3
CHH137B	ENVIRONMENTAL SCIENCE	NA	CHEMISTRY	SOFT	AUDIT	1	0	0	0	1	0
CDS102B	PROFESSIONAL COMMUNICATION-II	NA	SOFT	CORE	CORE	1	0	0	0	1	0
						14	3	9	0	26	20.5

Course Title/Code	**PHYSICS FOR ENGINEERS (PHH102B-T/P)**

Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0
Course Objective	To provide the student with a broad understanding of the physical principles of the universe, to help them develop critical thinking and quantitative reasoning skills, to empower them to think creatively and critically about scientific problems and experiments

Section-A

Semiconductors: Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices.

Section-B

Measurements basics and CRO: Standards of measurement-classification of errors-errors analysis. Static Characteristics- Accuracy, precision, sensitivity, linearity, resolution, hysteresis threshold, input impedance, loading effects etc. - dynamic characteristics.
CATHODE RAY OSCILLOSCOPE: Cathode Ray Oscilloscope: introduction- CRO, Cathode ray tube, Block diagram of CRO, Electrostatic Deflection, Measurement of phase, voltage and frequency using CRO, basic CRO circuits, dual trace and dual beam Oscilloscope, sampling and storage oscilloscopes.

Section-C

Measurements Techniques: DC measurements: DC voltmeter, Ammeter Ohmmeter, digital type voltmeter, AC measurement: Ammeter, Ohmmeter, AC voltmeter using rectifier, true RMS Voltmeter, chopper amplifier type voltmeter. Electronic voltmeter, electronic multi-meter, Q meter, RF Power measurement. Advantages of digital meters over analog meters, Digital voltmeter, Resolution and sensitivity of digital meters, digital frequency meter, period measurement, universal counter, measurement of pressure and displacement.

Section-D

Electromagnetic waves: The wave equation, Plane electromagnetic waves in vacuum, their transverse nature and polarization, relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples. Momentum carried by electromagnetic waves and resultant pressure. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

Suggested Text Books

1. Electrical & Electronics Measurement & Instrumentation by A K Sawhney, Dhanpat Rai & Company
2. David Griffiths, Introduction to Electrodynamics
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. .J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).

Suggested Reference Books:

(i) Halliday and Resnick, Physics
(ii) Measurement Systems by E O Doebilin
(iii) W. Saslow, Electricity, magnetism and light

Experiment List:

1. Study the IV characteristics of a PN junction diode.
2. Error analysis in measurement on simple electrical circuits.
3. Study and use of digital CRO.
4. Measurement of frequency and voltage using CRO
5. Mini Project
6. Measurement of Phase difference using CRO.
7. Study of DC / AC analog voltmeters and their comparison

8. Use of digital multimeter and sensitivity measurement.
9. Measurement of Q-factor L, R using LCRQ meter.
10. To measure a displacement using Linear Variable differential transformer (LVDT)

Course Title/Code	MATHEMATICS II (DIFFERENTIAL EQUATIONS)(MAH106B-T)
Course Type:	Core (Allied)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Course Objective	The objective of this course is to familiarize the prospective engineers with techniques in ordinary and partial differential equations and Numerical Methods. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION – A

Differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Applications of differential equations – electrical circuits and orthogonal trajectories.

SECTION – B

Partial Differential Equations – Formulation of differential equation, classification of differential equation, solution of differential equation by method of direct integration, by separation of variable. Application of PDE – Initial value problem, boundary value problem, formulation and solution of wave equation (1 D and 2D), heat equation (1 D and 2D) etc.

SECTION – C

Numerical Methods – 1: Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. B.TECH 17

SECTION – D

Numerical Methods – 2: Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of Differential equations Euler, RK.

Textbooks/References:

1. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.
2. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
3. Manish Goyal and N.P. Bali Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.
7. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
8. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
9. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
10. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.

Course Title/Code	**ELECTRONIC DEVICES & CIRCUITS**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0
Course Objective	To provide the students with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the devices, instruments and sensors used in various applications.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

Diodes and Applications : Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; PN Diode Switching time, Breakdown Mechanisms, Transition and Diffusion Capacitance Zener Diode – Operation and Applications;Tunnel Diode ,Schottky diode ,Varicap diode Opto-Electronic Devices – LEDs, Photo Diode and Applications; Diode Circuits:Rectifiers:Half Wave and Full Wave Rectifiers with and without Filters;Wave shaping circuits: Clipping circuits;Series,Shunt, Combinational, Clamping circuits; Series and Shunt; Applications; Voltage multiplier

. **SECTION-B**

Transistor Characteristics covering, Bipolar Junction Transistor (BJT) – Construction, Operation, Common Base, Common Emitter and Common Collector Configurations, Amplifying Action,Transistor Biasing: Selection of Operating Point, Stability factor Fixed biased configuration, Emitter-bias configuration Voltage Divider Bias Configuration;Bias compensation :Diode Compensation,Thermistor Compensation and sensistor Compensation;

SECTION-C

Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement Type Metal Oxide Semiconductor (MOS) FETs

Section D

Regulated and Switching Power Supplies :Characteristics of Regulated Power Supply,Stabilization,Voltage Regulators:Discrete Transistor Voltage Regulator:Series Volatge Regulator:Transistor series voltage regulator or Emitter follower voltage regulator ,Transistor Shunt Voltage Regulator, IC voltage Regulator

Text Books:

1. Millman&Halkias, “Integrated Electronics”, McGraw Hill Publications, 1992.
2. Boylestad&Nashlesky, “Electronic Devices & Circuit Theory”, PHI, 10th Edition.
3. Albert Malvino& David J. Bates, “Electronic Principles”, Tata McGraw Hill, 7th Edition 2007
4. Floyd, “Electronic Devices”, PHI, 7th Edition.

Reference Books:

1. Sedra, Smith, ‘Microelectronic Circuits’, Oxford University Press, fifth edition, 2004.
2. Paul Horowitz and Winfield Hill, ‘The art of electronics’, Cambridge university press, third edition, 2011.

List of Experiments:

1. Familiarization with electronic components and measuring instruments.
2. Plot the forward and reverse V-I characteristics of a PN junction diode and calculation of cut-in voltage, static and dynamic resistances.
3. Plot the Reverse V-I characteristics of a Zener diode and calculation of cut-in and Zener breakdown voltages. Application of Zener diode as a voltage regulator.
4. Implementation of half-wave and full-wave rectifier circuits and measurement of average and rms values of the rectifier output.
5. Study the working of a diode as a Clipper
6. Study the working of diode as a Clamper
7. Plot the input/output characteristics of a transistor in common Base configuration and calculation of its current amplification factor
8. Plot the input/output characteristics of a transistor in common Emitter configuration and and calculate its voltage gain.
9. To study the working of transistor in Common Collector configuration as a Buffer.
10. Plot the drain characteristics of a JFET
11. Study the working of a Regulated power supply
12. To design a project based on the above experiments

Course Title/Code	**APPLIED PHILOSOPHY (EDS288)**
Course Type	Elective (Allied)
Course Nature	Soft
L-T-P-O Structure	(2-0-0-0)
Objectives	To enable students to - confront the philosophical problems implicit in the experience of self, others and the society. - read critically the philosophy of influential philosophers with respect to society, Science and success in life - understand and apply concepts and theories of moral philosophy. - reflect philosophically and ethically on their own personal, professional and civic lives. -formulate for himself or herself a philosophy of life or world-view consistent with the objectives of liberal society.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION A

INTRODUCTION TO PHILOSOPHY: Philosophy: Meaning, Nature and Scope**,** Practical uses of Philosophy**,** Branches of Philosophy.

SECTION B

THOUGHTS OF PHILOSOPHERS AND THEIR IMPLICATIONS: General Philosophy of John Dewey, Swami Vivekananda and Rabindra Nath Tagore**,** Philosophy of life and success: Steve Jobs, N.R. Narayana Murthi, Dr. A.P.J. Abdul Kalam and Muhammad Yunus, Philosophy of Science and technology- Francis Bacon and Martin Heidegger.

SECTION C

PHILOSOPHICAL PERSPECTIVES OF SOCIO-POLITICAL SCENARIO IN INDIA: Nature of Democracy and its implications, Meaning and requirements of National Integration, Universal Human Rights

SECTION D

PHILOSOPHICAL PERSPECTIVES OF RELIGIOUS SCENARIO IN INDIA: Secularism—its nature and implications, Moral Philosophy of religion with special reference to Hinduism, Jainism, Buddhism, Islam, Christianity, Sikhism. Religious pluralism and Religious tolerance.

Reference Books and Readings:

1. Bhatia, K. & Bhatia, B. (1974) The Philosophical and Sociological Foundations of Education. Delhi: Doaba House.

2. Brubacher, John. S. (1969). Modern Philosophies of Education, New Delhi: Tata McGraw-Hill
3. Dewey, J. (1966). Democracy in Education, New York: Macmillan.
4. Ferre, F.(1995). Philosophy of Technology. University of Georgia Press.
5. Gandhi, M. K. (1956). Basic Education. Ahmedabad, Navajivan.
6. Goel, A. & Goel S. L. (2005). Human values and Education. New Delhi: Deep and Deep Publications Pvt. Ltd.
7. Palmer, Joy A. et.al. (2001). Fifty major thinkers on education from confucious to Dewey. New Delhi: Rutledge.
8. Rajput, J.S. (2006). Human Values and Education. New Delhi: Paragon Publications.
9. Walia, J.S. (2011). Philosophical, Sociological and Economic Bases of Education.

Course Title/Code	**Applied Psychology (EDS289)**
Course Type	Elective
Course Nature	Soft
L-T-P-O Structure	(2-0-0-0)
Objectives	-To define psychology and its application across various fields. -To understand the conceptual framework of attitude and personality along with cherishing out their attitude and personality development. -To conceptualize psychology in social and organizational settings. -To maintain and reform group dynamics.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

PSYCHOLOGY: ATTITUDE FORMATION

Psychology: Meaning, nature, and scope, Role of psychology across multi-disciplinary aspects, Introduction: Attitude, Stereotypes, Prejudice, and Discrimination, Formation of attitude and attitude change.

Section B

PERSONALITY AND PERSONALITY DEVELOPMENT

Definition of personality and personality development, State/ Trait approach to personality, Bandura's Social- Cognitive theory of personality

Section C

SOCIAL PSYCHOLOGY

Introduction to social identity, social cognition, and social influence, social conflicts and its resolutions, Group dynamics: Introduction, formation, types of groups, cooperation, competition, and conflict in groups

Section D

ORGANIZATIONAL PSYCHOLOGY

Organizational Psychology: Definition, fundamental concepts and importance, Introduction to job satisfaction, work motivation, and organizational commitment. Introduction to participation, empowerment, and team work

References Books and Readings:

1. Arrow, K. J. (1995). Barrier to Conflict Resolution. NY: W. W. Norton.
2. Bandra, A., & Walters, R. H. (1963). Social Learning and Personality Development. New York: Holt, Rinehart, & Winston.
3. Bandra, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice- Hall, Inc.
4. Baron, R. A., Byrne, D. (1997). Social Psychology (8th Ed.). Boston, MA: Allyn & Bacon.
5. Baron, R. A. (2001). Psychology (5th ed.). London: Pearson.
6. Cialdini, R. B. (2001). Influence: Science and Practice (4th Ed.). Boston, MA: Allyn & Bacon.
7. Feldman, R. S. (2008). Essentials of Understanding Psychology. New Delhi: Tata McGraw Hill.
8. Friedkin, N. (1998). A structural theory of social influence. Cambridge: Cambridge University Press.
9. Gage, N. L., & Berliner, D. C. (1992). Educational Psychology (5th Ed.). Boston, MA: Houghton Mifflin Co.
10. Hall, C. S., Lindzey, G. & Campbell, J. B. (2004). Theories of Personality (4th Ed.). New York: Wiley.
11. Hunt, R. R., & Ellis, H. C. (2006). Fundamentals of Cognitive Psychology. New Delhi: Tata McGraw Hill.

12. McDavid, J. M., & Harari, H. (1994). Social Psychology: Individuals, Groups, and Societies. New Delhi: CBS Publishers.
13. Millward, L. (2005). Understanding Occupational and Organizational Psychology. London: Sage Publications.
14. Morgan, C. T., King, R. A., Weisz, J. R., & Schopler, J. (1993). Introduction to Psychology. (7th Ed.). New Delhi: Tata McGraw Hill.
15. Woolfork, A. E. (2014). Educational Psychology (12th Ed.). Boston: Allyn & Bacon.

Course Title/Code	**APPLIED SOCIOLOGY (EDS235)**
Course Type	**Elective (Allied)**
Course Nature	**Soft**
L-T-P-O Structure	**(2-0-0)**
Objectives	1. To know and understand about the fundamental concepts of sociology and its applications. 2. To develop the analytical skills of students about ways in which social processes affect our everyday lives. 3. To understand the impact of various processes of social change and assess their impact on society. 4. To understand and analyze the social cultural dynamics that contribute to transformation of Indian reality 5. To study the various contemporary issues of society. 6. To develop basic research skills in area of sociology.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

Introduction and Applications of Sociology:

- Society, Community, Social Institutions, Social Groups, Introduction to Applied Sociology
- Sociology and Social Processes
- Sociology and Social Change
- Sociology and Social Problems
- Clinical Sociology

Section B

Sociological Processes:

- Social Stratification, Social Mobility and their impact on society
- Socialization, Agents of Socialization, Assessing the effects of Socialization
- Social Movements: Concept, Impact of Environmental Movements in India: Chipko Movement, Narmada Bachao Andolan

Section C

Processes and Issues of Social Change:

- Social Change: Westernization, Urbanization, Privatization, Globalization, Sustainable development
- Issues in urban development-Population, poverty, unplanned growth and ecological issues
- Conflict management:
    - Intergroup: Causes, Resolutions
    - Organizational Conflict, Conflict Management and Grievance Handling

Section D

Field Survey & Report Writing:

- Need, Meaning of Survey
- Types of Survey
- Steps in Conducting Survey
- Data Collection Methods
- Salient Features of Report Writing

References: Books and Readings

1. Andrew, W. (1997) Introduction to the Sociology of Development. New Jersey, Palgrave Macmillan.
2. Berg, L.B. (2001). Qualitative Research Methods for the Social Sciences (4th edition). Boston: Allyn and Bacon
3. Bhatia, H.(1970). Elements of Social Psychology. Bombay: Somaiyya Publications Pvt Ltd.
4. Bhattacharyya D.K (2009). *Organizational Behavior*, Oxford University Press, UK.
5. Dastupta Driskle(2007) : Discourse on Applied Sociology Volume-II, 2007
6. Desai, B Sonalde et al. (2010). Human Development in India: Challenges for a Society in Transition. OUP
7. Deshpande, S.(2003). Contemporary India: A Sociological View. New Delhi: Viking.
8. Hall R.H (2009). *Organizational Structures, Processes & outcomes, Asia*: Pearson Education Publications.
9. Hodegetts R M. (2009). *Organizational Behavior*, Macmillan.
10. Mc Michael.P. (1996). Development and Social change: A global perspective. California Thousand Oaks.
11. Merton, R and Nisbet, (1976) Contemporary Social Problems, New York: Harcourt, Brace and World.
12. Metha, S. (2009). Women and Social Change, Jaipur: Sage.
13. Michael Edwards (2011). Civil Society in India, edited The Oxford Handbook of Civil Society, Oxford, Oxford University Press
14. Mitra et.al. (2009). Democracy, Agency and Social Change in India, New Delhi: Sage
15. Pratt henry Fairchild(2009) : Outline of Applied Sociology, 2009
16. Ranjitkumar : Research Methodology, Person Education, Delhi.
17. Schaefer, R.T (2004). Sociology a Brief Introduction, (5thed.) New York: McGraw-Hill Inc..
18. Sirclaus Moser & G. Kalton: Survey Methods in Social Investigation, Heinemann Educational Books, London.
19. Sanderson. (2010). Social Psychology, New York: John Wiley.
20. Tepperman, L. & Curtis, J. (Eds.) (2009). Principles of Sociology: Canadian perspectives. Don Mills, ON: Oxford University Press.
21. Young, K. (2001). Handbook of Social Psychology, London: Routledge and Kegal Paul Ltd.

Course Title/ Code	**Programming Fundamentals using Linux (ECW------B)**
Course Type:	**Elective**(Departmental)
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3-0)
Objectives	Student will be able to design a website.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

List of labs:

1. General Purpose Commands: date, who, who am I, uname, cal, tty, stty, echo, printf, bc, script, passwd ,finger.
2. File Handling utilities:

directory related commands : pwd,mkdir,cd,rmdir,ls

File related commands: cat, cp, mv, rm, chmod, chown, chgrp, file, find, ln, ulink, ulimit,umask,touch

3. Process Related Commands: ps, kill, nohup, at, batch, crontab, fg, bg, jobs
4. Filters: cat, head, tail, cut, paste, cmp, comm, diff, sort, more, less, pg, tr, uniq etc….
5. Network Related commands: telnet, ftp, rlogin, arp
6. Disk and backup utilites
   disk utilities : df, du
   backup utilities: cpio ,tar
7. Advanced filters (grep,sed,awk)
   grep: (grep,egrep,fgrep)
   - Write a grep command that selects the lines from the file1 that have exactly three characters
   - Write a grep command that selects the lines from the file1 that have at least three characters.
   - Write a grep command that selects the lines from the file1 that have three or fewer characters
   - Write a grep command that count the number blank lines in the file1
   - Write a grep command that count the number nonblank lines in the file1
   - Write a grep command that selects the lines from the file1 that have the string UNIX.
   - Write a grep command that selects the lines from the file1 that have only the string UNIX.
   - Write a grep command that copy the file to the monitor, but delete the blank lines.
   - Write a grep command that selects the lines from the file1 that have at least two digits without any other characters in between
   - Write a grep command that selects the lines from the file 1 that do not start with A to G.

   Sed:
   - Write a sed command that print lines numbersof lines beginning with "O"
   - Write a sed command that delete digits in the given input file.
   - Write a sed command that delete lines that contain both BEGIN and END
   - Write a sed command that delete lines that contain BEGIN but not END
   - Write a sed command that deletes the first character in each line in a file
   - Write a sed command that deletes the last character in each line in a file

   Awk:
   - Write an awk command to print the lines and line number in the given input file
   - Write an awk command to print first field and second field only if third field value is >=50 in the given input file. (input field separator is ":" and output field separator is ",")
   - Consider the marks.txt is a file that contains one record per line(comma separate fields) of the student data in the form of studentid, student name, Telugu marks, English marks, Maths Marks, Science marks, Social Marks. Write an awk script to generate result for every students in the form of studentid, studentname, Total Marks and result. Result is PASS if marks is >=30 in TELUGU and English, and if marks>=40 in other subjects. Result is fail otherwise.
   - Write an awk program to print the fields 1 and 4 of a file that is passed as command line argument. The file contains lines of information that is separated by "," as delimeter. The awk program must print at the end the average of all 4th field data.
   - Write an awk program to demonstrate user defined functions and system command.
   - Write an awk script to count the number of lines in a file that do not contain vowels.
   - Write an awk script to find the number of characters, words and lines in a file.

Text Books:

Unix and Shell Programming – B. M. Harwani, OXFORD University Press.

Reference Books:

1. Linux Administration : A Beginner's Guide – Wale Soyinka , McGraw Hill Publication
2. Unix Concepts and Applications – Sumitabha Das, McGraw Hill Publication

Course Title/ Code	Professional English-Advance (**HLS103B**)
Course Type	Core (Allied)
Course Nature	Soft
L-T-P-O Structure	(2-0-2)
Credits	3
Objectives	The students (A) will be able to articulate (B) communication skills and develop talent (C) for increased understanding of corporate requirement (D).

Pre requisites: Knowledge of fundamental grammar along with **LSRW** (**L**istening, **S**peaking**, R**eading &**W**riting).
Learning Outcomes:Course Learning Outcomes: At the end of the semester the students will be able:

- To communicate articulately.
- To show the spirit of cohesiveness and art of collaborative approach through activities.
- To exhibit the substantive writing skills.
- To demonstrate the procedure of debating skills.
- To display the developed critical aptitude.

	UNIT	WEIGHTAGE
SYLLABUS	**I**	**30%**
	II	**20%**
	III	**25%**
	IV	**25%**
	TOTAL	**100%**

Course Outline:

Section – A

Lexis: Vocabulary Building: The Concept of Word Formation, Root Words from Foreign Languages and their use in English, Acquaintance with Prefixes & Suffixes from Foreign Languages in English to form derivatives, Synonyms, Antonyms, and Standard abbreviations.
Semantics: Basic Writing Skills: Sentence Structures, Use of Phrase & Clauses in Sentences, Importance of Proper Punctuation, Creating Coherence, Organizing Principles of Paragraphs in Documents, Techniques of Writing Precisely.

Section – B

Grammar: Identifying Common Errors in Writing: Subject-Verb Agreement, Noun-Pronoun Agreement, Misplaced Modifiers, Articles, Prepositions, Redundancies, Clichés

Section – C

Technical Writing: Nature & Style of Sensible Writing: Describing, Defining, Classifying, Providing Examples or Evidence, Writing Introduction & Conclusion, Writing Practices: Comprehension, Precis Writing, Essay Writing.

Section – D

Oral Communication: Listening Comprehension, Pronunciation, Intonation, Stress & Rhythm, Common Everyday Situations: Conversations & Dialogues, Communication at Work Place, Interviews, Formal Presentation.
Lab Activities

1. Exercises based on Grammar
2. Exercises based on Semantics
3. Telephonic and Face-to-Face Communication
4. Listening to Understand (Hearing vs. Listening)
5. Business Letters
6. Reading/Listening Comprehension
7. Essay Writing Session
8. Precis Writing Session
9. Role Plays
10. Business QUIZ based on Lexis and Semantics
11. Presentation
12. Developing Outlines

Suggested Text Book Reading:

CIEFL, Hyderabad. *Exercises in Spoken English Parts I-III*.Oxford University Press.
Koneru, Aruna. *Professional Communication*. Mcgraw Hills Education Pvt. Ltd.
Kumar, Sanjay and Pushpa Lata.Oxford University Press, 2011. Print.
Lyons, Liz Hamp and Ben Hearsly.Study Writing.Cambridge University Press. 2006. Print.
Swan, Michael. *Practical English Usage*.OUP, 2014. Print.
Wood, F T. Remedial English Grammar.Macmillan, 2007. Print.
Zinsser, William. *On Writing Well*.Harper Resource Book, 2006. Print.

Course Title/ Code	**Professional English-Basic (HLS104B)**
Course Type	Core (Allied)
Course Nature	Soft
L-T-P-O Structure	(2-0-2)
Credits	3
Objectives	The students (A) will be able to imbibe (B) the basics of communication skills & English Language and literature (C) by understanding the need of industry (D).

Pre-requisite:

Knowledge of elementary grammar and basic nuances of oral and written English communication skills.

Course Learning Outcomes: At the end of the semester the students will be able:

- To demonstrate the basic skills of effective communication.
- To build an elementary understanding of form, meaning and use of words in varied discourses.
- To equip with fundamental writing skills.
- To show the essentials of debating skills.
- To exhibit creative thinking.

	UNIT	**WEIGHTAGE**
SYLLABUS	**I**	**25%**
	II	**25%**
	III	**25%**
	IV	**25%**
	TOTAL	**100%**

Course Outline:

Section – A

Communication: Communication: Introduction to Business Communication, Basic forms of communication – Verbal & Non-Verbal Communication, Process of Communication, Principles of Effective Communication, 7 Cs of Communication, Media of Communication, Types of Communication, Barriers of Communication, Formal and Informal Communication Network, Grapevine Communication, Miscommunication, Steps for improving communication, Impact of cross-cultural communication.

Section – B

Grammar: Parts of Speech, Subject-Verb Agreement, Tenses, Sentence: Kinds & Parts, Active & Passive Voices, Direct & Indirect Narration, Spotting the Errors.

Section – C

Lexis: Homonyms, Homophones, Homographs, Words often confused, One word Substitutes, Synonyms and Antonyms, Foreign Words, Phrasal Verbs & Idioms and Phrases.

Section – D

Technical Writing: ABC of Writing, 7 Cs of Writing Skills, Notice Writing, Situation Writing, Précis Writing, Report Writing, Email Writing & Email Etiquettes, Paraphrasing, Comprehension, Essay Writing.

Lab Exercises/Activities

1. Exercises based on Communication
2. Exercises based on Grammar
3. Exercise on Sentence
4. Spotting the Errors

5. Reading/Listening Comprehension
6. Essay Writing Session
7. Report Writing and Email Writing
8. Direct & Indirect Narration
9. Active & Passive Voices
10. Tense
11. Paraphrasing
12. Presentation

Suggested Text Book Reading:
Wren and Martin: *High School English Grammar and Composition A Text Book for Indian Students*. S.Chand and Co. ed. Paperback 2018.
A Practical Course for Developing Writing Skills in English. J K Gangal: PHI Learning Pvt.
McMillan English Check your Vocabulary. MaCarthy: Foundation Books, OUP, 2007.
English Grammar, Competition and Correspondence. M.A. Pink and A.C. Thomas: S. Chand and Co.

Course Title/ Code	**Environmental Science (CHH137) T**
Course Type	Audit (Allied)
Course Nature	Soft
L-T-P-O Structure	(2-0-0-2)
Objectives	1. to make the student identify the areas of environmental degradation 2. to make the student identify the impact of environmental degradation on the surroundings 3. To apply the concepts such as sustainable development in real life. 4. To help the engineering student to correlate his field with various aspects of environment. .

	Sections	**Weightage**
Syllabus	A	28%
	B	28%
	C	28%
	D	16%
	TOTAL	**100%**

SECTION-A

Unit 1: Multidisciplinary nature of environmental studies

Definition, scope and importance, Need for public awareness (OC)

Unit 2: Renewable and Non-Renewable Resources

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, **use of alternate energy sources. Case studies (OC).**

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources. (OC)

Equitable use of resources for sustainable lifestyles

SECTION-B

Unit 3: Ecosystems

Concept of an ecosystem.Structure and function of an ecosystem.

- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the

- Following ecosystem:-
  - Forest ecosystem
  - Grassland ecosystem
  - Desert ecosystem
  - **Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (OC)**

Unit 4: Biodiversity and its conservation

• **Introduction** – Definition: genetic, species and ecosystem diversity.

• Biogeographical classification of India

- **Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic And option values (OC)**
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation
- Hot-sports of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- **Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity (OC).**

SECTION-C

Unit 5: Environmental Pollution

Definition

• Cause, effects and control measures of:-

- Air pollution
- Water pollution
- Soil pollution
- Marine pollution
- Noise pollution
- Thermal pollution
- Nuclear hazards
- Solid waste Management: Causes, effects and control measures of urban and Industrial wastes. (OC)
- Role of an individual in prevention of pollution. (OC)
- Pollution case studies. (OC**)**
- Diaster management: floods, earthquake, cyclone and landslides.

Unit 6: Social Issues and the Environment

• From Unsustainable to Sustainable development

• Urban problems related to energy

• Water conservation, rain water harvesting, watershed management

• Resettlement and rehabilitation of people; its problems and concerns. Case Studies

• Environmental ethics: Issues and possible solutions.

• Climate change, global warming, acid rain, ozone layer depletion, nuclear Accidents and holocaust. Case Studies (OC).

• Wasteland reclamation.

• Consumerism and waste products.

• Environment Protection Act.

• Air (Prevention and Control of Pollution) Act (OC)

• Water (Prevention and control of Pollution) Act (OC)

• Wildlife Protection Act

• Forest Conservation Act

• Issues involved in enforcement of environmental legislation (OC).

• Public awareness (OC).

SECTION-D

Unit 7: Human Population and the Environment

- Population growth, variation among nations.
- Population explosion – Family Welfare Programme
- Environment and human health.
- Human Rights (OC).
- Value Education (OC).
- HIV/AIDS (OC).
- Women and Child Welfare (OC).
- Role of Information Technology in Environment and human health.
- **Case Studies (OC).**

***OC = Outcome component**

Field work

- Visit to a local area to document environmental assets river/ forest/grassland/hill/mountain
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.
- Any socially relevant problem identification and proposing its possible solution

NOTE: Manav Rachna has adopted five villages, where students would be visiting, will identify the socially relevant issues and work on to provide possible solution.

Semester-III

SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	**OFFERING DEPARTMENT	*COURSE NATURE (HARD/ SOFT/ WORK SHOP/ NTCC)	COURSE TYPE (CORE/ELECTIVE/ UNIVERSITY COMPULSORY)	L	T	P	O	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
ECH202 B-T/P	NETWORK THEORY	BASIC ELECTRICAL	ELECTRONICS &	HARD	CORE	3	1	2	0	6	5

		ENGINEERING	COMMUNICATION								
ECH203 B-T/P	ANALOG ELECTRONICS	ELECRONIC DEVICES & CIRCUITS	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	2	0	6	5
ECH213 B-T/P	DIGITAL ELEECTRONICS	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
CSH103 B-T & P	DATA STRUCTURE &ALGORITHMS	NA	COMPUTER SCIENCE	HARD	CORE	3	1	2	0	6	5
CSW208B	PROGRAMMING FOR PROBLEM SOLVING USING PYTHON	PROGRAMMING FOR PROBLEM SOLVING USING C	COMPUTER SCIENCE	WORKSHOP	CORE	0	0	3	0	3	1.5
ECW205B	ELECTRONIC DESIGN WORKSHOP	NA	ELECTRONICS & COMMUNICATION	WORKSHOP	CORE	0	0	3	0	3	1.5
CDO201	PROFESSIONAL COMPETANCY ENHANCEMENT-I	NA	CDC	SOFT	CORE	0	0	1	0	1	0.5
RDO501	ITR	NA	ELECTRONICS & COMMUNICATION	SOFT	CORE	0	0	1	0	1	0.5
FLS101-103	FOREIGN LANGUAGE	NA	FOREIGN LANGUAGE	AUDIT	ELECTIVE	1	1	0	0	2	0
						13	5	14	0	32	23

Course Title/Code	**NETWORK THEORY**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0
Objective	

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section –A

Introduction: Introduction to Basic signals and introduction to systems, Thevenin's and Nortons's theorem, Superposition theorem Reciprocity theorem, Millman's theorem, Compensation theorem Maximum power transfer theorem for ac circuits. Two-Port Network: Introduction and characterization of two port networks, Open circuit impedance parameters, Short circuit admittance parameters Transmission parameters, Inverse transmission parameters, Hybrid parameters, Inverse hybrid parameters, Interrelation between parameters, Condition of symmetry and reciprocity for a two-port network, Interconnection of two port network.

Section-B

Transient Analysis: Introduction to transient analysis, Initial conditions in elements source free and forced response of RL, RC and RLC series and RLC parallel circuit for a DC source, Time constant, Introduction to Laplace transform and inverse Laplace, application of Laplace transform for solution of RL, RC & RLC Circuits. Graph Theory: Elements of graph theory: graph, tree and co tree, links and twigs, Incidence Matrix, Tie set matrix and KVL for tie set Cut set matrix and KCL for cut set, Duality.

Section -C

Filters: Classification of filters, Analysis and design of Low pass filter using constant K and m-derived method Analysis and design of High pass, band pass and band reject filters using constant K and m-derived method.

Section-D

Network Functions: Driving point functions and transfer functions, properties and necessary conditions of Driving point functions and transfer functions, Poles and Zeros of Network function, Causality and Stability Hurwitz polynomial and properties of Hurwitz polynomial, Positive real function Properties of Positive real function. Network Synthesis: Synthesis of one port networks: Cauer and Foster Methods LC networks Synthesis of one port networks: Cauer and Foster Methods, RL, RC networks.

LIST OF EXPERIMENTS:

1. To test and demonstrate the validity of nodal analysis and mesh analysis through experimental measurements.
2. To reduce the complexity of a two terminal linear network by means of Thevenin's and Norton's theorem.
3. To measure and verify Open-circuit impedance [Z] parameter for a two-port network and its application for a series network.
4. To measure and verify Short-circuit Admittance [Y] parameter for a two-port network and its application for a parallel network.
5. To measure and verify Hybrid parameter [h] and its application for a series parallel network for a two-port network.
6. To measure and verify Transmission line parameters [ABCD] for a two-port network and its application for a cascaded network.
7. Introduction of circuit creation & simulation software P-Spice and Transient response of RL circuit, Transient response of RC circuit.
8. Resonance frequency, Bandwidth of RLC series circuit using P-Spice software
9. To design a constant K low pass filter (both Π and T sections).
10. To design a constant K High pass filter (both Π and T sections)

Text Books:

1. A Sudhakar and Shyammohan S Palli, "Circuits and Networks- Analysis and Synthesis", McGraw Hill Education.
2. D Roy Choudary, "Network and Systems" New Age International.

Reference Book:

1. M. E. Van Valkenberg, "Network Analysis" 2nd Edition, Prentice Hall of India
2. S P Ghosh, A K Chakraborty, "Network Analysis and Synthesis", McGraw Hill Education

Course Title/Code	**ANALOG ELECTRONICS**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0
Objective	To provide the basic knowledge on the working and operation of various transistors and linear integrated circuits ,their design and applications

Syllabus	**Sections**	**Weightage**

	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

BJT circuits: Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits, ebers moll model.
MOSFET structure and I-V characteristics

Section B

MOSFET circuits:.MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, transconductance, high frequency equivalent circuit, Differential amplifier.

Section C

Power amplifier: Class A, Class B. Class AB, Class C, Transformer coupled amplifier, Oscillators: barkhausen criteria,Hartley Oscillators, Colpitts Oscillators, Phase-Shift Oscillators, Wein-Bridge Oscillators

Section D

OpAmp: Block diagram of OpAmp internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product)
Linear applications of op-amp: Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, instrumentation amplifier, integrator/differentiator, , active filter, Log & anti log amplifier.
Nonlinear applications of op-amp:Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector, Monoshot.

LIST OF EXPERIMENTS:

1. Design & measure the frequency response of an RC coupled amplifier using discrete components.

2. Design a two stage RC coupled amplifier and determine the effect of cascading on gain and bandwidth

3. Study the effect of voltage series, current series, voltage shunt, and current shunt feed-back on amplifier using discrete components.

4. Design & realize inverting amplifier, non-inverting and buffer amplifier using 741 Op Amp.

5. Verify the operation of a differentiator circuit using 741 op amp and show that it acts as a high pass filter.

6. Verify the operation of a integrator circuit using 741 op amp and show that it acts as a low pass filter.

7. Design and verify the operations of op amp adder and subtractor circuits.

8. Plot frequency response of AC coupled amplifier using op amp 741 and study the effect of negative feedback on the bandwidth and gain of the amplifier.

9. Design & realize using op amp 741, Wein -bridge oscillator.

10. To design & realize using op amp 741, square wave generator.

11.To design & realize using op amp 741, logarithmic amplifier & VCCS.

Text/References:

1. A. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier

theory and applications", McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1989.
5. P. R. Gray, R. G. Meyer and S. Lewis, "Analysis and Design of Analog Integrated Circuits", John Wiley & Sons, 2001.

Course Title/Code	**SIGNALS & SYSTEMS/ ECH202B-T/P**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

Introduction of Signals: Signals: Definition, Introduction to elementary signals: unit impulse, unit step, unit ramp, exponential, rectangular pulse, sinusoidal, Transformation of independent variable of signals, Classification of signals and their representations: continuous-time/discrete-time, periodic/non-periodic, even/odd, energy/power, deterministic/random, one-dimensional/multi-dimensional, Difference between analog and digital signals and their advantages, Introduction of System: classification of systems, system properties: linearity, time/shift-invariance, causality, stability.

Section B

Fourier Series (FS): Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients.
Fourier Transforms (FT): CTFT - Definition, conditions of existence of Fourier Transform, Properties of CTFT, Magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT, DTFT - Discrete time Fourier transform, Inverse DTFT, Condition of convergence, Properties and theorems of DTFT, Comparison between CTFT and DTFT

Section C

Laplace-Transform (LT) and Analysis of LTI system: One-sided LT of elementary signals, Regions of convergence (ROC), Important theorems and properties of LT, Inverse LT, Bilateral LT, Solutions of differential equations using LT, Relation between LT and FT, Analysis and characterization of LTI system using Laplace Transform, Impulse response, step response and frequency response.

Section D

Z-transform (ZT) and Analysis of Discrete Time System: One sided and Bilateral Z-transforms, ZT of signals, ROC, Properties and theorems, Inverse Z- transform, S to Z-plane mapping, relation between ZT and DTFT, Analysis and characterization of discrete time system using Z- transform, Impulse response, step response and frequency response.
Sampling and Reconstruction: The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects.

Text/References:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India.
2. Tarun Kumar Rawat, Signals and Systems, Oxford University Press, 1st edition, 2010.

Reference Books:

1. I J Nagrath, R. Ranjan&Sharan, Signal and Systems, TMH, New Delhi.

Course Title/Code	**DIGITAL ELECTRONICS(ECH213B-T/P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0
Course Objective	

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

Fundamentals of Digital Techniques: Binary, Octal and Hexadecimal number system, Binary, Octal and Hexadecimal arithmetic, Radix conversion, Signed binary numbers, Fixed and floating point numbers, BCD, Gray, Excess-3, Self-Complimentary codes, Error detecting and correcting codes- Parity check codes, Hamming code, Basic logic operation and logic gates, Truth table, Fundamental theorems of Boolean Algebra, Standard representation of logic functions-SOP and POS forms, Simplification using K-map and Quine Mc-Clusky methods.

Section-B

Combinational Design using MSI Devices: Design of combinational circuits - Half, full and parallel adder, Half and full subtractor, BCD adder, BCD Adder as a Subtractor, Multiplexer, Demultiplexer, Decoder/display driver, Encoder, Priority encoder, Magnitude comparator, Code converter, Binary Multiplier, Design examples.

Section-C

Sequential Logic Circuits: Latches, Flip-flops: R-S, J-K, Master-slave, T, D, Conversion of flip flops, Registers: SISO, SIPO, PISO, PIPO, Bidirectional and Universal registers, Counters: Asynchronous, Synchronous counters, Shift register counters: Ring & Johnson Counter, Designing examples of Counters, Arithmetic logic unit.

Section-D

Logic Families – Significance and Types, Characteristic Parameters, Transistor Transistor Logic (TTL), Emitter Coupled Logic (ECL), CMOS Logic Family, BiCMOS Logic, NMOS and PMOS Logic, Integrated Injection Logic (I2L) Family, Comparison of Different Logic Families, Interfacing with Different Logic Families- CMOS-to-TTL Interface and TTL-to-CMOS Interface, TTL-to-ECL and ECL-to-TTL Interfaces, CMOS-to-ECL and ECL-to-CMOS Interfaces

Text Books:

1. Anil K. Maini, Digital Electronics, Principles, Devices and Applications, John Wiley & Sons
2. M. Morris Mano and M. D. Ciletti, Digital Design, 4th Edition, Pearson Education
3. Anand Kumar, Fundamentals of Digital Circuit, PHI Publication

Reference Books:

1. Thomas L. Flyod, Digital Fundamentals, Pearson Education India
2. R.P. Jain, Modern digital electronics, 3rd edition, TMH Publication.

List of Experiments:

1. Verification of truth table of logic gates using TTL ICs, designing gates using diodes & resistors.

2. Design of AND, OR, NOT gates using Universal Gates.
3. Implementation of SOP & POS Boolean Functions.
4. Design a function using K-map and verify its performance using SOP and POS form
5. Design of Combinational circuits- Adders & Subtractors
6. Design of Combinational circuits- MUX and DEMUX.
7. Design a binary to gray code converter and Gray to Binary code converter
8.Analysis of basic flip-flops.Verify the truth table of RS, JK, T and D flip-flops using gates.
9. Design and verify the 4- Bit Synchronous or Asynchronous Counter using JK Flip Flop
10. Design of Arithmetic Logic Unit (ALU)
11. Mini Project

Course Title/ Code	**Data Structure and Algorithms (CSH103B-T/P)**
Course Type:	**Core (Departmental)**
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	The course should assess how the choice of data structures and algorithm design methods impacts the performance of programs and choose the appropriate data structure and algorithm design method for a specified application.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

Data structures and Algorithms: Introduction to Data structure: Concept of data structure, choice of right data structures, types of data structures, Abstract Data types, Introduction to algorithms, how to design and develop an algorithm: stepwise refinement, algorithm analysis, complexity of algorithms

Arrays: Introduction, One Dimensional Arrays, two dimensional array, Multidimensional arrays, address calculation of a location in arrays operations defined: traversal, selection, searching, insertion, deletion, and sorting.

Searching: linear search, binary search, Sorting: selection sort, bubble sort, insertion sort, merge sort, quick sort.

Section-B

Pointers: Introduction to pointers, Pointer variables, Pointer and arrays, array of pointers, pointers and structures, Dynamic allocation. Linked Lists: Concept of a linked list, circular linked list, doubly linked list, operations on linked lists: traversal, selection, searching, insertion, deletion, and sorting, concepts of header linked lists. Applications of linkedlists.

Section-C

Stacks: Introduction to Stacks, array representation of stack, operations on stack: PUSH, POP, Evaluation of Expression: Concept of precedence and associatively in expressions, difficulties in dealing with infix expressions, Resolving precedence of operators and association of operands, postfix & prefix expressions, conversion of expression from one form to other form using stack (with & without parenthesis), Evaluation of expression in infix, postfix & prefix forms using stack. Recursion, Linked list representation of stack, Applications of stacks.

Queues: Queues, Circular queues, array representation of Queues, priority queues, dequeue, circular queue, operations on queue: insertion and deletion, Applications of Queues.

Section-D

Non-Linear Structures: Trees definition, characteristics concept of child, sibling, parent child relationship etc, binary tree: different types of binary trees based on distribution of nodes: complete binary tree, binary tree (threaded and unthreaded),operation on binary tree: insertion, deletion, searching and traversal of binary trees, traversing: Preorder, Postorder and Inorder, Introduction to binary search tree, operations and Time complexity on BST: insertion, deletion, searching, Introduction to AVL tree: Concept of balanced

trees, balance factor in AVL trees, insertion into and deletion from AVL tree, balancing AVL tree after insertion and deletion, in B trees, Application of trees.
Graphs: Definition, Relation between tree & graph, directed and undirected graph, connected and disconnected graph, Euler graph, Hamiltonian graphs, Representation of graphs using adjacency matrix and list, Depth first and breadth first traversal of graphs, Applications of Graph.

List of Experiments:

1. Programs on C language
2. Write a program on Linear search and Binary search Using C
3. Write a program to implement bubble sort, insertion sort, selection sort
4. Write a program to implement Merge sort, Quick sort
5. Programs on Link list
6. Programs on stack
7. Programs on queues
8. Programs on binary trees
   • Traversal
   • Insertion
   • Deletion
9. Programs on binary search tree:
   • Calculate the height of BST
   • Calculate the number of leaf nodes
   • Insertion
   • Deletion
10. Programs on Graphs
    • BFS
    • DFS
11. Case studies on Trees and Graphs.

Text Books:

1. Data Structures with C by Seymour Lipschutz ,McGraw Hill Education(India) Private Limited.
2. Data Structures using C by A. K. Sharma, Pearson Publication. Data Structures using C-Yashwant Kanetkar Publication.

Reference Books:

1. Data Structures using C by A. M. Tenenbaum, Langsam, Moshe J. Augentem, PHI Pub.
2. Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman Publisher.

Course Title/ Code	**Programming for Problem Solving using Python (CSW208B)**
Course Type:	Domain Core (Department)
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3-0)
Objective	The course is designed to provide Basic knowledge of **Python**. **Python** programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the **Python** programming language.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

Introduction: Introducing the Python language, Understanding the Python shell, writing a simple program, Development environment setup, Concept of module and packages,

Basic Operators – Arithmetic, Relational, Assignment, Logical, Membership and Identity operators, Variables and Data Types, Understanding Mutable and Immutable types, Working with various type – None, Boolean(True/False), Numeric(int, float, long), Sequence(String, List & Tuple), Mapping(Dictionary) Understanding the concept of header & suites in the language construct, Conditionals and inline syntax, Multiple assignments in variables, Working with data type conversion, Working with Loops – While & For Effects of break, continue, pass & else statement in various construct.

Section-B

Implementing custom functions, Variable scope – Global vs. Local, Dealing with various function arguments – default, named and variable length arguments, Understanding the concept of pass by value and pass by reference, Returning multiple values from a function, Anonymous & Recursive function,

Understanding Strings in Python & different type of its delimiter, Working with special string operators & formatted strings, Exploring some useful built in string methods, Working with Date & Time,

Section-C

Understanding File Operations, Working with the File Object for reading & writing, Object oriented programming in Python, Understanding Classes & Objects, and Exploring different components of a Class **, Class** inheritance & Method overriding, Working with multiple Inheritance, Understanding the Abstraction mechanism in Python, Built-in Class attributes, Exception handling,

Section-D

Python DB Interaction. Python Demonstration: Reading and Writing CSV files, The Series Data Structure, Querying a Series, The Data Frame Data Structure, Data Frame Indexing and Loading, Querying a Data Frame, Indexing Data frames, Missing Values.

LIST OF EXPERIMENTS: Tool Used: - Eclipse Java Oxygen

1. Using IDE to create and execute Python Program.
2. Programming Constructs in Python – Hands- on - Practice
3. Control Structure - Hands- on - Practice
4. String & List : Hands- on - Practice
5. Operation on Tuples : Hands- on - Practice
6. Mapping(Dictionary) : Hands- on - Practice
7. Function – Pass by reference : Hands- on - Practice
8. Working with the File Object for reading & writing
9. UML, Object Oriented Programming
10. Class inheritance & Method overriding : Hands- on – Practice
11. Exception handling : Hands- on - Practice
12. Python DB Integration

Text Books:

1. Dave Kuhlman, "A Python Book: Beginning Python, Advanced Python, and Python Exercises", December 2013.
2. Mark Lutz's, "Learning Python", O'Reilly, 2001

Reference Books:

1. Sahana Kumaraswamy, Roy Antony Arnoid G, "Assignment for Object Oriented Programming using Python", Infosys, Dec 2015.
2. Lutz, Mark, and Mark Lutz. Programming python. Vol. 8. O'Reilly, 1996.
3. Sommerville, "Software Engineering", Addison Wesley, 1999.

Course Title/Code	**ELECTRONIC DESIGN WORKSHOP/ ECW204B**
Course Type:	WORKSHOP (Departmental)
Course Nature:	Hard

L-T-P-O Structure	0-0-3-0
Objective	To provide hands-on experience on the state-of-the-art Cadence EDA tools for VLSI Design. The participants will have an exposure to the Circuit Design & Simulation, Layout, Physical Verification (DRC, LVS), and Extraction.

Experiment List:

Software proposed: ORCAD/EAGLE/DESIGN SPARK

1. Introduction to PCB Design Software, Editing and Routing.
2. Designing of low pass, high pass, all pass & band pass filters for a given cut off frequency
3. Designing of half-wave rectifier with effects of variable capacitance
4. Designing of full-wave rectifier with effects of variable capacitance.
5. Designing of 5V power supply
6. Designing of Half adder and Full Adder using gates

7-8. Introduction to Screen Printing, Component Mounting, Soldering and Drilling.

9-12. Project using design software.

Course Title/ Code	**FRENCH-I(FLS103)**
Course Type:	**Allied Elective**
Course Nature:	Audit (University Compulsory)
L-T-P-O Structure	(1-1-0-0)
Prerequisite	Basic knowledge of grammatical structure, syntax, and vocabulary of English and/or Hindi.
Objectives	At the end of the course, students will be able to 1. Exchange greetings and do introductions using formal and informal expressions 2. Understand and use interrogative and answer simple questions 3. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary 4. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed 5. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. 6. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary 7. Provide basic information about familiar situations and topics of interest 8. Express or/and justify opinions using equivalents of different verbs Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture

Course Outcomes:

FLS103.1. Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.

FLS103.2. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed.

FLS103.3. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic

vocabulary.

FLS103.4**.** Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary. Provide basic information about familiar situations and topics of interest.

FLS103.5. Express or/and justify opinions using equivalents of different verbs. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture.

FLS103.6. Describe various places, location, themselves using simple sentences and vocabulary.

SECTION-A

Unit - Saluer et épeler l'alphabet

1.1 Les Salutations & forms of politeness

1.2 Alphabets

Unit 2- Usage de Vous et de Tu

2.1 Taking leave expressions

2.2 Les pronoms sujets

2.3 Basic Questions

SECTION-B

Unit 3- Présentez-vous

3.1 Les verbes ER

3.2 Self introduction

3.3 Décrivez votre ami(e)

SECTION-C

Unit 4- Identifier un nombre, compter

4.1 Les noms

4.2 Verbes Avoir, Etre, Aller & Faire

4.3 Les nombres

Unit 5- Demander/ donner l'explications

5.1 Les articles define et indefini

5.2 Les mois de l'annee

5.3 Les jours de la semaine

SECTION-D

Unit 6- Parler des saisons et demander l'heure

6.1 Time

6.2 Weather

6.3 Unseen Passage

Text Books/Reference Books/ Suggested Readings:

1. Alter Ego Level One Textbook, Annie Berthet, Catherine Hugot, Hachette Publications
2. Apprenons Le Francais II & III, Mahitha Ranjit, 2017, Saraswati Publications

Weblinks:

www.bonjourfrance.com

www.allabout.com

Course Title/ Code	**GERMAN-I(FLS102)**
Course Type:	**Allied Elective**
Course Nature:	Audit (University Compulsory)
L-T-P-O Structure	(1-1-0-0)
Prerequisite	Basic knowledge of grammatical structure, syntax, and vocabulary of English and/or Hindi.
Objectives	At the end of the course, students will be able to

	1. Exchange greetings and do introductions using formal and informal expressions 2. Understand and use interrogative and answer simple questions 3. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary 4. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed 5. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. 6. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary 7. Provide basic information about familiar situations and topics of interest 8. Express or/and justify opinions using equivalents of different verbs 9. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture

Course Outcomes:

FLS102.1. Students will be able to exchange greetings and introductions using formal and informal expressions. They will be able to ask and answer simple questions.
FLS102.2. Students will be able to discuss everyday life and daily routines, using simple sentences and familiar vocabulary.
FLS102.3. Students will be able to identify key details in short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed.
FLS102.4. Students will be able to discuss likes and dislikes, understand simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed
FLS102.5. Students will be able to differentiate certain patterns of behavior in the cultures of the German- speaking world and the student's native culture.
FLS102.6. Students will be able to describe various places, location, themselves using simple sentences and vocabulary.

SECTION-A

Unit-1: Begrüßungen

1.1 Salutations/Greetings

1.2 Introduction

Unit-2: sich vorstellen und Zahlen

2.1 Introduction

2.2 Alphabets

2.3 Numbers 1-20

SECTION-B

Unit-3: Berufe/ Pronomen

3.1 Personal pronouns

3.2 Hobbies and professions

SECTION-C

Unit-4:Café

4.1 Café related vocabulary and dialogues

4.2 Revision personal pronouns

Unit-5: Café dialog

5.1 Café related vocabulary and dialogues

5.2 Common verbs and their conjugations

SECTION-D

Unit-6: Zeit und Monate

6.1 Time

6.2 Days

6.3 Months

Text Books/Reference Books:

1. Studio D A1, Hermann Funk, 2011, Cornelson Publication
2. Tangaram Aktuell A1, Kursbuch & Arbeitsbuch, 2011, Hueber
3. Netzwerk, Stefanie Dengler, Paul Rusch et. Al, 2011, Klett

Weblinks:

http://www.nthuleen.com/

Course Title/ Code	**SPANISH-I(FLS101)**
Course Type:	**Allied Elective**
Course Nature:	Audit (University Compulsory)
L-T-P-O Structure	(1-1-0-0)
Prerequisite	Basic knowledge of grammatical structure, syntax, and vocabulary of English and/or Hindi.
Objectives	At the end of the course, students will be able to 1. Exchange greetings and do introductions using formal and informal expressions 2. Understand and use interrogative and answer simple questions 3. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary 4. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed 5. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. 6. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary 7. Provide basic information about familiar situations and topics of interest 8. Express or/and justify opinions using equivalents of different verbs 9. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture

Course Outcomes:

FLS101.1. Students will be able to exchange greetings and introductions using formal and informal expressions and students will be able to ask and answer simple questions.

FLS101.2. Students will be able to discuss everyday life and daily routines, using simple sentences and familiar vocabulary and students will be able to discuss likes and dislikes understand simple conversations about familiar topics.

FLS101.3. Students will be able to identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed and students will be able to offer basic descriptions of self, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.

FLS101.4. Students will be able to provide basic information about familiar situations and topics of interest and students will be able to express or/and justify opinions using equivalents of different verbs.

FLS101.5. Spanish-speaking world and student's native culture.

FLS101.6. Students will be able to describe various places, location, themselves using simple sentences and vocabulary.

SECTION-A

Unit 1: Introduction to Spanish and SER

1.1 Presentation on Spanish language

1.2 Greetings and goodbyes

1.3 Spanish letters

1.4 Introduction of verbo SER

Unit 2: Verb Ser, Nationality, Profession and Counting

2.1 Uses of verbo SER

2.2 Adjectives related to verbo SER.

2.3 Introduction of Nationality

2.4 Professions and vocabulary related to professions.

2.5 Counting till number 20.

SECTION-B

Unit 3: Articles, Interrogative and Estar

3.1 Introduction of Articles and Indefinite articles

3.2 Interrogatives

3.3 Introduction of Verbo Estar

SECTION-C

Unit 4:Estar, Preposition, Tener and Self Introduction

4.1 Uses of Verbo ESTAR and adjectives related to it

4.2 Introducton of 'my house' vocabulary

4.3 Prepositions related to the positioning of an object

4.4 Self – introduction

SECTION-D

Unit 5 : Day, Month and Regular AR verb

5.1 Days

5.2 Months

5.3 Introduction to regular –AR verbs

Text Books/Reference Books:

1. ¡Ole!-Langers
2. ¡Uno, dos, tres……

Weblinks:

http://studyspanish.com/

Course Title/ Code	**PROFESSIONAL COMPETANCY ENHANCEMENT-I(CDO201)**
Course Type:	**Allied Core**
Course Nature:	Soft
L-T-P-O Structure/Credits	(0-0-1-0)/0.5

Course Outcomes:

Students will acquire basic knowledge about aptitude

Students will become better at analytics and problem solving

Students will be able to solve aptitude problems quickly utilizing the short cuts

Students will have enhanced level of reasoning, numerical skills and speed

Students will have the ability to 'quickly think on their feet'

Students will have enhanced concentration & thinking ability.

SECTION-A – Reasoning Ability

Unit 1: Mental Ability

1.1 Mental Ability Test

1.2 Direction Sense Test

1.3 Blood Relations Test

1.4 Cubes
1.5 Cuboids
1.6 Dice
1.7 Word Problems
1.8 Puzzles

Unit 2: Verbal & Non Verbal Reasoning

2.1 Letter Series
2.2 Set Theory
2.3 Venn Diagram
2.4 Syllogism
2.5 Missing Value in figure
2.6 Practice Test

SECTION-B

Unit 3: Logical Reasoning & Word Puzzles

3.1 Logical Reasoning I
3.1.1. Row Arrangement
3.1.2. Circular Arrangement
3.2 Logical Reasoning II
3.2.1. Arrangement
3.2.2. Puzzles
3.3 Logical Reasoning III
3.4 Practice Test
Personality Development

Unit 4: Personality Development

4.1 Concept of personality
Concept of personality
Bringing out the best in one's personality
4.2 Self awareness
Different learning styles
Areas of Self awareness
Developing self-awareness
4.3 Goal Setting
Five principles of goal setting
Setting "SMART" goals
6P's of goal setting
SWOT analysis
Short term& Long term goals

SECTION-C

Unit 5: Resume Writing
What, why and how of Resume
Building different sections of the Resume through projects and activities during the course

Unit 6 : Presentation Skills
Designing the presentation
Audience and content analysis
Delivering the presentation- Preparation, Practice, Performance

SECTION-D

Unit 7: Professional Communication
Email writing
Diction and Speech Clarity
LSRW & Introduction to verbal ability as an assessment tool for employability

Unit 8: Professional Grooming and Etiquette
Professional grooming
Personal Grooming
Professional Etiquette
Courtesy and communication discipline

Text Books/Reference Books:

1. A Modern Approach to Logical Reasoning: R S Aggarwal, S Chand & Company Pvt Ltd
2. A Modern Approach to Non Verbal Reasoning: R S Aggarwal, S Chand & Company Pvt Ltd
3. Developing Management Skills by *David A Whetten, Kim S Cameron*
4. Personality and Soft Skills Development by *Rajeev Kumar*
5. English for business, 100 tips foe effective communication,*By: Dignen, Bob; McMaster, Ian. Planegg: Spotlight Verlag GmbH. 2016. eBook.*
6.Presentation Skills for technical professionals: Achieving Excellence,*By: Karten, Naomi; Gottesdiener, Ellen. Series: Soft Skills for IT Professionals. Ely, Cambridgeshire, United Kingdom :IT Governance Publishing. 2010. eBook., Database: eBook Collection (EBSCOhost)*

Weblinks:

http://www.indiabix.com/aptitude/questions-and-answers/
http://www.indiabix.com/non-verbal-reasoning/questions-and-answers/

Course Title/ Code	**INTRODUCTION TO RESEARCH(RDO501)**
Course Type:	**Core**
Course Nature:	Research Type
L-T-P-O Structure/Credits	(0-0-1-0)/0.5
Objectives	To make student understand the impact of research and l be able to identify broad area of research, analyze, the processes and procedures to Carryout research

Course Outcomes:
1. The student shall be able to describe research and its impact.
2. The student shall be able to identify broad area of research, analyze, the processes and procedures to Carryout research.
3. The student shall be able to use different tools for literature survey
4. The student is able choose specific area of research and supervisor/mentor is finalized
5. To understand and adopt the ethical practice that are to be followed in the research activities
6. To work in groups with guidance

SECTION-A

Unit 1: What is Research and its impact?

1.1 Capturing the current research trends
1.2 Insight about scientific research performed by renowned experts in the related field(case studies)
1.3 Do's and Don'ts pertaining to research

SECTION-B

Unit 2: Identification of Broad Area of research

2.1 Identification of thrust area of research for deciding broad area

2.2 Framing the research questions and hypothesis
2.3 Identification of the research gap based on feasibility of problem
2.4 Exploration of in-house and commercially available facilities related to broad area

SECTION-C

Unit 3: Understanding the tools for Literature Survey

3.1 Finding research papers related to a topic
3.2 Understanding the different aspects of Literature search
3.3 Usage of different sources like Google scholar, WoS, SCI/ SCIE, PubMed, Scopus, ABDC, EBSCO etc.
3.4 Search for online journals relevant to research area
3.5 Indexing of Journals
3.5 Usage of scholarly networking sites like Research Gate, Mendeley, and Academia.edu etc.
3.6 Demo sessions on the usage of above mentioned sources

SECTION-D

Unit 4: Review of research papers pertaining to broad area and specific area of research

4.1 Selection of relevant papers
4.2 Finding specific research problem from broad area of research
4.3 Literature survey and justification of specific research problem
4.4 Experimentation and data cleaning and verification
4.5 Understanding and selection of the research domain
4.6 Seeking information through published work w.r.t the problem
4.7 Reading & categorizing the downloaded/referred papers and structuring of the idea
4.8 Model design about framing the research questions

Unit 5: Report Writing and Presentation skill Development

5.1 Report making on the surveyed literature to cater the basic idea of the research papers
5.2 Compiling and analyzing the published results to justify and understand the proposed ideas
5.3 Usage of MS-PowerPoint and other technical resources for the presentation
5.4 Development of presentation skills and group addressing
5.5 Scientific/technical writing and ethical practice, project report

Semester-IV

SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	**OFFERING DEPARTMENT	*COURSE NATURE (HARD/ SOFT/ WORKSHOP/ NTCC)	COURSE TYPE (CORE/ELECTIVE/ UNIVERSITY COMPULSORY)	L	T	P	O	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
ECH206B-T/P	ELECTROMAGNETIC FIELD AND WAVES	PHYSICS FOR ENGINEERS	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4

ECH207B-T/P	ANALOG AND DIGITAL COMMUNICATION	SIGNALS & SYSTEM	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	2	0	6	5
ECH214B-T/P	DIGTAL HARDWARE MODELLING USING VHDL	c	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	2	0	6	5
ECH209B-T/P	VLSI DESIGN	ANALOG ELECTRONICS	ELECTRONICS & COMMUNICATION	HARD	CORE	3	0	0	0	3	3
CSH201B-T/P	OOPS USING JAVA	PROGRAMMING FOR PROBLEM SOLVING USING C	COMPUTER SCIENCE	HARD	CORE	3	0	2	0	5	4
ECW210B	ALTAIR WORKSHOP	NA	ELECTRONICS & COMMUNICATION	WORKSHOP	CORE	0	0	2	0	2	1
CDO202	PROFESSIONAL COMPETANCY ENHANCEMENT-II	NA	CDC	SOFT	CORE	0	0	1	0	1	0.5
RDO502	RESEARCH & INNOVATION-I	NA	ELECTRONICS & COMMUNICATION	SOFT	CORE	0	0	1	0	1	0.5
FLS105-107	FOREIGN LANGUAGE	NA	FOREIGN LANGUAGE	AUDIT	ELECTIVE	1	1	0	0	2	0
						16	4	10	0	31	23

Course Title/Code	**ELECTROMAGNETIC FIELD AND WAVES/ (ECH206B-T/P)**
Course Type:	**Core (Departmental)**
Course Nature:	**Hard**
L-T-P-O Structure	**3-1-0-0**
Objective	**To introduce the concepts and mathematical methods to understand and analyze the Electro magnetic field and waves**

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

Transmission Lines- Equations of Voltage and Current on Transmission line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on Transmission line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

SECTION-B

Maxwell's Equations- Basics of Vectors, Vector calculus, Basic quantities of Electromagnetics, Basic laws of Electromagnetics: Gauss's law, Ampere's Circuital law, Faraday's law of Electromagnetic induction. Maxwell's Equations, Surface charge and surface current, Boundary conditions at Media Interface.

Uniform Plane Wave- Homogeneous unbound medium, Wave equation for time harmonic fields, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity and group velocity of a wave, Power flow and Poynting vector.

SECTION-C

Plane Waves at a Media Interface- Plane wave in arbitrary direction,Plane wave at dielectric interface, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

SECTION-D

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna.

Text/Reference Books:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. NarayanaRao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
4. David Cheng, Electromagnetics, Prentice Hall

Course Title/Code	**ANALOG AND DIGITAL COMMUNICATION**
Course Type:	Core
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0
Objective	Students will be able to analyze and design various analog and digital communication systems by applying the concepts of modulation, noise analysis anf multiplexing techniques.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

COMMUNICATION SYSTEM: The essentials of a Communication system, types: Analog and digital, modes of Communication, Various frequency bands used for communication, need of modulation, **NOISE:** External noise, internal noise, S/N ratio, noise figure. **AMPLITUDE MODULATION:**Generation of AM waves (Square law modulation, collector modulation), Demodulation of AM waves (Square-law detector, envelope detector) DSBSC, Generation of DSBSC waves, Coherent detection of DSBSC waves. SSB modulation, generation of SSB waves, demodulation of SSB waves, vestigial sideband modulation (VSB)

SECTION B

ANGLE MODULATION: Basic definitions: Phase modulation (PM) & frequency modulation (FM), narrow band frequency modulation, wideband frequency modulation, generation of FM waves, Demodulation of FM waves, generation of PM waves, Comparison between FM and PM Signals, Pre-emphasis & De-emphasis circuits.**RECEIVER:** Tuned radio frequency (TRF) receiver, superheterodyne receiver, RF section and characteristics, mixers, frequency changing and tracking, IF rejection and IF amplifiers. Detection and automatic gain control (AGC), receiver characteristics.

SECTION C

PULSE ANALOG MODULATION: TDM, FDM, Sampling theory, Aliasing, Modulation and Demodulation: PAM, PWM, PPM. **PULSE DIGITAL MODULATION:** Elements of pulse code modulation, quantization noise, μLaw and A- law compandor, channel capacity of PCM, Delta modulator (DM), Differential pulse code modulation (DPCM), Adaptive delta modulation (ADM).

SECTION D

DIGITAL MODULATION TECHNIQUE: Amplitude shift keying(ASK), frequency shift keying (FSK), phase shift keying – BPSK, M-ary PSK, Quadrature Amplitude modulation (QAM), MSK, GMSK, Matched filter, carrier recovery –squaring loop.

Text/Reference Books

1. Haykin S., "Communications Systems", John Wiley and Sons.
2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education.
3. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill.
4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley.
5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers.
6. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill.

List of Experiments:

1. Introduction to communication toolbox and observe the waveforms of various signals in Simulink
2. (a) Develop a Amplitude modulator (DSB –FC) and demodulator using MATLAB. Plot the graph for modulated and demodulated output.

(b) Generation of Amplitude modulated (DSB –FC) signal and its demodulation using trainer kit. Hence calculation of modulation index.

3. Generation of Double side band-suppressed carrier (DSB-SC) signal using MATLAB and plot the graph for modulated and demodulated output.
4. Generation of Single side band-suppressed carrier (SSB-SC) signal using MATLAB and plot the graph for modulated and demodulated output.
5. (a) Develop a Frequency modulator and demodulator using MATLAB. Plot the graph for modulated and demodulated output.

(b) Generation of Frequency Modulated signal and calculate Modulation Index of Frequency Modulated Waveform.

6. To generate the PAM/PWM/PPM signals on trainer kit and observe the waveforms on CRO.
7. To generate pulse code modulation signal on trainer kit observe the waveform on CRO.
8. To generate ASK, FSK and PSK signals using trainer kit and observe the waveform on CRO.

Course Title/Code	**DIGTAL HARDWARE MODELLING USING VHDL**
Course Type:	Core
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0
Objective	To understand the logic of various digital circuits this will further help in their designing.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%

	D	25%
	TOTAL	**100%**

Section A

Introduction: Introduction to Computer-aided design tools for digital systems, Design flow, Hardware Description Languages, VHDL capabilities and basic terminologies. VHDL Fundamentals**:** Identifiers,Data objects and data types, Operators, Operator overloading, Entity and architecture declaration, Introduction to behavioural, dataflow, structural and mixed modeling.

Section B

VHDL Statements: BehaviouralModelling**:** Processstatement, Assignment statements, Delta delay, Wait statement, If statement, Case statement, Null statement, Loop statement, Exit statement, Next statement, Assertion and report statement, Multiple process, Types of delay, Signal drivers and the effect of delays on signal drivers, Dataflow modeling: Conditional signal assignment statement, Selected signal assignment statement, Unaffected value, Block statement, Concurrent assertion statement, Resolution function, Packages and Libraries, Subprograms: Functions, Procedures and Subprogram overloading, Structural Modeling: component declaration and instantiation, generics and configuration.

Section C

Combinational & Sequential Circuit Design: VHDL models and simulation of combinational circuits such as half adder, full adder, multiplexers, demultiplexers, encoders, decoders, code converters, comparators, Implementation of Boolean functions; VHDL models and simulation of sequential circuits: flip flops, shift registers, counters, State diagrams, Implementation of Mealy and Moore FSM using VHDL, Creating test benches.

Section D

Design of Microcomputer & Programmable Devices: Basic components of a computer, Architecture and implementation using VHDL, Design of circuits using Programmable logic devices: ROM, PLA, PAL, Other Programmable Logic Devices:GAL,PEEL, CPLD, FPGA

List of Experiments:

1. Introduction to Xilinx ISE Foundation tool and synthesize and simulate half adder, full adder and half subtractor using schematic capture.
2. To model, simulate and synthesize all digital gates in VHDL.
3. To model, simulate and synthesize full adder and full subtractor using Dataflow Modeling style in VHDL.
4. To model and simulate Multiplexer using Dataflow and Behavioral Modeling, Demultiplexer using Structural Modeling style.
5. To model and simulate Encoder and Priority Encoder using Dataflow and Behavioral Modeling, Decoder using structural Modeling and verify using Test Bench.
6. To model and simulate Binary to Gray Code converter and BCD to Seven segment using VHDL and verify using Test Bench.
7. To model and simulate 3-bit comparator using VHDL and verify using Test Bench.
8. To model and simulate all flip flops using VHDL and verify using Test Bench.
9. To model and simulate 4-bit register (SIS0, PIPO, shift left and shift right) using VHDL and verify using Test Bench.
10. To model and simulate up counter, decade counter and up/down counter using VHDL and verify using Test Bench.
11. VHDL synthesis of models in FPGA from lab 3 and 4.
12. VHDL modeling and implementation of Project.

Text Books:

1. J Bhasker, A VHDL Primmer, Prentice Hall
2. Douglas L Perry, VHDL-IV Edition, TMH

Reference Books:

1. Volnei A Pedroni, Circuit Design with VHDL, PHI
2. Charles H Roth, Digital System Design using VHDL, PWS publishing
3. Navabi Z, VHDL-Analysis & Modeling of Digital Systems, McGraw Hill
4. Brown and Vranesic, Fundamentals of Digital Logic with VHDL Design, TMH
5. R P Jain, Modern Digital Electronics, III Edition, TMH

Course Title/Code	**VLSI DESIGN**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-0-0-0
Objective	The course objective is to introduce the fundamental principles of VLSI circuit design, to examine the basic building blocks of large-scale digital integrated circuits & analog integrated circuits.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

BASIC MOS TRANSISTOR : Enhancement mode & Depletion mode – Fabrication (NMOS, PMOS, CMOS, BiCMOS) Technology – NMOS transistor current equation – Second order effects – MOS Transistor Model.

Section-B

NMOS & CMOS INVERTER AND GATES : NMOS & CMOS inverter – Determination of pull up / pull down ratios – Stick diagram – Lamda based rules – Super buffers – BiCMOS& steering logic.

Section-C

SUB SYSTEM DESIGN & LAYOUT: Structured design of combinational circuits – Dynamic CMOS & clocking – Tally circuits – (NAND-NAND, NOR-NOR and AOI logic) – EXOR structure – Multiplexer structures – Barrel shifter.

Section-D

DESIGN OF COMBINATIONAL ELEMENTS & REGULAR ARRAY LOGIC : NMOS PLA – Programmable Logic Devices - FiniteState Machine PLA – Introduction to FPGA.

VHDL PROGRAMMING: RTL Design – Combinational logic – Types – Operators – Packages – Sequential circuit – Sub-programs – Test benches. (Examples: address, counters, flipflops, FSM, Multiplexers / De-multiplexers).

TEXT BOOKS:

1. Introduction to Digital Integrated Circuits: Rabaey,Chandrakasan&Nikolic.
2. Principles of CMOS VLSI Design: Neil H.E. Weste and Kamran Eshraghian; Pearson.

REFERENCE BOOKS:

1. Introduction to Digital Circuits: Rabaey and ……..LPE (PH).
2. VLSI Technology: S.M. Sze; McGraw-Hill.
3. Integrated Circuits: K.R. Botkar; Khanna

Course Title/ Code	**Object Oriented Programming Using Java(CSH201B) T & P**
Course Type	Core (Departmental)
Course Nature	Hard
L-T-P-O Structure	(3-0-2-0)
Objectives	Student will be able to apply the object-oriented programming principles and techniques for solving the real life problems.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

Overview of Applications: Desktop Based Application like Library Management System in order to understand problem solving skills.

Introduction to OOPS: Paradigms of Programming Languages - Basic concepts of Object Oriented Programming, Differences between Procedure Oriented Programming and Object Oriented Programming, Objects and Classes, Data abstraction and Encapsulation, Inheritance, Polymorphism, Dynamic binding, Message communication, Benefits of OOP, Application of OOPs.

Introduction to Java: History of Java, Java features, Java Environment: JDK API. Types of java program, Creating and Executing a Java program, Java Tokens: Keywords, Character set, Identifiers, Literals, Separator, Java Virtual Machine (JVM), Comments in Java program, Command line input and Arguments, Data Types, Variables, Operators, Control Statements, Arrays, String handling.

Section-B

Class and objects: Defining a class, Methods, Creating objects, Accessing class members. Constructors, Method overloading, Static members, Nesting of Methods, this keyword.

Inheritance: Defining a subclass, Deriving a sub class, Single Inheritance, Multilevel Inheritance, Hierarchical Inheritance, Overriding methods , super keyword, Final variables and methods, Final classes, Final methods, Abstract methods and classes, Visibility Control, Public access, Private access, protected. Defining interface, Extending interface, Implementing Interface, Accessing interface variables.

Section-C

Packages: Java API Packages: System Packages, Naming Conventions, Creating & Accessing a Package, Adding Class to a Package, Hiding Classes

Exception Handling: Exception Handling Mechanism, using try and catch blocks, nesting try Statements, Multiple catch Block, Throwing Exceptions, using finally clause, creating a Custom Exception.

Multithreading: Getting the main thread, naming a Thread, Pausing a thread, Creating a Thread with the Runnable Interface, Creating a Thread with Thread Class, Creating Multiple Threads, Waiting for (joining) Threads, Checking whether thread is alive, Setting Thread Priority and Stopping Threads, Thread Synchronization, Suspending and Resuming Threads.

Section-D

I/O Streams: I/O Basics Reading Console Input Writing Console Output, Using the File Class, InputStream, OutputStream, FileInputStream, FileOutputStream, Buffered Input Stream, Buffered Output Stream, Random Access File, File Reader, File Writer, Buffered Reader, Buffered Writer, Serialization.

Applets: Introduction: Applet Life cycle, Creating & Executing an Applet, Applet tags in HTML, Parameter tag, Drawing graphics in Applets, Adding controls to Applets: Text Fields, Buttons

List of Experiments

1. Basic programs in java, use of if else construct and switch construct.
2. Programs on Loops and Arrays.
3. Programs on Strings and classes creation in java.
4. Programs on constructors and use of keyword this keyword, static keyword, final keyword, finalize method.
5. Programs on single inheritance,
6. Programs on multilevel inheritance, Hierarchical inheritance.
7. Programs on method overriding, super keyword and final method.
8. Programs on interfaces
9. Programs on Packages
10. Programs Exception Handling
11. Programs on threads
12. Programs on File Handling
13. Programs on Applets

14. Programs on AWT

Text Books:

1. Programming with Java Primer by E BalagurusamyTmh Publication
2. Java; the complete reference, 7th editon, Herbert schildt, TMH.
3. H. M. Deitel and P. J. Deitel, Java How to Program, Prentice Hall, 7th Edition, 2007

Reference Book:

1. Java2 Programming Black Book, Steven Holzner (no. of copies: 23)
2. C. S. Horstmann and G. Cornell, Core Java 2 (Volume I-Fundamentals), Prentice Hall, 7th Edition, 2004. (no. of copies: 10)
3. Head First Java By *Kathy Sierra*

Course Title/Code	**ALTAIR WORKSHOP**
Course Type:	Domain Core (Workshop)
Course Nature:	Hard
L-T-P-O Structure	0-0-3-0
Objective	To impart fundamental knowledge and practical abilities in Altair required utilizing it to build programs and solve engineering problems effectively.

LIST OF EXPERIMENTS:

1) INTRODUCTION TO ALTAIR COMPOSE AND ACTIVATE.
2) COMMANDS AND DATA TYPES
3) COMMANDS FOR MATH AND CURVE FITTING
4) MATRICES AND VECTORS
5) PLOT ATTRIBUTES AND HANDLE MANAGEMENT
6) LOGIC AND LOOPING ANDFUNCTIONS AND DEBUGGING
7) STRINGS, FILES AND I/O
8) INTERFACING WITH OTHER LANGUAGES AND HIGHER LEVEL COMMANDS
9) IMPLEMENTATION OF DIGITAL CIRCUITS
10) PROJECT

Course Title/ Code	**FRENCH-II (FLS107)**
Course Type:	**Allied Elective**
Course Nature:	Audit (University Compulsory)
L-T-P-O Structure	(1-1-0-0)
Pre-Requisites	Basic knowledge of grammatical structure, syntax, and vocabulary of French
Objectives	At the end of the course, students will be able to 1. Recognize numbers and tell their age using numbers. 2. Tell and ask time in 12 hour and 24 hour format 3. Learn Basic vocabulary that can be used to discuss the weather and seasons 4. Identify colors, professions and adjectives in French and describing different people and objects using these three. 5. Describe orally and in writing themselves, their family and their friends. 6. Use reflexive verbs to describe daily routine.

	7. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. 8. Provide basic information about familiar situations and topics of interest 9. Express or/and justify opinions using equivalents of different verbs 10. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture

Course Outcomes:

FLS107.1.Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.

FLS107.2. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed.

FLS107.3. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.

FLS107.4. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary. Provide basic information about familiar situations and topics of interest.

FLS107.5. Express or/and justify opinions using equivalents of different verbs. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture.

FLS107.6. Describe various places, location, themselves using simple sentences and vocabulary.

SECTION-A

Unit 1- Se présenter (1)

1.1 Les pluriels

1.2 Adjectives to describe a person

Unit 2- Se présenter (2)

2.1 Professions

2.2 Short essay on family & friend

2.3 Comprehension

SECTION-B

Unit 3- Parler de ses habitudes quotidiennes

3.1 Les verbes pronominaux

3.2 Décrivez votre journée

SECTION-C

Unit 4- Nommez et localiser des lieux dans la ville

4.1 Prepositions

4.2 Asking & telling the way

Unit 5- Informations simples sur le climat, la météo

5.1 Les saisons

5.2 Les expressions de la saison

5.3 Comprehension

SECTION-D

Unit 6- Demander/ indiquer les horaires et les couleurs

6.1 Timings

6.2 Colours

Text Books/Reference Books/ Suggested Readings:

1. Alter Ego Level One Textbook, Annie Berthet, Catherine Hugot, Veronique M Kizirian,Hachette Publications
2. Apprenons Le Francais II & III, Mahitha Ranjit, 2017, Saraswati Publications

Weblinks:

www.bonjourfrance.com

Course Title/ Code	**GERMAN-II (FLS106)**
Course Type:	**Allied Elective**
Course Nature:	Audit (University Compulsory)
L-T-P-O Structure	(1-1-0-0)
Pre-Requisites	Students are expected to have basic knowledge of German grammar. They should know regular verbs and conjugations. They should be able introduce themselves and make small sentences in German language.
Objectives	At the end of the course, students will be able to 1. Exchange greetings and do introductions using formal and informal expressions 2. Understand and use interrogative and answer simple questions 3. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary 4. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed 5. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. 6. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary 7. Provide basic information about familiar situations and topics of interest 8. Express or/and justify opinions using equivalents of different verbs 9. Differentiate certain patterns of behavior in the cultures of the German-speaking world and the student's native culture.

Course Outcomes:

FLS106.1. Students will be able to discuss about various directions, countries and languages they speak.

FLS106.2. Students will be able to write short essays on family and friends. They will have knowledge of tenses.

FLS106.3. Students will be able to identify classroom vocabulary in the German language

FLS106.4. Students will be able to speak ordinal and cardinal numbers and they will also learn months, days in German

FLS106.5. They will be able to express or/and justify opinions using equivalents of different verbs.

FLS106.6. They will be able to describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.

SECTION-A

Unit 1

1.1 Ordinal & Cardinal numbers

1.2 Months, days, Feiertage and dates

SECTION-B

Unit 2

2.1 Verbs: to be and to have

2.2 helping verbs practice worksheets

2.3 Vocabulary (Family) short essay on family, friends etc.

SECTION-C

Unit 3

3.1 Vocabulary (classroom)

3.2 Definite and indefinite articles

SECTION-D

Unit 4

4.1 Countries, languages, directions

4.2 Past of the verb 'to be'

Text Books/Reference Books:

1. Rita Maria Niemann, Cornelsen, 2005, Studio d A1: Deutsch als Fremdsprache, Volume 6
2. Dallapiazza, Rosa-Maria and Jan, Eduard von. Tangram aktuell 1. Deutsch als Fremdsprache Tangram aktuell 1 - Lektion 1-4: Deutsch als. (Hueber Verlag, 2005).
3. Dallapiazza, Rosa-Maria and Jan, Eduard von. Tangram aktuell 1. Deutsch als Fremdsprache Tangram aktuell 1 - Lektion 5-8: Deutsch als. (Hueber Verlag, 2005)
4. Paul Rusch, 2015: Langenscheidt and Klett

Weblinks:

http://www.nthuleen.com/

Course Title/ Code	**SPANISH-II (FLS105)**
Course Type:	**Allied Elective**
Course Nature:	Audit (University Compulsory)
L-T-P-O Structure	(1-1-0-0)
Pre-Requisites	Basic knowledge of grammatical structure, syntax, and vocabulary of Spanish
Objectives	At the end of the course, students will be able to 1. Exchange greetings and do introductions using formal and informal expressions 2. Understand and use interrogative and answer simple questions 3. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary 4. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed 5. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. 6. Describe colours, clothing, profession, family and marital status in short discourse using simple sentences and basic vocabulary 7. Provide basic information about familiar situations and topics of interest 8. Express or/and justify opinions using equivalents of different verbs 9. Differentiate certain patterns of behavior in the cultures of the Spanish-speaking world and the student's native culture

Course Outcomes:

FLS105.1.Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.

FLS105.2.Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed.

FLS105.3. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.

FLS105.4. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary. Provide basic information about familiar situations and topics of interest.

FLS105.5. Express or/and justify opinions using equivalents of different verbs. Differentiate certain patterns of behavior in the cultures of the Spanish-speaking world and the student's native culture.

FLS105.6. Describe various places, location, themselves using simple sentences and vocabulary.

SECTION-A

Unit 1- Mi famila

1.1 Describe your family

1.2 Adjectives to describe a person

1.3 Short essay on family & friend

Unit 2- Gustar

2.1 Likes and dislikes

2.2 Conjugation

2.3 Comprehension

SECTION-B

Unit 3- Verbos Irregulares y reflexivos

3.1 Conjugation

3.2 Routina diaria

3.3 Sentence formation

SECTION-C

Unit 4- El horario

4.1 Timings

4.2 Colours

Unit 5- Estar+gerundio

5.1 Conjugation

5.2 Prepositions

5.3Picture description

SECTION-D

Unit 6- Ser y estar

6.1 Direction

6.2 Comprehension

Text Books/Reference Books:

1. ¡Ole!-Langers
2. ¡Uno, dos, tres……

Weblinks:

http://studyspanish.com/

Course Title/ Code	**PROFESSIONAL COMPETANCY ENHANCEMENT-II (CDO202)**
Course Type	Core (Allied)
Course Nature	Soft
L-T-P-O Structure	(0-0-1-0)/ 0.5

Objectives	**1. To improve students basic knowledge about Arithmetic Aptitude** **2. To make students solve aptitude problems quickly utilizing the short cuts** **3. To make students have the ability to 'quickly think on their feet'** 4. To strengthen students communication skills

Section A – Quantitative Aptitude

Unit 1: Arithmetic I

.1 Simplification

1.1.1 Use of BODMAS rule and Formulas for solving equations.

1.1.2 Simple Fractions and Decimal Fractions.

1.1.3 Surds and Indices.

1.2 Ratio and Proportion

1.2.1 Changes in Ratios, Combined Ratio and Continued Proportion.

1.2.2 Application in different questions.

1.2.3 Variations and Partnership.

1.3 Percentage

1.3.1 Basic Conversion, Consumption & Expenditure, Successive changes and Errors.

1.3.2 Application in Areas and Volumes.

1.4 Profit and Loss

1.4.1 Sales and Purchase Transactions.

1.4.2 MRP and Discount, Equivalent discounts.

1.4.3 Errors in weight (Dishonest Dealer).

1.5 Average

1.5.1 Combined and Mistaken Averages.

1.5.2 Changes in Average.

1.5.3 Application in Cricket and others.

1.5.4 Practice Exercise.

1.6 Interest

1.6.1 Simple and Compound Interest Formulae.

1.6.2 Relations and their Applications.

1.6.3 Practice Exercise.

Unit 2: Arithmetic II

2.1 Time and work

2.1.1 Combined work, Work & Wages, Work & Efficiency.

2.1.2 Working Alternatively, Work and Equations.

2.1.3 Pipes and Cisterns, Inlet and Outlet pipes, Capacity of Tank and Leakage.

2.2 Alligations & Mixtures

2.2.1 Formula Based

2.2.2 Successive Displacement

2.2.3 Mixtures

2.2.4 Error in Measurement

2.2.5 Profit on False Weight

2.3 Revision & Practice

2.3.1 Problems on Ages & Numbers

2.3.2 Calendar

2.3.3 Coding & Decoding

2.3.4 Data Sufficiency

Section B – Verbal Ability Test

Unit 3. Communication Skills in English

1.1 Relevance of Verbal Ability AND PREPARATORY GUIDELINES

1.2 Functional Grammar – Subject Verb Agreement

1.3 Tenses – Perfect, Simple , Continuous

1.4 Common Errors and rectification

Unit 4: Word Power Building Skills

2.1 Words: Antonyms, Synonyms, Analogies,

2.2 Compound words: Homophones, Homonyms, Word Families

2.3 Root Word Technique for Prefixes & Suffixes

2.4: Word Power: 7 Tips for Learning New Words

2.5 Practice Vocabulary Exercises

Section C

Unit 5: Writing Skills

3.1 Writing: Introduction of Writing Skills, Objectives of enhancing Writing Skills & Types of Writing

3.2 Sentences, Phrases, Types of Sentences, Parts of Sentences

3.3 Paragraph Writing: Construction, Linkage & Cohesion

3.4 Practice Exercises: Writing Skills

Section D

Unit 6: Reading Skills

4.1 Objectives of Reading, Definition & Types of Reading & Importance of Reading

4.2 Reading Techniques: SW3R, Active Reading, Detailed, Speed

4.2 Practice Exercises: Short & Medium Passages

Text Books/Reference Books:

1. Quantitative Aptitude : R S Aggarwal, S Chand & Company Pvt Ltd
2. Quantitative Aptitude for CAT: Arun Sharma
3. Verbal Ability and Reading Comprehension: MVN Enterprises

Web links:

http://www.indiabix.com/aptitude/questions-and-answers/

http://www.indiabix.com/non-verbal-reasoning/questions-and-answers/

Course Title/ Code	**RESEARCH & INNOVATION-I (RDO502)**
Course Type:	**Research Type**
Course Nature:	Hard
L-T-P-O Structure/Credits	(0-0-1-0)/ 0.5
OBJECTIVE	To apply the contextual knowledge of designing in research and to understand and adopt the ethical practice that are to be followed in the research activitiesThe student is able choose specific area of research.

Course Outcomes:

XX-400.1. The students will be able to critically evaluate the work done by various researchers relevant to
The research topic

XX-400.2. To integrate the relevant theory and practices followed in a logical way and draw appropriate conclusions

XX-400.3. To understand the research methodologies/approaches/techniques used in the literature

XX-400.4. To structure and organize the collected information or findings through an appropriate abstract, headings, reference citations and smooth transitions between sections

Section A

Unit-1 Literature Survey (LS)/Design of Experiment

1.1 Collection of research papers related to previously identified gap/problem (15 papers or more)

1.2 Comprehend and arrange the literature based on the idea framed

1.3 Presenting the collected data and inferring it with the further scope of expansion and Designing the experiment wherever Applicable.

Section B

Unit-2 Structuring of Review Paper and setting up of experimental facility

2.1 Analysis of different approach/methodology adopted by various researchers

2.2 Listing out the components of the paper/ setting up experimental facility w.r.t the problem

2.3 Identification of suitable Journal or Conference

2.4 Formatting/Styling the paper according to the respective template

Section C

Unit-3 Departmental Presentation in the Mid Term Exam

3.1 Structuring and preparation of PPT

3.2 Mock presentation

3.3 Review on presentation skills and content delivered both

3.4 Incorporating the review comments in the slides

Semester-V

SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	**OFFERING DEPARTMENT	*COURSE NATURE (HARD/SOFT/ WORKSHOP/ NTCC)	COURSE TYPE (CORE/ELECTIVE/ UNIVERSITY COMPULSORY)	L	T	P	O	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
ECH323B-T/P	DIGTAL HARDWARE MODELLING USING VERILOG	DIGITAL HARDWARE DESIGN	ECE	HARD	CORE	3	1	2	0	6	5
ECH302B-T/P	DIGITAL SIGNAL PROCESSING	SIGNALS AND SYSTEMS	ECE	HARD	CORE	3	1	2	0	6	5
ECH303B-T/P	COMPUTER ARCHITECTURE	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	0	0	0	3	3
ECH304B-T/P	CONTROL SYSTEMS	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	2	0	6	5
ECH305B-T/P	INTERNET OF THINGS	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	2	0	2	0	4	3
CDO301	PROFESSIONAL COMPETANCY RNHANCEMENT-III	NA	CDC	SOFT	CORE	0	0	1	0	1	0.5
RDO601	RESEARCH &INNOVATION-II	NA	ELECTRONICS & COMMUNICATION	SOFT	CORE	0	0	1	0	1	0.5
						14	3	10	0	27	22

Course Title/Code	**DIGITAL HARDWARE MODELLING USING VERILOG** (ECH323B-T/P)
Course Type:	Domain Core
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0
Objective	Applied to electronic design, Verilog is used for verification via simulation, for timing analysis, logic synthesis and test analysis.

	Section	Weightage
Syllabus	**A**	**25%**
	B	**25%**

	C	**25%**
	D	**25%**

Section-A

Introduction to Verilog HDL: Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, Systems tasks, programming language interface, Module, Simulation and Synthesis tools. Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic values, Strengths, Data types, Scalars and Vectors, Parameters, Operators.

Section-B

Gate Level Modeling: Introduction, AND Gate Primitive, Module, Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip – Flops with Gate Primitives, Delays, Strengths and Construction Resolution, Net Types, Design of Basic Circuit. Modeling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments Assignment to Vectors, Operators.

Section-C

Behavioral Modeling: Introduction, Operations and Assignments, Functional Bifurcation, Initial Construct, Always Construct, Assignments with Delays, Wait Construct, Multiple Always Block, Designs at Behavioral Level, Blocking and Non-Blocking Assignments, The Case Statement, Simulation Flow if an if-Else Constructs, Assign- De-Assign Construct, Repeat Construct, for Loop, the Disable Construct, While Loop, For Ever Loop, Parallel Blocks, Force Release, Construct, Event.

Section-D

Sequential Circuit Description: Sequential Models – Feedback Model, Capacitive Model, Implicit Model, Basic Memory Components, Functional Register, Static Machine Coding, Sequential Synthesis. Component Test and Verification: Test Bench-Combinational Circuit Testing, Sequential Circuit Testing, Test Bench Techniques, Design Verification, Assertion Verification

TEXT BOOKS:

- T R Padmanabhan, B.Bala Tripura Sundari, Design Through Verilog HDL,2009, Wiley.
- Zainalabdien Navabi, Verilog Digital System Design, TMH,2nd Edition.

REFERENCES:

- Stephen Brown, Zvonkoc Vranesic, "Fundamentals of Digital Logic with Verilog Design", 2nd Edition, 2010, TMH
- Sunggu Lee, " Digital Logic Design using Verilog, State Machine & Synthesis for FPGA," Cengage Learning 2009
- Verilog HDL – Samir Palnitkar, 2nd Edition, Pearson Education, 2009.
- Advanced Digital Design with verilog HDL – Michel D.Ciletti, PHI,2009

List of Experiments:

- Write Verilog code to realize all the logic gates.
- Write a VHDL and Verilog code to describe the functions of a Full Adder using three modeling styles.
- Write a Verilog program for the combinational designs i.e. 2 to 4 decoder and 8 to 3 (encoder without priority & with priority).
- Write a Verilog program for the combinational designs i.e. 8 to 1 multiplexer and 4 bit binary to gray converter.
- Write a Verilog program for the combinational designs i.e. Multiplexer, de-multiplexer, comparator.
- Write a Verilog code to model 32 bit ALU.
- Develop the Verilog code for the following flip-flops, SR, D, JK and T.
- Design a 4 bit binary, BCD counters (Synchronous reset and Asynchronous reset).
- Design a "any sequence" counters, using Verilog code.
- Project

Course Title/Code	**DIGITAL SIGNAL PROCESSING (ECH302B-T/P)**
Course Type:	Domain Core
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0

Objective	Provide a thorough understanding and working knowledge of designing, implementation and analysis of DSP systems.

Syllabus	Section	Weightage
	A	**25%**
	B	**25%**
	C	**25%**
	D	**25%**

SECTION A

Signal Processing: Signal, Signal processing, Basic signals, Representation of signals, Representation of systems, Applications of signal processing - signal restoration, reconstruction, synthesis, estimation.

Z-Transforms and system analysis: The z-transformation, Convergence region of z-transform, Transfer function, zeros and poles, Stability of system, Inverse z-transformation – Partial-fraction expansion method – Contour integration (residue) method

SECTION B

Digital structures: Direct-form realizations of digital filters, The system (transfer) function, Zeros, poles, and the stability, The cascade connection, The parallel connection, State-space representation of digital filters, The equivalent transformation, Cascade realization, Parallel realization, Minimum norm form realization, Lattice Ladder structures,

Discrete Fourier Transforms and FFT Discrete Fourier Transform (DFT), Discrete Fourier transformation (DFT), Linearity, Periodicity, Periodicity Symmetry, Direct method for calculating DFT, Fast Fourier transform, Computational cost of FFT, Convolution based on FFT, Filtering based on FFT, Cross-correlation based on FFT

SECTION C

Digital filters Digital filtering and applications, the filter types, General process for designing a filter, Direct filtering using Fourier transform, Window methods for designing FIR filters, Specifications for designing IIR filters, IIR design techniques- Impulse invariance, difference approximation, bilinear transformation, Basic steps for computer aided design (CAD), Stabilization of digital filters. Adaptive Filters,

SECTION D

Spectral Analysis and Power Spectrum Approximation Definition of Power Spectrum, Deterministic signal example, Power Spectrum of a Random Process, The Periodogram Estimator, The Averaged Periodogram, Blackman-Tukey Method, Use of Data Windowing in Spectral Analysis, Spectrogram: Speech Signal Example.

Applications of DSP Application of FFT to finding correction • Application of FFT to data compression • Detection of fetal Heartbeats • Discrete Cosine Transforms and its applications.

Text Books:

1. Tarun Kumar Rawat, Digital Signal Processing, 1/e, Oxford university Press
2. John G Proakis, Dimitris G Monolakis-Digital Signal Processing, 4/e, PHI.

Reference Books:

1. Sanjith K Mitra: Digital Signal Processing, 2/e, Tata McGraw Hill.
2. Salivahanan, A Vallavaraj, C Gnanapriya -Digital Signal Processing, 2/e, TMH

Lab Experiments:

1. To realize discrete auto correlation and cross correlation for signals given as [1 3 5 7] and [-1 2 3]

(a) By implementing the expressions.

(b) Using MATLAB inbuilt function

2. (a) Obtain DFT of a sequence, and verify the result by implementing DFT equation & inbuilt MATLAB function.

(b) Obtain IDFT of a sequence X (k) = [6, -2-2j, 2, -2+2j]

3. a) Given an input sequence, find the output y(n) when the signal is passed through a filter, whose impulse response is given by h(n) = (1,2)

b) Given an input sequence, find the output y(n) when the signal is circularly convolved with h(n) = (1,2).

4. To design and realize a Butterworth low pass IIR filter with pass band frequency of 10kHz, stop band frequency of 20kHz and minimum stop band attenuation of 45dB.

5. To design and realize a Chebyshev _I IIR filter with pass band ripple 0.03, stop band ripple of 0.02, pass band frequency =1800Hz and Stop band frequency= 2400Hz, sampling frequency=10,000Hz, Minimum Attenuation=40dB

6. Design and realize a FIR using Hanning window function with following parameters, pass band ripple 0.03, stop band ripple of 0.01, pass band frequency =1400Hz and Stop band frequency= 2000Hz, sampling frequency=8000Hz.

7. Design and realize a FIR using Kaiser window function with following parameters, pass band ripple 0.02, stop band ripple of 0.01, pass band frequency =1000Hz and Stop band frequency= 1500Hz, sampling frequency=10000Hz, β value= 5.8

8. To transform analog filter to a digital filter using bilinear transformation with a zero at -0.1 and poles at -0.1,-0.1 and sampling interval T=0.276s and a gain of 2.

9. Compute the parallel and cascade realization values of an IIR digital filter whose numerator polynomials are [6, 15, 12] and the denominator polynomials are [2, 5, 3].

10. Compute the parallel and cascade realization values of an FIR linear phase digital filter whose polynomials are [1,]

11. Introduction to DSP starter kit and Code Composer Studio and Generation of basic signals.

12. Project

Course Title/ Code	**COMPUTER ARCHITECTURE (ECH303B-T/P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-0-0-0)
Objective	To teach the basics involved in data representation and digital logic circuits used in the computer system. This course will also expose students to the basic architecture of processing, memory and i/o organization in a computer system.

	Section	**Weightage**
Syllabus	**A**	**25%**
	B	**25%**
	C	**25%**
	D	**25%**

SECTION A

Basic Computer Organization: Von Neumann concept - Store program control concept - Flynn's classification of computers (SISD, MISD, MIMD, SIMD) - Multilevel viewpoint of a machine: digital logic, micro architecture, ISA. Boolean algebra and Logic gates - Combinational logic blocks (Adders, Multiplexers, Encoders, de-coder) - Sequential logic blocks (Latches, Flip-Flops, Registers, Counters) - Operating systems - high level language - structured organization - CPU, caches, main memory, secondary memory units & I/O - Performance metrics; MIPS, MFLOPS.

SECTION B

Memory Hierarchy & I/O Organization: The need for a Memory Hierarchy - Locality of reference principle - Memory parameters: access/ cycle time, cost per bit - Main memory (Semiconductor RAM & ROM organization, memory expansion, Static & dynamic memory types) - Auxiliary Memory - Cache memory (Associative & direct mapped & Set-associative Cache Organizations, Cache Coherence, I/O interface - Modes of transfer - DMA - Types of Interrupts - Input-Output and Interrupt.

SECTION C

CPU and Instruction Set Architecture: Basics**:** Instruction Codes – Computer Registers – Computer Instructions – Timing and Control – Instruction Cycle - Types of Instructions - Instruction set formats (fixed, variable, hybrid). Processor Organization:General register organization – Stack organization – Instruction formats – Addressing modes – Data transfer and Manipulation – Program control - Instruction set based classification of processors (RISC, CISC, and their comparison) - Design of accumulator logic.

SECTION D

Micro programmed Control: Control Memory - Address sequencing - Micro program example – Design of control unit - Microinstruction sequencing - Implementation of control unit. Introduction to Parallelism**:** Goals of parallelism (Exploitation of concurrency, throughput enhancement) - Enhancing performance with pipelining - Amdahl's law - Instruction level parallelism (pipelining, super scaling –basic features) - Processor level parallelism (Multiprocessor systems overview).

Text Books:

1. M. Mano, Computer System Architecture, Prentice-Hall.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design, Morgan Kauffmann.
3. John P. Hayes, Computer Architecture and Organization, TMH.

Reference Books:

1. William Stallings, Operating Systems Internals and Design Principles, Prentice-Hall Upper Saddle River, New Jersey
2. Carl Hamacher, ZvonkoVranesic, Computer Organization, SafwatZaky.
3. A.S. Tanenbaum, Structured Computer Organisation, Prentice-Hall of India, Eastern Economic Edition.
4. W. Stallings, Computer Organisation& Architecture: Designing for performance, Prentice-Hall International edition

Course Title/Code	**CONTROL SYSTEMS (ECH304B-T/P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0
Objective	Students will be able to understand, model and analyse a control system under various factors (disturbance, inputs, orders) which limit the achievable control system performance by graphical, block representation and different stability techniques.

Syllabus	**Section**	**Weightage**
	A	**25%**
	B	**25%**
	C	**25%**
	D	**25%**

Section A

Control System Modelling: Basic elements of control system – Open loop and closed loop systems, Differential equation–Transfer function models, Modeling of electric systems, Translational and rotational mechanical systems, Block diagram reduction techniques, Signal flow graphs, Feedback control systems- Stability, steady-state accuracy, transient accuracy, disturbance, rejection, insensitivity and robustness. Benefits of Feedback.

Section B

Time Response Analysis: Standard test signals, Time response of first order systems to various standard inputs, Impulse and step response analysis of second order systems, Design specifications for second-order systems based on the time-response. Application of initial and final value theorem.Steady state and dynamic errors and error constants.

Techniques for stability analysis in time domain:Stability, Routh-Hurwitz criterion, Relative stability, Root Locus technique, Construction of Root Locus, Stability, Dominant poles, Application of Root Locus diagram, Relative stability.

Section-C

Frequency Response Analysis: Relationship between Time and Frequency Response, Bode plot, Stability in frequency domain, Minimum and non-minimum phase systems, All-pass systems, Polar plot, Nyquist plot, Nyquist stability criteria. Performance specification in frequency domain.

Compensation and their realization in time and frequency domain, Lead, Lag and Lead Lag Compensator.

Section-D

Basic Modes of Feedback Control: Proportional, Integral and Derivative PID Controllers. Hardware: **C**ontrol hardware and their model.

State Variable Analysis: Concepts of state variables. State space model.Diagonalization of State Matrix.Solution of state equations.Eigenvalues and Stability Analysis.Concept of controllability and observability.Pole-placement by state feedback.

Discrete-time systems: Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

Text/References:

1. M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.

2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

3. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.

4. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009

List of Experiments:

1. To find speed torque characteristics of a DC servomotor and its speed control.
2. To find speed torque characteristics of AC Servo Motor and find out the Eb constant.
3. To study the performance of analog PID controller with model process as temperature control system, analyze the effect of various controllers.
3. To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots and also find specifications of closed loop response.
4. To study the magnetic amplifier and to plot its load vs control current characteristics for :
    1. Positive feedback mode
    2. Negative feedback mode
5. To plot the characteristics of Synchro Transmitter-Receiver.
6.Implement basic MATLAB programs
    2. Introduction to control system toolbox
    3. Find the location of poles and zeros and plot poles and zeros of given transfer function.
7. To solve problems based on block diagram reduction using MATLAB.
8. To plot transient response of first order and second order system and find its specifications using MATLAB.
9. To analyze the stability of a system using Routh's Hurwitz criterion and Root Locus Technique.
10. To plot Bode plot and Nyquist plot for stability analysis of a system using MATLAB.
11. Project

Course Title/Code	**INTERNET OF THINGS (ECH305B-T/P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	2-0-2-0
Objective	1. To assess the vision and introduction of IoT. 2. To acquire knowledge of State of the Art - IoT Architecture. 3. To acquire basic knowledge IoT Protocols. 4. To Implement Data and Knowledge Management and use of Devices in IoT Technology.

	Section	**Weightage**
Syllabus	**A**	**25%**
	B	**25%**
	C	**25%**
	D	**25%**

SECTION A

FUNDAMENTALS OF IoT: Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack -– Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects

SECTION B

IoT PROTOCOLS: IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1 01.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: – Application Layer Protocols: CoAP and MQTT

SECTION C

DESIGN AND DEVELOPMENT: Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming.

SECTION D

DATA ANALYTICS AND SUPPORTING SERVICES: Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – NoSQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG

Textbooks:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

References:

1. ArshdeepBahga, Vijay Madisetti, ―Internet of Things – A hands-on approach, Universities Press, 2015

2. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2)

3. Jan Ho¨ ller, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Elsevier, 2014.

4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things, Springer, 2011.

5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011

LIST OF EXPERIMENTS

1. Understanding Arduino IDE environment and blinking on-board LED.
2. Temperature Sensor interfacing with Arduino and displaying the output on LCD.
3. Arduino interfacing with Wi-Fi module ESP8266 for sending data on Thingspeak.
4. Arduino interfacing with Wi-Fi module ESP8266 for sending temperature and humidity data on Thingspeak
5. Arduino interfacing with RFID module to send data on Thingspeak.
6. To perform LED blinking using Raspberry-Pi.
7. To perform push-button interfacing using Raspberry-Pi.
8. To send data over Thingspeak using Raspberry-Pi.
9. To interface 7 segment display with Raspberry-Pi.
10. To interface LCD with Raspberry-Pi.

Course Title/ Code	PROFESSIONAL COMPETANCY RNHANCEMENT-III **(CDO301)**
Course Type:	SOFT
Course Nature:	Hard
L-T-P-O Structure/Credits	(0-0-1-0)/0.5

Part A – Quantitative Aptitude

Unit 1: Time, Speed and Distance

1.1 Basics
1.2 Proportionality
1.3 Direct Formulae
1.4 Average Speed
1.5 Relative Speed
1.6 Trains
1.7 Boats & Streams
1.8 Circular Motion
1.9 Clocks

Unit 2: Number System

2.1 General Formulae
2.2 Primes
2.3 Series
2.4 Factors & Multiples
2.5 HCF & LCM
2.6 Unit digits
2.7 Factorials
2.8 Remainders

2.9 Base System
2.10 Remainder Theorem for functions
2.11 Divisibility
2.12 Calendars

Unit 3: Data & Analysis

3.1 Data Interpretation

3.1.1 Different types of Charts-Table, Bar, Line, Pie and Radar Graph.
3.1.2 Data Caselets and their Applications.

3.2 Data Sufficiency

3.2.1 Problems on Reasoning.
3.2.2 Problems on Quantitative Aptitude.

Part B – Soft Skills

Unit 4: Personality and Professionalism &Emotional Intelligence

4.1Intrinsic and Extrinsic Personality
4.2 Code of Conduct and Ethical behavior
4.3 Professional Etiquette and behavior
4.4 Introduction
4.5 Five Components of EI
4.6 Emotional Self Awareness
4.7 Self Control

Unit 5: Advanced Vocabulary

5.1 Spotting Errors
5.2 Ordering of Words
5.3 One Word Substitutes
5.4 Idioms and Phrases
5.5 Vocabulary, COW, Punctuation

Unit 6:Sentence Construction & Syntax

6.1 Sentence Improvement
6.2 Spotting Errors
6.3 Sentence Improvement
6.4 Ordering of Sentences
6.5 Change of Voice
6.6 Completing Statements

Unit 7:Reading Comprehension & Writing skills

7.1 Strategic Reading, Eliminating Poor Reading Habits
7.2 Techniques to increase speed reading, comprehension and recall
7.3 Solving Sample RC Passages
7.4 Closet Test
7.5 Professional Writing: KISS Principle, styles of writing: technical & formal, formatting
7.6 Practice Exercises: Formal Letter writing, Report Writing, Essay Writing
7.7 Verbal Analogies

Unit 8: Employability Skills

8.1 Group Discussion
8.2 Resume and Cover letter
8.3 Personal Interviews

8.4Self-introduction

Text Books/Reference Books:

1. Quantitative Aptitude : R S Aggarwal, S Chand & Company Pvt Ltd
2. Quantitative Aptitude for CAT: Arun Sharma
3. Developing Management Skills by *David A Whetten, Kim S Cameron*

Weblinks:

http://www.indiabix.com/aptitude/questions-and-answers/
http://www.tcd.ie/Careers/resources/skills/oral-communication.php
http://www.mindtools.com

Course Title/ Code	**RESEARCH & INNOVATION-II (RDO601)**
Course Type:	Research Type
Course Nature:	Hard
L-T-P-O Structure/Credits	(0-0-1)/0.5
OBJECTIVE	To understand and adopt the ethical practice that are to be followed in the research activities and to be able to work in a team

Course outcomes

XX-500.1. The students will be able to apply the contextual knowledge in designing and conducting the experiments
XX-500.2. To analyze and interpret the research outcomes
XX-500.3. To gain hands on experience in techniques/technologies
XX-500.4. To get an insight on the follow-up research

SECTION-A

Unit-1Setting up the simulation/experiment environment

1.1 To conceptualize simulation/verifying experimental set up
1.2 Measurements on experimental system/simulations of the model
1.3 Choosing the appropriate research methodology
1.4 Finding the resources for performing experiments/simulations

SECTION-B

Unit-2 Planning of experiments

2.1 Formulate experimental procedures with Modification of the experimental set-up, if required
2.2 Procurement of materials

SECTION-C

Unit-3 Execution of experiments/simulations

3.1 Conduct experiments/ build prototype
3.2 Tabulating and recording data
3.3 Analysis and interpretation of the data
3.4 Comparison of the results with other reported experiments
3.5 Interpretation of observations

SECTION-D

Unit-4 Documentation and presentation

4.1 Integration of relevant theory, findings in a structured way and draw appropriate conclusions
4.2 Review and modification of the draft
4.3 Seminar presentation

4.4 Communication to conference/Journal

Semester-VI

SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	**OFFERING DEPARTMENT	*COURSE NATURE (HARD/ SOFT/ WORK SHOP/ NTCC)	COURSE TYPE (CORE/ELECTIVE/ UNIVERSITY COMPULSORY)	L	T	P	O	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
ECH324 B-T/P	HARDWARE VERIFICATION USING SYSTEM VERILOG	DIGTAL HARDWARE MODELLING USING VERILOG	ECE	**HARD**	CORE	3	1	2	0	6	5
ECH307B-T/P	ANTENNA AND WAVE PROPOGATION	ELECTRO MAGNETIC FIELD AND WAVE	ECE	HARD	ELECTIVE	3	1	2	0	6	5
ECH310B-T/P	NEURAL NETWORK AND FUZZY LOGIC	NA	ECE								
CSH206 B-T/P	OPERATING SYSTEMS	NA	**CST**								
CSH202 B-T/P	DATABASE MGT SYSTEM	PROG. WITH C	**CST**								
ECH311B-T/P	MICROWAVE AND RADAR ENGG	EMFW	**ECE**	HARD	ELECTIVE	3	1	2	0	6	5
ECH312B-T/P	WIRELESS COMMUNICATION	ADC	**ECE**								
CSH404 B-T/P	CLOUD COMPUTING	NA	**CST**								
ECH313B-T/P	DIGITAL IMAGE PROCESSING AND COMPUTER VISION	NA	**ECE**								
ECH314B-T/P	CMOS VLSI DESIGN	VLSI DESIGN	**ECE**								
ECH315B-T/P	DATA COMMUNICATION	NA	**ECE**	HARD	ELECTIVE	3	1	0	0	5	4
CSH301 B-T/P	COMPUTER NETWORKS	NA	**CST**								

ECH316B-T/P	WAVELETS AND MULTIRATE SYSTEMS	NA	**ECE**								
ECH317B-T/P	EMBEDDED AND REAL TIME SYSTEMS	MICROCONTROLLER AND MICROPROCESSOR	**ECE**								
MCS232	FUND OF FINANCE	NA	**MC**	SOFT	ELECTIVE	1	0	2	0	3	2
MCS231	ECONOMICS	NA									
LWS223	CYBER LAW	NA	**LAW**	SOFT	ELECTIVE	1	0	2	0	3	2
LWS225	LAW RELATING TO IPR	NA									
ECW318B	VERILOG	NA	**ECE**	WORKSHOP	ELECTIVE	0	0	3	0	3	1.5
ECW319B	EDA FOR RF	AWP	**ECE**								
CSW213B	UNIX	NA	**CST**								
ECW320B	TANNER	VLSI DESIGN	**ECE**								
CDO302	PROFESSIONAL COMPETANCY ENHANCEMENT-IV	NA	**CDC**	SOFT	CORE	0	0	1	0	1	0.5
						16	4	14	0	33	25

Course Title/ Code	**HARDWARE VERIFICATION USING SYSTEM VERILOG (ECH234B-T/P)**
Course Type:	**Core (Departmental)**
Course Nature:	**Hard**
L-T-P-O Structure	**(3-1-2-0)**
Objective	Hardware description and hardware verification language used **to model, design, simulate, test and implement electronic systems**.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

Introduction: Introduction to System Verilog: What is system verilog? Features of SV, Event regions in SV; Data Types: 4-State type, 2-State type, Real, Arrays, Packed, Unpacked, Dynamic Array, Queue, Associative Array, Array query function, Array ordering method, User define data type, Structure and Union (Basic), String (Basic), Enumeration, Const, Casting, static and dynamic.

Section B

Data Classes, Statements & Subprograms: Verilog operator overview, System verilog operators, Arithmetic, increment/decrement, bitwise, shift, wildcard equality, inside Verilog loops overview for each, do while loop, Package, `include and import, Scope and Lifetime, Parameter, Function, Task. Introduction to class: Object Constructor, Parametrized class, This Lifetime in class, Function and task in class, Features of OOP, Encapsulation, local, protected, Inheritance, super, Static members in class. Polymorphism, Virtual method, Abstraction, Virtual class, Singleton class, Shallow copy, Deep copy.

Section C

Semaphore, Mailbox & Randomization: What is semaphore? Semaphore methods, What is mailbox? Mailbox methods, Parametrized mailbox, Bounded, unbounded mailbox; Why randomize? Verilog constraint randomization , SV constraint randomization, $urandom, randomize(), Rand vsRandc, Pre and post randomize , Controlling randomization, Relational operator in constraint, Bidirectional constraint, Inside, Implication constraint, Inline constraint, Constraint in inheritance.

Section D

Processes, Coverage & Assertion: Final block, Block statement, Fork join, fork join_any, fork join_none, Wait and disable, what is event? Conditional event control, Named event, Event triggering, Blocking and non-blocking, What is program block? Re-active region, What is Interface? Modport, Parameterized interface, Virtual interface, What is coverage? Code coverage, Functional coverage, Covergroup, Coverpoint, Embedded covergroup, Bins, types of bins,bins for transition, wildcard, illegal bins, ignore bins, cross-coverage, coverage option , What is assertion? Immediate and concurrent, Assertion severity, Property blocks and sequences, Assertion operator (Basic).

Course Title/ Code	**ANTENNA AND WAVE PROPOGATION (ECH307B-T/P)**
Course Type:	**Core (Departmental)**
Course Nature:	**Hard**
L-T-P-O Structure	**(3-1-2-0)**
Objective	Student shall be able to identify, analyze and develop various antennas for wave propagation using simulators and hardware.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

Introduction: Origin of EM theory and antennas, radiation mechanism, radian &steradian. Basic antenna parameters & radiation pattern, near-and far-field regions, Gain, Directivity, reciprocity,Resolution, Aperture, Beam-width, Effective height, Efficiency, Bandwidth etc.Friis transmission equation, Wave polarization, Point Source: Power and field pattern, Radiation density & intensity, Antenna temperature.

Section-B

Antenna Theory: Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements, dipoles for mobile communication, small circular loop. Wave equation for radiated fields, Relation between current distribution and field pattern of an antenna.Antenna impedance, Directivity, Radiation resistance, Directional properties.

Section-C

Antenna Arrays: Points, Linear, Planar and Circular, two element array, Broad side, End fired pattern, Beam width pattern multiplication, Multi element array and their properties, Synthesis of an array.

Aperture and Reflector Antennas - Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Section-D

Practical Antennas - Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas. Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, design of rectangular and circular patch antennas. Basic Concepts of Smart Antennas-Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming. Different modes of Radio Wave propagation used in current practice.

Text/Reference Books:

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw Hill, 1984.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
6. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
7. R.E. Crompton, Adaptive Antennas, John Wiley

Course Title/Code	**NEURAL NETWORK AND FUZZY LOGIC (ECH310B-T/P)**
Course Type:	Domain Elective
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0
Objective	Provide a thorough understanding of the concepts of neural network and Fuzzy logic architectures, algorithms, applications from an engineering perspective.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION A

FUNDAMENTALS OF NEURAL NETWORKS Introduction to Artificial Neural Network – Biological neurons and their artificial models, building blocks of ANN, characteristics of neural networks, McCulloch-Pitts neuron, learning methods, Hebbian learning rules, perceptron learning rule, LMS rule, Hebb net

SECTION B

NEURAL NETWORK ARCHITECTURES Single layer perceptions – Adaline – Madaline – Multilayer Feedback networks: Hop-Field, Discrete Hop field, Feedforward Networks – Back propagation network, Radial Basis Function Network, Adaptive Resonance Theory

SECTION C

FUNDAMENTALS OF FUZZY LOGIC Crisp set – Vagueness – Uncertainty and Imprecision – Fuzziness – Basic definitions - fuzzy set theory – classical set Vs fuzzy set - properties of fuzzy sets – Fuzzy operation – Fuzzy arithmetic – Fuzzy relation – Fuzzy relational equations – Fuzzy Cartesian product and composition – Non-interactive fuzzy sets – Tolerance equations relations – Fuzzy ordering relations – Fuzzy morphism

SECTION D

FUZZY MODELS AND CONVERSION: Introduction to Fuzzy model- fuzzy logic control – structure of FLC – Fuzzification models - knowledge Base – Rule base - Inference Engine – Fuzzy to Crisp Conversion - Lambda cuts for fuzzy sets and relations – Defuzzification Methods, Applications of Neural Networks and Fuzzy Logic– in Forecasting – Traveling salesman problem – in Knowledge Extraction, Fuzzy image processing.

Suggested Text / Reference Books:

1. S.N.Sivanandam , S. Sumati ,S.N.Deepa "Introduction to Neural Networks" Tata Mcgraw hill.
2.LawrenceFausett, "Fundamentals of Neural Networks", Pearson Education, New Delhi. 2. Bart Kosho "Neural Networks & Fuzzy systems", Prentice Hall of India.
3.Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, S. Rajasekaran and G. A. VijayalakshmiPai, Prentice Hall of India, New Delhi.
4. S.N.Sivanandam, S.Sumathi, S.N.Deepa "Introduction to Fuzzy Logic " Springer publications.

Course Title/ Code	**Operating Systems (CSH206) T & P**
Course Type:	**Core**
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	Students shall be able to learn the conceptual design, functional architecture and services of an operating system to use the computer resources efficiently.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

Introduction: Operating system and functions, Classification of Operating systems- Batch, Interactive, Time sharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multithreaded Systems, Operating System Structure- Layered structure, System Components, Operating System services, Reentrant Kernels, Monolithic and Microkernel Systems.

Processes and Threads : Process Concept, Process Scheduling, Operations on Processes, Cooperating Processes, Interprocess Communication, Communication in Client-Server Systems, Multithreading Models, Threading Issues, Pthreads Basic Concepts.

Section-B

CPU Scheduling: Scheduling criteria, scheduling algorithms (First Come First Serve (FCFS), Shortest-Job-First (SJF), Priority Scheduling, Round Robin (RR), multi-processor scheduling, Real-time scheduling.

Process Synchronization: Co-operating Process, Inter-Process Communication, Critical region, Semaphores. Classical Problems of Synchronization, Deadlocks: Overview, Methods of Handling Deadlocks, Deadlock Prevention, Avoidance, Detection and Recovery.

Section-C

Memory Management: Logical & Physical Address Space, swapping, contiguous and non-contiguous memory allocation, paging and segmentation techniques, segmentation with paging; virtual memory management - Demand Paging & Page- Replacement Algorithms; Demand Segmentation. File System: Types of files and access methods, directory structures, various allocation methods, disk scheduling and management and its associated algorithms, Introduction to distributed file system.

Section-D

Protection :Goals of Protection, Domain of Protection, Access Matrix, Implementation of Access Matrix, Revocation of Access Rights, Language-Based Protection, Capability-Based Systems, The Security Problem , User Authentication , Program Threats, System Threats, Securing Systems and Facilities.:: I/O Systems: Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O to Hardware Operations, STREAMS, Performance, Disk Structure, Disk Scheduling, Swap-Space Management.

List of Experiments:

1. Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait
2. Write programs using the following system calls of UNIX operating system: close, stat, opendir, readdir
3. Write programs using the I/O System calls of UNIX operating system (open, read, write, etc).
4. Write C programs to simulate UNIX commands like ls, grep.
5. Given the list of processes, their CPU burst times and arrival times. Display/print the Gantt chart for FCFS and SJF. For each of the Scheduling policies compute and print the average waiting time and average turnaround time.
6. Given the list of processes, their CPU burst times and arrival times. Display/print the Gantt chart for SJF. For each of the Scheduling policies compute and print the average waiting time and average turnaround time.
7. Given the list of processes, their CPU burst times and arrival times. Display/print the Gantt chart for Priority CPU scheduling. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
8. Given the list of processes, their CPU burst times and arrival times. Display/print the Gantt chart for Round robin CPU scheduling. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
9. Implement some Memory management schemes FIRST FIT
10. Implement some Memory management schemes BEST FIT.
11. Implement some Memory management schemes WORST FIT.
12. Implement any file allocation techniques Contiguous.
13. Implement any file allocation techniques Linked.
14. Implement any file allocation techniques Indexed.

Text Books:

1. Silberschatz, Galvin, and Gagne, “Operating System Concepts with Java,” 7th Edition. *John Wiley & Sons*, Inc. 2007. ISBN: 0-471-76907-X
2. Harvey M Dietel ,”An Introduction to Operating System”, Pearson Education

Reference Book:

1. William Stallings, “Operating Systems: Internal and Design Principles,” 5th Edition. *Prentice-Hall*, Inc. 2005. ISBN: 9780131479548
2. Andrew S. Tanenbaum and Albert S Woodhull, “Operating Systems Design and Implementation,” 3rd Edition .*Prentice Hall*, 2006. ISBN: 9780131429383.

Course Title/ Code	**Database Management System (CSH202B) T & P**
Course Type	Elective (Allied)
Course Nature	Hard
L-T-P-O Structure	(3-1-2-0)

Objectives	To do logical and physical design of data bases and manipulate them.

Syllabus	Sections	Weightage
	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

File system & Introduction to DBMS: File, operations on files, file header, Different file organizations - serial, sequential, indexed sequential, direct/hash, Indexing – primary, secondary, single level, multi-level, clustered, Introduction to DBMS – comparison with conventional file processing, ANSI SPARC three level DBMS architecture, data independence, data abstraction, different users of DBMS, Applications of DBMS, SQL(Introduction, Data Types, Constraints, Creation of Tables)

Section-B

Relational model and Algebra: Introduction to SQL(Insertion of Data, Updating in the data, Alternation in the Schema, Data Fetching, Functions), Relational model – Mathematical formulation, Relation and its properties, domain compatibility, Relational algebra – set operations (union, intersect, difference, cross product), relational operations (select, project, division, joins-cross, inner/outer, theta, natural, equivalence), group operations Tuple calculus, Relational Calculus.

Section-C

Relational Database design: SQL (Set Operations, group by, order by, Joins), Relational Database Design and ER Model(Entity, Relationship, Strong Entity, Weak Entity, Type of Attributes and their representation), EER(Generalized and Specialization) , Functional dependency, Armstrong inference axioms, Closure and its algorithm, Minimal set of Functional Dependencies and its algorithm, Keys – super key, minimal super key, candidate keys, primary key, foreign key, Algorithm to find primary key.

Good decomposition properties – dependency preservation and loss less join, Algorithm for checking los less join decomposition, Synthesis Approach, Anomalies – insertion, deletion and updating, I NF, 2 NF, 3 NF, BCNF, Multi - valued dependency, 4 NF, Join dependency, 5 NF.

Section-D

Transaction processing, Concurrency control & recovery: SQL(Sub queries, View, Sequence, DCL(Roll back, commit)), Introduction to transaction, properties of transaction and life cycle of transaction, Schedule – serial, non-serial, serializable (result, conflict and view), strict schedule, Concurrency and problems related, Concurrency control techniques – Locking, two phase locking, strict, rigorous 2PL, Deadlock – detection, prevention, breaking deadlock, Recovery System, Basic Concepts of Recovery, Database Update(update in place, Deferred Update), Undo-Redo Algorithm, No Undo-Redo Algorithm, Undo-NoRedo Algorithm, Shadow Paging Technique.

List of Experiments

1. File Vs DBMS
2. DDL statement
3. DML Statement
4. DCL Statement
5. Project
6. Tool related to RDBMS

Text Books:

1. Fundamentals of Database Systems by R. Elmasri and S.B. Navathe,6th edition, 2013, Addision-Wesley, Low Priced Edition
2. Database system concepts, 6th edition, McGraw-Hill, AviSilberschatz, Henry F. Korth, S. Sudarshan

Reference Book:

1. An Introduction to database systems by Bipin C. Desai, Galgolia Publications.
2. Modern Database Management by Feffray A. lioffcr, Mary B. Prcscotl, Fred R Mefaddcn, 6th edition. Pearson Education

Course Title/ Code	MICROWAVE & RADAR ENGINEERING
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objective	Student shall be able to identify, analyze and develop various microwave components for various applications using simulators and hardware.

Section A

Waveguides: Introduction to waveguides & comparison with transmission lines, Microwave frequency bands and general solutions for TEM, TE & TM waves from Maxwell equations, Rectangular & circular waveguides: Propagation of TE &TM modes, Non-existence of TEM mode, Cut-off frequency, Dominant mode, Evanescent mode, Degenerate mode, Phase velocity, Group velocity, Wave impedance & characteristic impedance, Power transmission & power losses in waveguides, Introduction to stripline&microstrip line, Application of waveguides.

Section B

Microwave Passive Components: Cavity Resonators: Rectangular & Cylindrical, Resonant frequencies, Limitation of two port parameters & introduction to S-parameters,Reciprocal Devices: Directional couplers, E-plane Tee, H-plane Tee, Magic Tee, Attenuators, Rat Race circuit, Bends, Twists, Non-reciprocal devices: Circulators, Phase shifter & Isolators. Microwave Tubes: Limitations of conventional tubes, Linear beam tubes (O type): Multi-cavity Klystron & reflex klystron, Velocity modulation, Bunching process, efficiency &applegate diagram. Travelling wave tube (TWT): Slow wave structures & wave modes.

Section C

Microwave Tubes : Electron motion in electromagnetic field in cylindrical coordinate system, Cross Field Tubes (M Type): device operation, Pi-mode of operation, Strapping, Mode jumping, Frequency pulling and pushing, Performance and Rickie diagram, Cylindrical & linear magnetron, Introduction to Gyrotrons**,** Microwave Solid State Devices: Esaki diode, Transferred electron devices: Two valley model, Gunn diode & its modes of operation, Avalanche diodes: IMPATT & TRAPATT, Parametric amplifiers: Manley Rowe power relation, PIN diode, MASERs, Esbar (Schottky) diode.

Section D

Radar: Radar Block diagram and Operation, Radar Frequencies, millimeter and submilimeter waves, Applications of Radar.Radar Equation, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Signal to Noise Ratio, Matched filter impulse response, Integration of radar Pulses, Radar Cross Section of Targets, Cross section Fluctuations, Radar Clutter-surface clutter, sea clutter and Land clutter, weather clutter, Transmitter Power, Pulse Repetition Frequency and Range ambiguities, Antenna Parameters, system losses, propagation effects, other considerations.CW and FM CW Radar Doppler effect: CW radar. FM CW radar,Multiple frequency CW Radar. MTI And Pulse Doppler Radar: platform, Other types of MTI, Airborne radar.Tracking Radar: Radar Transmitters, Antennas and Receivers Navigational Aids, GPS principle of operation, Position location determination, GPS receiver.

List of Experiments:

1. Assembling of microwave bench with proper reasoning & measurement of VSWR of unknown load with calculation of impedance on Smith Chart.
2. Plotting & analysis of the TE & TM Field pattern of the different modes in the Rectangular waveguide using MATLAB.
3. Plotting & analysis of the TE & TM Field pattern of the different modes in the Circular waveguide using MATLAB
4. Measurement of frequency & wavelength law verification in rectangular waveguide.
5. Design & characterization of a Microstrip line using EM simulator.

6. Calculation of the coupling factor, directivity and insertion loss of Directional Coupler and measurement of attenuation of attenuator (variable attenuator).
7. Calculation of the power division, coupling co-efficient, isolation of Magic Tee and isolation, insertion loss of a Circulator.
8. Study of Beam coupling coefficient as a function of gap transit angle in Klystrons & Output Power as function with Repeller voltage using MATLAB.
9. Plotting of I-V Characteristics of Gunn Diode & Output power & frequency as a function of bias voltage.
10. Calculation of low and high VSWR (using standing wave and double minima method) introduced by the waveguide in dominant mode of propagation.

Text Books:

1. S. Y. Liao, Microwave Devices and Circuits, PHI.
2. D.M. Pozar, Microwave Engineering, 2nd ed., John Wiley

Reference Books:

1. R. R. Collin, Foundations for Microwave Engineering, McGraw Hill.
2. R. S. Rao, Microwave Engineering, PHI.
3. Skolnik, Introduction to Radar Systems, Tata McGraw-Hill

Course Title/Code	**WIRELESS COMMUNICATION (ECH312B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0
Objective	Student shall be able to identify, analyze and develop various microwave components for various applications using simulators and hardware.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

Cellular Concepts: Frequency bands used for communication, Evolution of mobile radio communications, Spectrum allocation, Concept of cell, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, 2G, 2.5G, 3G

SECTION-B

Multiple Access Techniques for Wireless Communication: Introduction to multiple access, FDMA, TDMA, spread spectrum multiple access, CDMA, Direct sequence spread spectrum signals, Frequency hopped spread spectrum Signals, Capacity of a CDMA system, Space division multiple access (SDMA), Packet radio, Capacity of a cellular systems

SECTION-C

Mobile radio propagation: Diversity & types of diversity, Fading, Large scale path loss: propagation mechanisms: reflection, diffraction, scattering Free Space loss-model, Okumura &Hata Models, Ground reflection (Two-Ray) model.

SECTION-D

Equalization Techniques & Advanced Wireless Standards: Fundamentals of equalization, equalizer in communication receiver, Types of equalization, linear equalize, Rake receivers OFDMA: Transmission & Reception, SCFDMA, MIMO Technology, and Introduction to LTE &4G Standard

Text Books:

1. Theodore S. Rappaport, Wireless Communications, Pearsons.
2. 2. B P Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, Oxford

Reference Books:

1. UpenDalal, Wireless Communication, Oxford University Press.

Course Title/ Code	**Cloud Computing (CSH404B) T & P**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	Students will be able to learn the concepts, techniques and implementation of clouds.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

Overview of Cloud Computing: Brief history and evolution - History of Cloud Computing, Evolution of Cloud Computing, Traditional vs. Cloud Computing. Why Cloud Computing, Cloud service models (IaaS, PaaS&SaaS). Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing.
Working with Private Cloud: Basics of virtualization, Virtualization technologies, Server virtualization, VM migration techniques, Role of virtualization in Cloud Computing. Business cases for the need of Cloud computing environment, Private Cloud Definition, Characteristics of Private Cloud, Private Cloud deployment models, Private Cloud Vendors, Private Cloud Building blocks
namely Physical Layer, Virtualization Layer, Cloud Management Layer, Challenges to private Cloud, Virtual Private Cloud. Implementing private cloud (one out of CloudStack, OpenStack, Eucalyptus, IBM or Microsoft)

Section-B

Working with Public Clouds: Public Cloud, Public Cloud Service Models, and Public Cloud Players. Infrastructure as a Service Offerings, IaaSVendors, PaaS offerings, PaaS vendors, Software as a Service. Implementing public cloud (one out of AWS, Windows Azure, IBM or Rackspace).

Application Development: Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.

Section-C

Cloud Services Management: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services.

Cloud Infrastructure: Architectural Design of Compute and Storage Clouds - Layered Cloud Architecture Development –Design Challenges. Inter Cloud Resource Management System – Resource Provisioning and platform Deployment- Global Exchange of Cloud Resources.

Future directions in Cloud Computing: Future technology trends in Cloud Computing with a focus on Cloud service models, deployment models, cloud applications, and cloud security. Migration paths for cloud, Selection criteria for cloud deployment.Current issues in cloud computing leading to future research directions.

Section-D

Business Clouds: Cloud Computing in Business, Various Biz Clouds focused on industry domains (Retail, Banking and Financial sector, Life Sciences, Social networking, Telecom, Education). Cloud Enablers (Business Intelligence on cloud, Big Data Analytics on Cloud)

Programming Cloud IT Model: Parallel and Distributed Programming Paradigms, Twister and Iterative MapReduce, Hadoop Library from Apache- Mapping Applications – Programming Support of Google App Engine, Cloud Software Environments – including Eucalyptus, Open Nebula, OpenStack, Aneka and Cloud Sim.

LIST OF EXPERIMENTS:

1. Creation of EC2 Instance on Amazon.
2. Implementation of Load Balancing.
3. Deployment of various services on Amazon.
4. Design, development and implementation of a given business application.
5. Management of one application using multi-cloud management.

Text Books:

1. A Practical Approach Cloud Computing: By Anthony T Velte, Toby J Velte, Robert C Elsenpeter.
2. Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, *Kai Hwang, Jack Dongarra and Geoffrey Fox*, Morgan Kaufmann, 2011.

Reference Book:

1. Cloud computing: Implementation, management and security By Rittinghouse, John, W.
2. Cloud Computing Bible, By Barrie Sosinsky, Wiley, 2011.
3. Cloud Computing Architected: Solution Design Handbook by Rhoton, John.
4. Cloud Security, A comprehensive Guide to Secure Cloud Com puting by Krutz, Ronald L.; Vines, Russell Dean
5. Cloud Computing: Principles and paradigms By Raj Kumar Buyya, James Broberg, AndrezeiM.Goscinski, 2011

Course Title/Code	**DIGITAL IMAGE PROCESSING AND COMPUTER VISION (ECH313B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0
Objective	This course Covers the basic theory and algorithms that are widely used in digital image processing, current technologies and issues that are specific to image processing systems. Develop hands-on experience in using computers to process images.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION A

Digital Image Fundamentals & Image Transforms**:** Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels. Image Transforms: 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform. Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non –

Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering. Image Enhancement (Frequency Domain): Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

SECTION B

Image Restoration**:** Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration. Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, thresholding, Region Oriented Segmentation. Morphological Image Processing: Dilation and Erosion: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation**.**

SECTION C

Computer Vision: Recognition Methodology, Conditioning, Labeling, Grouping, Extracting, Matching. Morphological Image Processing: Introduction, Dilation, Erosion, Opening, Closing, Hit-or-Miss transformation, Morphological algorithm operations on binary images, Morphological algorithm operations on gray-scale images, Thinning, Thickening, Region growing, region shrinking. Image Description: Representation schemes, Boundary descriptors, Region descriptors

SECTION D

Binary Machine Vision: Thresholding, Segmentation, connected component labeling, Hierarchal segmentation, Spatial clustering, Split & merge, Rule-based Segmentation, Motion-based segmentation. Area Extraction, Region and boundary Analysis: Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting, Curve fitting (Least-square fitting), Region properties, External points, Spatial moments, Mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers.

Text books

1 Digital Image Processing, Gonzalez.R.C& Woods.R.E., 3/e, Pearson Education, 2008.
2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall, 1998.
3. Fundamentals of Digital image Processing, Anil Jain.K, Prentice Hall of India,
4. Digital Image Processing Using MATLAB, Gonzalez.R.C& Woods. R.E., 3/e, Pearson Education, 2014

References

1. Digital Image Processing, S. Jayaraman, S. Esakkirajan, T. Veerakumar, McGraw Hill Education ,2009. Pvt Ltd, NewDelhi
2. 1989Digital Image Processing, Kenneth R Castleman, Pearson Education, 1995.

Lab Experiments:

SECTION A
Lab1: Introduction: Key features/functions of image processing.
Lab2: Image Representation in spatial domain
Lab3: Grayscale Image -Data type and bit-plane
SECTION B
Lab 4: Image Enhancement
Lab 5: Histogram Equalization
Lab 6: Smoothing: Low pass filter
SECTION C and D
Lab 7: Generate HDL Code for Image Sharpening
Lab8. Generate HDL Code for Image Sharpening (contd..)
Lab Exercise 9 and 10 Image Acquisition
Lab Exercise 11 Object detection by colourthresholding

Course Title/Code	**CMOS VLSI DESIGN (ECH314B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-2-0

Objective	To learn CMOS process technology. To learn techniques of chip design using programmable devices. To learn the concepts of designing VLSI Subsystems.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

Implementation Strategies for Digital IC's: Introduction, from custom to semicustom and structured Array design approaches, Custom circuit design, Cell based design methodology – Standard cell, Compiled cell, Microcells, Mega cells and intellectual property, Array based implementation approaches – Prediffused arrays and Prewired arrays. Coping with Interconnect: Introduction, Capacitive parasitics – Capacitance & Reliability, Capacitance & Performance, Resistive parasitic – Resistance & Reliability, Electro migration, Resistance & performance, Inductive parasistics – Inductance & Reliability, Inductance & Performance, Advanced interconnect techniques – Reduced swing circuits, Current mode transmission techniques

Section B

Timing Issues in Digital Circuits: Introduction, Timing classification of digital systems, Synchronous interconnect, Mesochronous interconnect, Plesiochronous interconnect, Asynchronous interconnect, Synchronous design – Synchronous timing basics, Sources of Skew & Jitter, Clock distribution techniques, Latch based clocking, Self-timed circuit design – Self timed logic, Completion –signal generation, Self-timed signalling, Synchronizers & arbiters, Clock synthesis & synchronization using basic concept, Building blocks of a PLL, Distributed clocking using DLL's, Optical clock distribution, Synchronous versus asynchronous design.

Section C

Designing Arithmetic Building Blocks: Introduction, Data paths in digital processor architecture, Adder: binary adder (Definition, Logic design consideration), Full adder (Circuit design & consideration), Multiplier: definitions, Partial product generation, Partial product accumulation, Final addition, Shifter – Barrel shifter, Logarithmic shifter , Other arithmetic operators, Power & speed trade-offs in Datapath structures, Design time power reduction techniques, Run time power management, Reducing the power in standby (or sleep) mode.

Section D

Designing Memory & Array Structures: Introduction: Memory classification, Memory architectures & building blocks, Memory core – ROM, Non-volatile Read-Write memories, RAM, Contents- Addressable or Associative memory (CAM), Memory peripheral circuitry, Address decoders, Sense amplifiers, Voltage references, Drivers / Buffers, Timing & control, Memory reliability and yield, Static noise margin, Memory yield, Power disspation in memories, Sources of power dissipation in memories, Partitioning of the memory, Addressing the active power dissipation, Data retention dissipation, Case study in memory design, PLA, 4 –Mbit SRAM, 1-Gbit NAND flash memory.

List of Experiments:

1. To construct &Analyse CMOS Inverter in Tanner EDA.
2. To construct &Analyse the logic gates in Tanner EDA.
1. To construct &analyse the half adder in Tanner EDA.
2. To Construct &analyse Full adder in Tanner EDA.
3. To construct &analyse D – Flip Flop in Tanner EDA.
4. To construct &analyse current mirror in Tanner EDA.
5. To construct &analyse differential amplifier in Tanner EDA.
6. To construct &analyse operational amplifier in Tanner EDA.
7. To construct &analysetrans conductance amplifier in Tanner EDA.
8. Mini Project

Text Books:

1. Jan M Rabaey, Digital Integrated Circuits - A Design Perspective, Prentice Hall.
2. Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits - Analysis & Design, MGH, Second Ed., 1999.

Reference Books:

1. R. J. Baker, H. W. Li, and D. E. Boyce, CMOS circuit design, layout, and simulation. New York: IEEE Press, 1998.
3. David A. Hodges, Horace G. Jackson, and Resve A. Saleh, Analysis and Design of Digital Integrated Circuits, Third Edition, McGraw-Hill, 2004.

Course Title/ Code	DATA COMMUNICATION (ECH315B-T/P)
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	1. To introduce the basics of data communications and computer networks. 2. To examine and understand network protocols and architectures. 3. To educate the student in modern networking technologies.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

Data Communications: Overview of basic modulation techniques, Data Communications: Introduction, History of data communication, Standard organization for data communication, Physical Layer: Transmission media, Serial interfaces: RS-232, RS-449 & RS-530, Parallel interfaces, Circuit switching, Packet switching, Hybrid switching, CCITT X.21, HUBs, Data modems.

Section B

Data Communications Protocols and Network Configurations: Data Link Layer: Data link layer services (error detection & correction), Data link layer protocols, HDLC, Point to point protocols, CSMA, CSMA/CD, CSMA/CA, Ethernet, Switches, Basic link protocols. Character oriented and bit-oriented protocols, integrated services digital network (ISDN), IEEE standard 802 for LAN, Framing, Error control, Flow control, ATM. The Network Layer: Design issues, Routing algorithms (distance vector routing, link state routing), Routing protocols (RIP, OSPF, BGP), Virtual circuit and Data gram Subnet, Flow control, Bridges, Routers, Sub netting and network layer protocols (TCP/IP suite), Connection oriented and connection less services

Section C

Multiplexing: The Transport Layer: Design issues, Transport layer protocols (TCP and UDP), Connection management, Study of Internet. Session Layer: session layer services (authentication, authorization), Protocols. Multiplexing: Introduction, Time division multiplexing, T1 digital carrier system, CCITT time division multiplexed carrier systems, CODECS, COMBO chips, Line encoding, T-CARRIERS, Frame synchronization, Bit interleaving vs word interleaving, Frequency division multiplexing, AT&T's FDM hierarchy, Composite base band signal, Formation of a master group.

Section D

Internet: Presentation layer: services (data encryption, decryption, compression and conversion), Application layer services: DNS, DHCP, FTP, TFTP, SMTP, SNMP, HTTP, WWW. Cloud computing: History, Introduction, Services (Infrastructure as a service, platform as a service, and software as a service).

List of Experiments:

1. To make Cross & Straight LAN Cable using RJ45 connector and to transmit data between Two System.
2. To transmit data using different transmission media (Optical Fiber Cable, Wireless).

3. To perform Serial Interface RS-232 and Parallel Interface.
4. To install LAN using Tree topology, STAR topology, Bus topology and Token-Ring topology.
5. To configure a HUB/Switch using Packet Tracer software (minimum 5 System)
6. To configure a router using Packet Tracer software
7. To configure a network using static routing using Packet Tracer software
8. To configure a network using Dynamic routing using Packet Tracer software
9. To perform telnet in a given network using Packet Tracer software
10. To create a VLAN on a Switch using Packet Tracer software
11. Project

Text Books:

1. Forauzan, Data Communication and Networking (2nd edition), McGraw Hill.
2. Andrew S. Tanenbaum, Computer Networks, PHI India.

Reference Books:

1. Leon-Garcia, Widjaja, Communication Networks, TMH.
2. William Stallings, Data & Computer Communication, Prentice Hall.

Course Title/Code	**Computer Networks (CSH301B-T/P)**
Course Type:	**Core**
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objective	To familiarize the students with different protocols, network components, functioning of different layers and IEEE standards employed in computer networking

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

DATA COMMUNICATION: Components –Transmission Modes, Synchronous and Asynchronous transmission – networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – TCP/IP Model
PHYSICAL LAYER: Transmission Media -- Line Configuration -- Line Coding -- Modem -- Interconnection devices: Hub, Repeater, Switch, Bridges, Router, and Gateway

Section-B

DATA LINK LAYER & LOCAL AREA NETWORK: Framing -- Error – detection and correction, Window based – Flow Control and Error control - stop and wait –sliding window- go back-N ARQ – selective repeat ARQ. –Access Techniques: STDM, FDMA, TDMA, Spread Spectrum techniques, and CDMA, DSSS, FHSSS – Media Access Control: Aloha. Pure Aloha, Slotted Aloha, Polling, CSMA, CSMA/CD -- IEEE 802 Standards -LAN - Ethernet IEEE 802.3 - IEEE 802.5 – IEEE 802.6 -- IEEE 802.11 – FDDI-- X.25 – HDLC -- Frame Relay – ATM -- SONET/SDH

Section-C

NETWORK LAYER*:* Internetworks Switching : Circuit Switching, Packet Switching, Virtual Circuit and PVC, Message Switching, Cell Switching – IP addressing – Subnetting–classful and classless– Routing Algorithms – Distance Vector Routing – Link State Routing, Path Vector Routing -- Error control and congestion control—ARP,RARP,ICMP,DHCP --IPV4 and IPV6 – NAT -- Mobile IP

Section-D

TRANSPORT LAYER: Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS).
APPLICATION LAYER: Client Server model -- Network File System -- Remote Login- TELNET, FTP -- EMAIL SYSTEM: SMTP, POP3, IMAP4 -- DNS, DNS Server – HTTP – SNMP, Network Security .Firewalls -- Proxy Servers – VLAN-- VPN -- NETWORK Simulator case Study—Cisco Packet Tracer.

Text Books:

1. Data Communications and Networking by ForouzanBehrouz A., TMH Publications
2. Computer Networks (3rd edition), Tanenbaum Andrew S., International edition, 1996

Reference Books:

1. Data Communications, Computer Networks and Open Systems (4th edition), Halsall Fred, 2000, Addison Wesley, Low Price Edition. -
2. Computer Networks – A System Approach, Larry L. Peterson & Bruce S. Davie, 2nd Edition Computer Networking – ED Tittel , 2002, T.M.H.

Course Title/Code	**WAVELETS AND MULTIRATE SYSTEM (ECH316B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	This course will provide an introduction to the theory of wavelets and its applications in mathematics and signal processing.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION A

CONTINUOUS WAVELET TRANSFORM
Introduction, C-T wavelets, Definition of CWT, The CWT as a correlation.Constant Q-Factor Filtering Interpolation and time frequency resolution, the CWT as an operator, inverse CWT.

INTRODUCTION TO DISCRETE WAVELET TRANSFORM AND ORTHOGONAL WAVELET DECOMPOSITION
Introduction.Approximation of vectors in nested linear vector spaces, (i) example of approximating vectors in nested subspaces of a finite dimensional liner vector space, (ii) Example of approximating vectors in nested subspaces of an infinite dimensional linear

vector space.MRA.(i) Bases for the approximations subspaces and Harr scaling function, (ii) Bases for detail subspaces and Haar wavelet.

SECTION B

MRA, ORTHO NORMAL WAVELETS AND THEIR RELATIONSHIP TO FILTER BANKS
Introduction, Formal definition of an MRA. Construction of a general orthonormal MRA, (i) scaling function and subspaces, (ii) Implication of dilation equation and orthogonality, a wavelet basis for MRA. (i) Two scale relations for (t), (ii) Basis for the detail subspace (iii) Direct sum decomposition, Digital filtering interpolation (i) Decomposition filters, (ii) reconstruction, the signal.

EXAMPLES OF WAVELETS
Examples of orthogonal basis generating wavelets, (i) Daubechies D4 scaling function and wavelet. (ii) band limited wavelets, Interpreting orthonormal MRAs for Discrete time MRA, (iii) Basis functions for DTWT.

SECTION C

ALTERNATIVE WAVELET REPRESENTATIONS
Introduction, Bi-orthogonal wavelet bases, Filtering relationship for bi-orthogonal filters, Examples of bi-orthogonal scaling functions and wavelets. 2-D wavelets.
Non - separable multidimensional wavelets
Non - separable multidimensional wavelets, wavelet packets. Wavelets Transform and Data Compression: Introduction, transform coding, DTWT for image compression (i) Image compression using DTWT and run-length encoding.

SECTION D

CONSTRUCTION OF SIMPLE WAVELETS
Construction of simple wavelets like Harr and DB1. Other Applications of Wavelet Transforms: Introduction, wavelet de-noising, speckle removal, edge detection and object isolation, Image fusions, Object detection by wavelet transforms of projections.

Text books:
1. Raghuveer M Rao and Ajit S Bopadrikar, "Wavelet transforms: Introduction to theory and applications" Gerald Kaiser, A Friendly Guide to Wavelets, Birkhauser, New York, 1995, Prentice Hall

References:
P. P. Vaidyanathan, Multirate Systems and Filter Banks, Prentice Hall, New Jersey, 1993.

Course Title/Code	**EMBEDDED AND REAL TIME SYSTEM (ECH317B-T/P)**
Course Type:	Elective (Department)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	To hone the students in problem solving and system design skills using modeling practices and learn key concepts in real time embedded application development using RTOS.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

INTRODUCTION TO EMBEDDED SYSTEMS: Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor, selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

SECTION-B

EMBEDDED NETWORKING: Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols – RS232 standard – RS422 – RS485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers.

SECTION-C

EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT: Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modeling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object-oriented Model.

SECTION-D

RTOS BASED EMBEDDED SYSTEM DESIGN: Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, C/OS-II, RT Linux.

TEXT BOOKS:

1. Raj Kamal, 'Embedded System-Architecture, Programming, Design', McGraw Hill, 2013.
2. Peckol, "Embedded system Design", John Wiley & Sons, 2010
3. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson, 2013

REFERENCES:

1. Shibu. K.V, "Introduction to Embedded Systems", Tata McGraw Hill, 2009.
2. Elicia White," Making Embedded Systems", O' Reilly Series, SPD, 2011.
3. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
4. Han-Way Huang,"Embedded system Design Using C8051", Cengage Learning, 2009.

Course Title/Code	**VERILOG WORKSHOP (ECW318B)**
Course Type:	Elective Workshop
Course Nature:	Hard
L-T-P-O Structure	0-0-3-0
Objective	Explain design, test and implementation of digital hardware.

1. Introduction to Verilog. Write the Verilog code & Simulate for a Half Adder, Full Adder, Half Subtractor and Full Subtractor using dataflow modelling.
2. Write the Verilog code& Simulate Mux and demux using data flow.
3. Write the Verilog code & Simulate encoders and decoders using behavioral.
4. Write the Verilog code& Simulate higher level mux and demux using gate level.
5. Write the Verilog code & Simulate Code Convertors.
6. Write the verilog code & Simulate all flip Flops
7. Write verilog code & Simulate 8-bit register with parallel load and shift left modes of operation and test its operation.
8. Write the hardware description &Simulate a 4-bit down counter and test it.
9. Write the hardware description&Simulate a 4-bit mod-13 counter and test it.
10. Write the hardware description and simulate a universal shift register.
11. Project based Learning.

Text/ Reference Books:

1. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Prentice Hall PTR
2. T.R. Padmanabhan, B.Bala Tripura Sundari, Design through Verilog HDL , Wiley

Course Title/ Code	EDA FOR RF (ECW319B)
Course Type:	Core (Departmental)
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3)
Objectives	Design and analysis of RF components

List of Experiments:

Software proposed: CST MW STUDIO/HFSS

1. Introduction to RF Design Software, Simulation Steps.
2. Designing and Analysis of Microstrip Line.
3. Designing and Analysis Planar Antenna for Bluetooth Range.
4. Designing and Analysis Planar Antenna for GPS.
5. Designing and Analysis of Low pass and high Pass Filter.
6. Designing and Analysis of rectangular and circular Wave guides.
7. Implementation and testing of components designed using CST MW STUDIO/HFSS.

Course Title/Code	TANNER WORKSHOP (ECW320B)
Course Type:	Elective (WORKSHOP)
Course Nature:	Hard
L-T-P-O Structure	0-0-3-0

1.Plot I-V characteristics of n-MOSFET, P-MOSFET & CMOS.
2. Design gates using MOSFET
3. Design Half adder and Full adder using MOS
4. Design Flip Flops using MOS
5. Design 4-bit adder using MOS
6. Design 4-bit ADC
7. Design Differential Amplifier
8. Design differential amplifier with current mirror technique

9. PROJECTS

i) Design and implementation of active low pass and active high pass filters
ii) Design of an Op-amp

Course Title/ Code	UNIX (CSW213B)
Course Type	Elective (Allied)
Course Nature	Workshop
L-T-P-O Structure	**0-0-3-0**
Objectives	Student shall be able to formulate commands and scripts in UNIX operating system to meet the stated functional

	requirements of the operating system.

Section-A

Introduction to UNIX: UNIX architecture and command usage, Internal and external commands, Command structure, browsing the manual pages, learning about UNIX file system, file naming, parent-child relationship. Commands for: displaying calendar, system date, using the calculator, Recording the session, knowing logged in user details, knowing the machine characteristics, knowing the terminal, and displaying terminal characteristics knowing the login name, host name, name of the operating system, version of the operating system.

File and Directory Commands : Knowing about HOME directory, checking for the current directory, learning about absolute and relative pathnames and difference between them, changing the current directory, making and removing directories, conditions for removing directories, listing the directory contents in varied ways, displaying and creating files, copying, deleting and renaming files, paging the output of the file, printing a file, knowing the file types, counting lines, words and characters, displaying data in octal, comparing two files, converting one file to another, compressing and archiving files, listing file attributes, listing directory attributes, Changing Permissions on Files and Directories

Section-B

File statistics: Searching for patterns, Comparing files, Printing files, Rearranging files, sorting files, Splitting files, Translating character, linking files with hard and soft links and understanding the difference between them.
Operating on files: Locating files, applying simple filters on file, paginating files, displaying the beginning and end of a file, splitting a file vertically, pasting files, ordering a file, Locating repeated and non-repeated lines, transliteration sorting and searching a file, pattern matching-the wild-cards.
Standard I/O redirection: Standard files, standard output; Standard input, standard error; filters and pipelines, creating a tree.
Process In Unix: Learning about customizing the environment: environment variables, the common environment variables, aliases, Command history, in-line command editing, Process basics, process status, system processes, mechanism of process creation, internal and external commands, process states, running jobs in background, killing processes, Running jobs periodically, timing processes

Section-C

Shell scripts: Types of shells, Shell functionality ,Displaying – using echo, Using Expr Using Test ,Getting input – using read, Writing script & executing basic script ,Debugging script, Making interactive script,Variables (default Variables), Mathematical expressions
Conditional statements: If-else-elif, Test command, Logical operators-AND, OR, NOT, case –esac
Loops: While, For, Until
Command line arguments Positional parameters Set & shift IF, Break & continue
Functions & file manipulationsprocessing file line by line, Functions

Section-D

AWK programming: Splitting a line into fields, formatting output, variables and expressions, Comparison operators, number processing, variables, storing programs in a file, BEGIN and END sections, built-in variables. Arrays, functions, control flow, loop programming

Text Books:

1. UNIX concepts and applications, Fourth Edition, Sumitabha Das, TMH
2. Unix Shell Programming-YashwantKanetkar

Reference Book:

1. Introduction to UNIX & SHELL programming, M.G. Venkatesh Murthy, Pearson Education.
2. UNIX and shell Programming –A text book, B.A. Frozen& R.F. Giberg, Thomson.

Course Title/ Code	Fundamentals of Finance (MCS232)
Course Type:	Elective (Allied)
Course Nature:	Soft
L-T-P-O Structure	(1-0-2-0)

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	100%

SECTION-A

Introduction to Finance ; Forms of Business Organization ; Overview to financial statements , Balance Sheet, Profit and Loss Account , Cash Flow Statement.

SECTION-B

Financial Analysis and Planning; Financial Ratios, Break Even Analysis Sources of Long term Finance – Equity Capital, Preference Capital, Terms Loans, Debentures; Raising Long term Finance.

SECTION-C

Time Value of Money, Capital Budgeting- Techniques of Capital Budgeting, Net Present Value and Payback Period; Capital Structure and Cost of Capital.

SECTION-D

Working Capital: Introduction, Components of Current Assets and Current Liabilities, Operating Cycle, Estimation of Working Capital; Operating Income , Earning Before Interest and Tax (EBIT).

Suggested Readings:

1. Pandy, I.M., Financial Management, Vikas Publishing House, New Delhi
2. Khan M.Y, and Jain P.K., Financial Management, Tata McGraw Hill, New Delhi
3. Keown, Arthur J., Martin, John D., Petty, J. William and Scott, David F, Financial Management, Pearson Education
4. Chandra, Prasanna, Financial Management, TMH, New Delhi
5. Van Horne, James C., Financial Management and Policy, Prentice Hall of India
6. Brigham & Houston, Fundamentals of Financial Management, Thomson Learning, Bombay.
7. Kishore, R., Financial Management, Taxman's Publishing House, New Delhi

Course Title/ Code	Basics of Economics (MCS231)
Course Type:	OPEN Elective
Course Nature:	Soft
L-T-P-O Structure	(1-0-2-0)

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	100%

SECTION-A

Definition of Economics - various definitions, Nature of Economic problem, Production possibility curve, Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility - its practical application and importance.

SECTION-B

Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, degrees of Price elasticity of demand, factors effecting elasticity of demand, practical importance & applications of the concept of elasticity of demand.

SECTION-C

Meaning of production and factors of production, laws of production, various concepts of cost - Fixed cost, variable cost, average cost, marginal cost, money cost, real cost and opportunity cost. Shape of short run cost curves.

SECTION-D

Meaning of Market, Types of Market -Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition (Main features of these markets).Supply and Law of Supply, Role of Demand & Supply in Price Determination and effect of changes in demand and supply on prices.

TEXT BOOKS:

1. Principles of Economics: P.N. Chopra (Kalyani Publishers).
2. Economics for Engineers- T R Jain & O P Khanna
3. Micro Economic Theory – M.L. Jhingan (S.Chand).
4. Micro Economic Theory - H.L. Ahuja (S.Chand).
5. Modern Micro Economics: S.K. Mishra (Pragati Publications).
6. Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co.).
7. Indian Economy: Rudar Dutt & K.P.M. Sundhram

Course Title/ Code	**Cyber Law (LWS 323)**
Course Type:	OPEN Elective
Course Nature:	Soft
L-T-P-O Structure	(2-0-0-0)
Objectives	The Objective is this paper is to focus on basic concepts of Cyber Law relevant for understanding evolution of Cyber law and its conformity in any changing society.

8.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%

Section A

Unit 1: Cyber Crimes: Meaning, Categories & Kinds- (Contact Hours - 4)

A. Cyber Crime: Meaning & Categories

B. Nature of Cyber Crime, Cyber Crimes v. Conventional Crimes

C. Kinds of Cyber Crime- hacking, spamming, phishing, cyber stalking, cyber pornography, malware etc

Section B

Unit 2: Privacy Issues & Access Rights :- (Contact Hours -6)

A. Freedom of speech and expression in Cyberspace.

B. Right to Privacy and Right to Data Protection.

C. Access Rights

Section C

Unit 3: Cyber Space & Legal framework:- (Contact Hours -3)
A. Cyber Security
B. Cyber Space , Concept of Property in Cyber Space
C. Jurisdiction in Cyber Space

Section D

Unit 4: Information and Technology Act 2000 & IT Amendment Act 2008 (Contact Hours - 3)
A. Need of Cyber Law in India
B. Enactment & Scheme of the IT Act
C. Objectives of the IT Act 2000, Amendments to the Act
D. Justice Dispensation System for Cyber Crimes under IT Act

Reference Books:
1. Cyber Law - Pavan Duggal
2. Cyber Crimes & Laws-Sushma Arora & Raman Arora-Taxmann's

Course Title/ Code	**Law Relating to Intellectual Property Rights (LWS325)**
Course Type:	Elective
Course Nature:	Soft
L-T-P-O Structure	(2-0-0-0)
Objectives	The objective of this paper is to orient students to legal studies. The paper focuses on generally about law and legal system.

	Section	**Weightage**
Syllabus	**A**	**25%**
	B	**25%**
	C	**25%**
	D	**25%**

Section A

Introduction to IPRs and Trademark and Trade Secrets (Contact Hours 4)

a. Introduction to various types of IPR Laws
b. Protection of Trademarks under Trademarks Act – Basic legal Framework
c. Trade Secrets and protection thereof

Section B

Protection of Copyright, Traditional Knowledge, Design and Integrated Circuits (Contact hours 4)

a. Legal Framework relating to Copyright protection in India
b. Protection of Industrial Designs under Designs Act
c. Protection of integrated circuits

Section C

Law relating to Patents (Contact Hours - 4)

a. Legal Framework for registration and protection of patents and related rights

Section D

IT Law and Cyber Offencesand other IPRs (Contact Hours – 4)

1. Introduction to Information Technology Act, 2002
2. **Cyber** Offences
3. Geographical Indicators and PPVFBR

Tutorial activities 1 Hr/Week

a. Statutes and Case Laws
b. Case studies from India and abroad

Course Title/ Code	PROFESSIONAL COMPETANCY RNHANCEMENT-IV (CDO302)
Course Type:	CORE
Course Nature:	SOFT
L-T-P-O Structure	(0-0-1-0)
Objectives	1. To strengthen students Modern Math concepts 2. To help students perform well during placements 3. To help students get proficient with problem solving at various levels like basic, intermediate and advanced 4. To help students with shortcuts to problem solving 5. To improve students communication skills

Part A – Quantitative Aptitude

Unit 1: Modern Math

1.1 Permutation and Combination

1.1.1 Principal of counting and basic formulas
1.1.2 Arrangements, Selection and Selection + Arrangement.
1.1.3 Linear/Circular arrangements, Digits and Alphabetic Problems and Applications.

1.2 Probability

1.2.1 Events and Sample Space, Basic Formulas.
1.2.2 Problems on Coins, Cards and Dices.
1.2.3 Conditional Probability, Bayes' Theorem and their Applications.

Unit 2: Advanced Math

2.1 Mensuration 1- Areas

2.1.1 Different types of Triangles and their area and perimeter.
2.1.2 Different types of Quadrilateral and their area and perimeter.
2.1.3 Circumference and Area of Circle, Area of Sector and length of Sector.
2.1.4 Mixed Figures and their Applications.

2.2 Mensuration 2- Surface Areas and Volumes

2.2.1 Problems on Cubes & Cuboids, Cone, Cylinder and Sphere.

2.2.2 Prism and Pyramid.
2.2.3 Mixed Figures and their Applications.

Unit 3: ALGEBRA :

3.1 Linear and Quadratic equations.
3.2 Inequalities.
3.3 Integral Solutions and Max and Min values.

Part B – Soft Skills

Unit 4:Professional Writing

4.1. Profiling on Social Sites: LinkedIn, Facebook, Instagram
4.2. Cover Letter/Emails
4.3. Resume Writing

Unit 5: Group Discussions

5.1. Do's and Dont's of a Group Discussion
5.2. Roles played in a Group Discussion
5.3. Tips for Cracking a Group Discussion

Unit 6: Managing Interviews

6.1. Developing the employability mindset
6.2. Preparing for Self -Introduction
6.3. Researching the employer
6.4. Portfolio Management
6.5. Answering Questions in an Interview

Text Books/Reference Books:

4. Quantitative Aptitude : R S Aggarwal, S Chand & Company Pvt Ltd
5. Quantitative Aptitude for CAT: Arun Sharma
6. Verbal Ability and Reading Comprehension: MVN Enterprises

Weblinks:

http://www.indiabix.com/aptitude/questions-and-answers/
http://www.indiabix.com/non-verbal-reasoning/questions-and-answers/

Semester-VII

SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	**OFFERING DEPARTMENT	*COURSE NATURE (HARD/ SOFT/ WORKSHOP/ NTCC)	COURSE TYPE (CORE/ELECTIVE/ UNIVERSITY COMPULSORY)	L	T	P	O	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
ECH421B-T/P	HARDWARE VERIFICATION USING UVM										
ECH401B-T/P	INFORMATION THEORY AND CODING	NA	ECE	**HARD**	CORE	3	1	2	0	6	5
ECH40	MIXED	AE, DE	ECE								

2B-T/P	SIGNAL IC DESIGN			HARD	ELECTIVE	3	1	0	0	4	4
ECH403B-T/P	WIRELESS SENSOR NETWORKS	NA	ECE								
ECH404B-T/P	SECURITY IN WIRELESS AND MOBILE COMMUNICATION	EMFW	ECE								
CSH310B-T/P	ARTIFICIAL INTELLIGENCE	NN AND FL	**CST**								
ECH405B-T/P	SPEECH PROCESSING AND RECOGNITION	NA	**ECE**								
CSH303B-T/P	MOBILE COMPUTING WITH ANDROID	NA	**CST**								
ECH406B-T/P	ASIC DESIGN AND FPGA	VLSI DESIGN	**ECE**								
ECH407B-T/P	RF SYSTEM DESIGN	AE	**ECE**								
ECH408B-T/P	SATELLITE COMMUNICATION	ADC	**ECE**	HARD	ELECTIVE	3	1	0	0	4	4
ECH409B-T/P	ROBOTICS DESIGN	NA	**ECE**								
ECH410B-T/P	STATISTICAL SIGNAL PROCESSING	DSP	**ECE**								
CSH311B-T/P	THEORY OF AUTOMATA AND COMPILER DESIGN	NA	**CST**								
ECH411B-T/P	VLSI TESTING	VLSI DESIGN	**ECE**								
MCS368	BASICS OF ENTRENEURSHIP	NA	**MC**	SOFT	ELECTIVE	2	0	0	0	2	2
MEW203B	3D PRINTING(CAD)	NA	**ME**								
RDO304	PROJECT PHASE-I	NA	**ECE**	HARD	CORE	0	0	2	0	2	1
						11	3	4	0	17	16

Course Title/Code	**INFORMATION THEORY AND CODING (ECH401B-T/P)**
Course Type:	Elective (Departmental)

Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	Students will be able to formulate and reduce the performance of channel and error probability respectively by implementing the techniques of information measurement and error correction coding.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

Information Theory: Definition of Information, Entropy, Mutual Information, Properties of Mutual Information, Fundamental Inequality, I.T. Inequality, Divergence, Properties of Divergence, Divergence Inequality, Relationship between entropy and mutual information, Chain Rules for entropy, relative entropy and mutual information.

SECTION-B

Channel Capacity: Uniform Dispersive Channel, Uniform Focusing Channel, Strongly Symmetric Channel, Binary Symmetric Channel, Binary Erasure Channel. Channel Capacity of the all these channels, Channel Coding Theorem, Shannon-Hartley Theorem, Data Compression: Kraft inequality, Huffman codes, Shannon-Fano coding, Arithmetic Coding

SECTION-C

Linear Block Codes: Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Hamming codes; Weight enumerators and the Mac Williams identities; Perfect codes. Cyclic Codes, BCH codes; Reed-Solomon codes, MDS codes; Spectral properties of cyclic codes.

SECTION-D

Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm.A fast Berlekamp – Massey algorithm. Convolution codes Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm, Turbo Codes, Concatenated Codes.

Text Books:

1. Information Theory and Coding by "N Abramson"
2. Information Theory by "R B Ash"
3. Error control coding by "Shu Lin and D J Costello"

Reference Books:

1. Information theory and Coding Basics and Practices by "Veluswamy S"
2. Information Theory and Coding by "MuralidharKulkarni and K S Shivaprakasha"

Course Title/Code	**MIXED SIGNAL DESIGN (ECH402B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard

L-T-P-O Structure	3-1-0-0
Objective	Students learn to navigate Analog Design IC textbooks using a bottom-up and a top-down design view of MIxed Signal Electronic Systems, and are given a design problem requiring use of modern Computer Aided Design (CAD) tools.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

Section B

Switched-capacitor filters- Non idealities in switched-capacitor filters; Switched-capacitor filterarchitectures; Switched-capacitor filter applications.

Section C

Basics of data converters; Successive approximation ADCs, Dual slope ADC's, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

Section D

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.

Text/Reference Books:

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2. BehzadRazavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003.
3. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.
4. Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
5. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
6. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
7. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

Course Title/Code	**WIRELESS SENSOR NETWORKS (ECH403B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	Provide students with the fundamentals of WSN architecture, network platforms, and applications to design energy-efficient MAC protocols for sensor networks in IoT environments.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION A

SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES: Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

SECTION B

ADHOC NETWORKS AND ROUTING PROTOCOLS: Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).

SECTION C

WSN NETWORKING CONCEPTS AND PROTOCOLS:MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, The Mediation Device Protocol, Contention based protocols - PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols- Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

SECTION D

SENSOR NETWORK SECURITY: Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks. INTRODUCTION TO CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, , Programming beyond individual nodes – State centric programming.

Suggested Text / Reference Books

1. C. Siva Ram Murthy and B. S. Manoj, ―Ad Hoc Wireless Networks Architectures and Protocols‖, Prentice Hall, PTR, 2004.
2. Holger Karl , Andreas willig, ―Protocol and Architecture for Wireless Sensor Networks‖, John wiley publication, Jan 2006
3. . Feng Zhao, Leonidas Guibas, ―Wireless Sensor Networks: an information processing approach‖, Elsevier publication, 2004.
4. Charles E. Perkins, ―Ad Hoc Networking‖, Addison Wesley, 2000.
5. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, ―Wireless sensor networks: a survey‖, computer networks, Elsevier, 2002, 394 - 422.

Course Title/Code	**SPEECH PROCESSING AND RECOGNITION (ECH405B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	The course provides an introduction to speech processing oriented to human-computer interaction. To understand the basic principles of sound and speech production and perception,basic principles of speech regognition,synthesis and dialogue systems to obtain an introductory overview in the field.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION A

Digital Models for The Speech Signal Process of speech production, Acoustic theory of speech production, Lossless tube models, and Digital models for speech signals.

Time Domain Models for Speech Processing Time dependent processing of speech, Short time energy and average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using energy & zero crossings, Pitch period estimation, Short time autocorrelation function, Short time average magnitude difference function, Pitch period estimation using autocorrelation function, Median smoothing.

SECTION B

Digital Representations of the Speech Waveform: Sampling speech signals, Instantaneous quantization, Adaptive quantization, Differential quantization, Delta Modulation, Differential PCM, Comparison of systems, direct digital code conversion.

Short Time Fourier Analysis: Linear Filtering interpretation, Filter bank summation method, overlap addition method, Design of digital filter banks, Implementation using FFT, Spectrographic displays, Pitch detection, Analysis by synthesis, Analysis synthesis systems.

SECTION C

Homomorphic Speech Processing: Homomorphic systems for convolution, Complex cestrum, Pitch detection, Formant estimation, Homomorphicvocoder. Linear Predictive Coding of Speech: Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters, Synthesis of speech from linear predictive parameters, Applications.

Speech Enhancement: Spectral subtraction & filtering, Harmonic filtering, parametric re-synthesis, Adaptive noise cancellation. Speech Synthesis: Principles of speech synthesis, Synthesizer methods, Synthesis of intonation, Speech synthesis for different speakers, Speech synthesis in other languages, Evaluation, Practical speech synthesis.

SECTION D

Automatic Speech Recognition: Introduction, Speech recognition vs. Speaker recognition, Signal processing and analysis methods, Pattern comparison techniques, Hidden Markov Models, Artificial Neural Networks.

Audio Processing: Auditory perception and psychoacoustics - Masking, frequency and loudness perception, spatial perception, Digital Audio, Audio Coding - High quality, low-bit-rate audio coding standards, MPEG, AC- 3, Multichannel audio - Stereo, 3D binaural and Multichannel surround sound.

Text Books:

1. L. R. Rabiner and R. W. Schafer, “Digital Processing of Speech Signals", Pearson Education (Asia) Pte. Ltd., 2004.
2. D. O’Shaughnessy, “Speech Communications: Human and Machine”, Universities Press, 2001.

Reference Books:

1. L. R. Rabiner and B. Juang, “Fundamentals of Speech Recognition”, Pearson Education (Asia) Pte.Ltd., 2004. Z. Li and M.S. Drew, “Fundamentals of Multimedia”, Pearson Education (Asia) Pte. Ltd., 2004.

Course Title/ Code	**SECURITY IN MOBILE AND WIRELESS SYSTEM (ECH404B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objective	To understand the basics of Wireless and mobile network security along with the security basics, security in on-

	the-shelf and emerging technologies along with the Security measures in wireless systems, their Threats and generic security

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

Mobile radio propagation: Large scale path loss Reflection, ground reflection model (2 raymodel), diffraction, practical link budget design using path loss models. Small scale fading andmulti-path Small-scale multipath propagation, parameter of multi-path channels, types of smallscale fading, Rayleigh and Ricean distribution, diversity, RAKE Receiver.

SECTION-B

IP Layer Security, Link Layer Security, Network Security Options. Security Issues in a MobileIPV6 Network, Mobile Code Issues: Security Measures for Mobile Agents, Security Issues forDownloaded Code in Mobile phones.

SECTION-C

Secure Mobile Commerce: MCommerce and its Security Challenges, Security of the radiointerface Security issues in Single Hop Wireless Networks: Cellular Network Security, AccessControl and Roaming Issues, Mobile IP Security.

SECTION-D

Security Issues in Multi-hop Wireless Networks: Mobile Adhoc Network Security, TrustManagement and Routing Issues, Wireless Sensor Network Security, Key Management, SybilAttacks and Location Privacy, Vehicular Networks Application and Security, WirelessMetropolitan Area Networks (e.g.802.11b), cryptographic security.

Text Books:

1. Man Young Rhee, “Mobile Communication Systems and Security”, John Wiley & Sons, 2009
2. HakimaChaouchi, Maryline Laurent-Maknavicius, “Wireless and Mobile Networks Security”,John Wiley & Sons, 2010
3. S. Kami Makki, “Mobile and Wireless Network Security and Privacy”, Springer, 2007
4. Merritt Maxim, David Pollino, “Wireless Security”, McGraw Hill Professional, 2002

Reference Books:

1. Aaron E. Earle, “Wireless Security Handbook”, CRC Press, 2010
2. Nichols, Lekkas, “Wireless Security Models, Threats, and Solutions”, McGraw-Hill
3. Aaron E. Earle ,“Wireless Security Handbook”, Auerbach
4. Steven Furnell, “Mobile Security”, IT Governance Ltd, 2009

Course Title/Code	**ASIC AND FPGA (ECH406B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	1. To study the design flow of different types of ASIC. 2. To gain knowledge about partitioning, floor planning, placement and routing including circuit extraction of ASIC. 3.To analyse the synthesis, Simulation and testing of systems. 4. To know about different high performance algorithms and its applications in ASIC

Syllabus	Sections	Weightage
	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

Introduction To ASICS, CMOS Logic and ASIC Library Design Types of ASICs - Design flow - CMOS transistors CMOS Design rules - Combinational Logic Cell – Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort -Library cell design - Library architecture.

Section B

Review of VHDL/Verilog: Entities and architectures

Programmable Asics, Programmable ASIC Logic Cells and Programmable ASIC I/O Cells Anti fuse - static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT - Xilinx LCA - Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - Xilinx I/O blocks.

Section C

Programmable ASIC Interconnect, Programmable ASIC Design Software and Low-Level Design Entry Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 - Altera FLEX - Design systems - Logic Synthesis - Half gate ASIC - Schematic entry - Low level design language - PLA tools - EDIF- CFI design representation.

Section D

ASIC Construction, Floor Planning, Placement and Routing System partition - FPGA partitioning - partitioning methods - floor planning - placement - physical design flow - global routing - detailed routing - special routing - circuit extraction - DRC.
Design using Xilinx family FPGA

Text/References Books:

• M.J.S .Smith, - " Application - Specific Integrated Circuits " - Addison -Wesley Longman Inc., 1997
• Skahill, Kevin," VHDL for Programmable Logic", Addison-Wesley, 1996
• John F. Wakherly, " Digital Design: Principles and Practices", 2nd Edn 1994, Prentice Hall International Edn
• Charles W. Mckay, "Digital Circuits a proportion for microprocessors", Prentice Hall

Course Title/ Code	Artificial Intelligence (CSH310B-T/P)
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	The student will be able to solve computationally complex problems using artificial intelligence techniques.

Syllabus	Sections	Weightage
	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

Intelligent agents and AI Problems: Introduction to AI, Foundation and History of AI, Turing Test, Intelligent Agents: Architectures, Types: reactive, deliberative, goal-driven, utility-driven, and learning agents, Applications and Current Trends of AI.

Problem Representation in AI, State Space Representation and Problem Reduction, Production Systems: Inference Engine, Working Memory, Knowledgebase and Control Strategy using Water Jug Problem and n-Queens Problem.

Section-B

Search Strategies and Knowledge Representation: Search Strategies: Uninformed Search Strategies, Informed Search strategies (Heuristic Search): Generate and Test, Hill Climbing, Best First Search, A*algorithm, AO*Algorithm, Constraint Satisfaction, Means End Analysis.

Game Playing: Minmax Strategy, Alpha-beta Pruning.

Introduction to Knowledge, Types of Knowledge, Issues in Knowledge Representation, Approaches to Knowledge Representation: Logic, Semantic Nets, Partitioned Semantic Nets, Frames and its types, Conceptual Dependency.

Section-C

Reasoning, Planning and Learning: Logical agents: Propositional logic, Inferences, First-order Predicate Logic, Inferences in First-order Predicate Logic, Forward Chaining, Backward chaining, Unification, Resolution.

Reasoning under Uncertainty: Monotonic and Non-Monotonic Reasoning, Statistical Reasoning: Review of probability: Axioms of probability, Probabilistic inference, Probabilistic Reasoning(Bayes Theorem), Bayesian Networks, Inferences in Bayesian networks, Temporal and Spatial Reasoning, Dempster-Shafer Theory, Fuzzy Reasoning, Hidden Markov models. Planning with state-space search, partial-order planning, planning graphs.
Learning from observation, Inductive learning, Deductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Machine Learning and its types: Supervised, Unsupervised and Reinforcement Learning, Natural Language Understanding, Overview of Natural Language Understanding and Deep Learning.

Section-D

Advanced Topics and Applications of AI: Expert Systems: Architecture, Characteristics, Types, Advantages and Drawbacks, Knowledge Acquisition Principles, Study of MYCIN and DENDRAL, Overview of Knowledge Discovery from Databases, Web Intelligence, Robotics.

Semantic Webs, Natural Language Processing, Neural Networks, Genetic Algorithms, Big Data, Speech Processing.

Text Books:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivashankar B. Nair, Third Edition, TMH.
2. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education.

Reference Books:

1. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Pearson Education.
2. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers, 1998
3. Simon Haykin, "Neural Networks", Pearson Education, Second Edition.
4. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems", Eastern Economy Edition, PHI

Course Title/ Code	**Mobile Computing with Android (CSH303B-T/P)**
Course Type:	Elective (ALLIED)

Course Nature:	Hard Course
L-T-P-O Structure	(3-1-0-0)
Objectives	Students would be able to develop Android applications

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section –A

INTRODUCTION TO ANDROID AND ITS CONCEPTS:Overview of Android Ecosystem, Introduction to Android SDK, Android application building block, features of Android Studio, Android Platform Architecture, Challenges in development, Environment setup &Installation of Android Studio, AVD Setup. Design Criteria for Android Application including Hardware Design,Views: GUI, XML, Programmatically (TextView, EditText, Button, ToggleButton, Spinner, ImageView, etc), View component properties, Activityand AppCompActivity,Activity life Cycle, Intents: Implicit and Explicit, Manifest File. Layouts (Constraint, Linear, Relative, Table, GridView) and Layout Properties. Android Resources

Section-B

ANDROID UI AND TESTING:Component Event Handle,Component Focus,Threads, Menu:Appbar with Option menu, Contextual menu,Pop Menu, Sub menu, and menu via XML and Code,Dialog, Navigation: Back & Hierarchy, Array &Base Adapters. Custom List View, Grid View using adapters & Recycler View, Styles and Themes, Adaptive Layout and Resource.Testing using Espresso. BACKGROUND OPERATION: AsyncTask and AsyncTaskLoader, Broadcast Receivers, Service, Notification.

Section-C

DATABASES AND ANIMATIONS: Storing Options: Shared Preference, Internal & External Storage, SQLite,SQLite Operation,and Sharing Data between Applications with Content Providersand Content Resolver. Working with Cursors: Inserts, Update and delete. Reading and Updating Contacts,Reading Bookmarks. Graphics and Animation:Custom views, Canvas, animation APIs, Multimedia: Audio, Video. Permission, performance and Security.Firebase feature and App publish.

Section-D

MOBILE COMPUTING:Introduction to Mobile technology and generations of various wireless technology, characteristics and Application of mobile Computing. Architecture and Security Issues, Design considerations for mobile computing .Modes used for Mobile Technology, Services and Architecture of GSM and CDMA, Mobile IP and Mobile Communication Protocol. Middleware and Gateway Required for Mobile Computing. Mobile Communication via Satellite: Low orbit satellite, Medium orbit satellite, Geo stationary satellite, Satellite phones

Text Books:

1. Lauren Darcey and Shane Conder"AndroidWirelessApplicationDevelopment", Pearson Education, 2nd ed. (2011)

Reference Book:

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd (2011).
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd(2009)
3. Marko Gargenta"LearningAndroid"WileyIndiaPvt Ltd.

Course Title/ Code	**RF SYSTEM DESIGN (ECH407B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)

Objective	Student shall be able to identify, analyze and develop various RF components for various applications using simulators and hardware.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

RESONATORS: Basic resonator and filter configurations-special filter realization-filter implementation coupled filter.

Section B

RF DIODE AND BJT: RF diodes-bipolar junction transistor - RF field effect transistor-high electron mobility transistors-diode models-transistor models-measurement of active devices-scattering parameter device characterization.

IMPEDANCE MATCHING: Impedance matching using discrete components-microstrip line matching networks amplifier classes of operation and biasing networks.

Section C

CHARACTERISTICS OF AMPLIFIERS: Characteristics of amplifier-amplifier power relations-stability consideration-constant gain-broadband, high power, and multistage amplifiers.

Section D

HIGH FREQUENCY OSCILLATORS: Basic oscillator model-high frequency oscillator configuration-basic characteristics of mixer.

Course Title/Code	**SATELLITE COMMUNICATION (ECH408B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	To enable the student to become familiar with satellites and satellite services along with their orbits and launching and to understand the earth segment and space segment components

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

SECTION-B

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity of a satellite, concepts of Solar day and Sidereal day.

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.

SECTION-C

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. Satellite link budget Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.

SECTION-D

Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.

Text /Reference Books: 1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002

2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009

3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

Course Title/Code	**ROBOTICS DESIGN (ECH409B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	Student shall acquire the knowledge on advanced algebraic tools for the description of motion, utilize it for computing the kinematics of robots and design robotic systems effectively.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

INTRODUCTION: Introduction -- brief history, types, classification and usage, Science and Technology of robots.

ELEMENTS OF ROBOTS -- JOINTS, LINKS, ACTUATORS, AND SENSORS: Position And Orientation Of A Rigid Body, Homogeneous Transformations, Representation Of Joints, Link Representation Using D-H Parameters, Examples Of D-H Parameters And Link Transforms, Different Kinds Of Actuators – Stepper, DC Servo And Brushless Motors, Model Of A DC Servo Motor, Types Of Transmissions, Purpose Of Sensors, Internal And External Sensors, Common Sensors – Encoders, Tachometers, Strain Gauge Based Force-Torque Sensors, Proximity And Distance Measuring Sensors, And Vision.

SECTION-B

ROBOT KINEMATICS AND DYNAMICS: Positions, Orientations and Frames, Mappings: Changing Descriptions From Frame To Frame, Operators: Translations, Rotations And Transformations - Transformation Arithmetic - D-H Representation - Forward And Inverse Kinematics Of Six Degree Of Freedom Robot Arm – Robot Arm Dynamics

SECTION-C

ROBOT DRIVES AND POWER TRANSMISSION SYSTEMS: Robot Drive Mechanisms, Hydraulic – Electric – Servomotor-Stepper Motor - Pneumatic Drives, Mechanical Transmission Method - Gear Transmission, Belt Drives, Cables, Roller Chains, Link - Rod Systems - Rotary-To-Rotary Motion Conversion, Rotary-To-Linear Motion Conversion, Rack and Pinion Drives, Lead Screws, Ball Bearing Screws.

MANIPULATORS: Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and Pneumatic Manipulators.

SECTION-D

PATH PLANNING & PROGRAMMING: Trajectory planning and avoidance of obstacles, path planning, skew motion, joint integrated motion – straight line motion-Robot languages -computer control and Robot software, Case study of

Text/Reference Books

1. S. R. Deb and S. Deb,Robotics Technology and Flexible Automation‟, Tata McGraw Hill Education Pvt. Ltd.
2. John J.Craig , “Introduction to Robotics”, Pearson.
3. Mikell P. Grooveret. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, New York.

Course Title/Code	**STATISTICAL SIGNAL PROCESSING (ECH410B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	This course introduces to the statistical approaches in signal processing for detection and estimation. Estimation and detection strategies for developing systems in presence of variety of noise conditions.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION A

Probability and random variables, Sample space, events, probability measure, axioms, Conditional probability, probability chain rule, independence, Bayes rule, Random variables (discrete and continuous), probability mass function (pmf), probability density function (pdf), cumulative distribution function,

SECTION B

Transformation of random variables, Bivariate: conditional pmf, conditional pdf, expectation, conditional expectation, Multivariates: marginals, Gaussian (properties), characteristic function, change of variables (Jacobian.)

SECTION C

Random processes, Definition of a random process, finite order densities, Markov chains. Auto-correlation functions. Stationarity– strict sense, wide sense. Examples: iid process, random-phase sinusoid. Ergodicity, Central limit theorem.Spectral density.Response of linear systems to stochastic inputs – time and frequency domain. Time series models: AR, MA, ARMA

SECTION D

Detection, Estimation and Inference Basic linear estimation theory: BLUE, MMSE, bias, variance, Wiener filters, Matched filters, Least squares, maximum likelihood, Bayesian inference. The ML/Bayesian linear Gaussian model, Maximum likelihood and Bayesian estimation, Example inference models: frequency estimation, AR model, Estimation of parameters for discrete Markov chain.

Text books:

Raghuveer M Rao and Ajit S Bopadrikar, "Wavelet transforms: Introduction to theory and applications" Gerald Kaiser, A Friendly Guide to Wavelets, Birkhauser, New York, 1995, Prentice Hall

References:

P. P. Vaidyanathan, Multirate Systems and Filter Banks, Prentice Hall, New Jersey, 1993.

Course Title/Code	**VLSI TESTING (ECH411B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	Students learn to test of static and dynamic circuits. Fault diagnosis: Fault models for diagnosis, Cause-effect diagnosis, Effect-cause diagnosis. Design for testability: Scan design, Partial scan, use of scan chains, boundary scan, DFT for other test objectives, Memory Testing.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

Scope of testing and verification in VLSI design process.Issues in test and verification of complex chips, embedded cores and SOCs.

Section B

Fundamentals of VLSI testing. Fault models. Automatic test pattern generation. Design for testability. Scan design.

Section C

Test interface and boundary scan. System testing and test for SOCs. Iddq testing. Delay fault testing. BIST for testing of logic and memories. Test automation.

Section D

Design verification techniques based on simulation, analytical and formal approaches. Functional verification.Timing verification.Formal verification.Basics of equivalence checking and model checking.Hardware emulation.

Reference:

1. M. L. Bushnell and V.D. Agrawal, Essentials of Electronic Testing for Digital Memory and Mixed Signal VLSI Circuits, Springer, 2005
2. H. Fujiwara, Logic Testing and Design for Testability, MIT Press, 1985
3. M. Abramovici, M. Breuer, and A. Friedman, *Digital System Testing and Testable Design*, IEEE Press, 1994
4. M. Huth and M. Ryan, Logic in Computer Science, Cambridge Univ. Press, 2004
5. T. Kropf, Introduction to Formal Hardware Verification, Springer Verlag, 2000

Course Title/ Code	**Theory of Automata & Compiler Design (CSH311B-T/P)**

Course Type	ELECTIVE (ALLIED)
Course Nature	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	Student will able to understand the principles and techniques of programming language translation.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

Finite Automaton: Finite State Systems, Representation of finite automaton, Non-Deterministic finite automata (NDFA), Deterministic finite automata (DFA), Equivalence of DFA and NDFA. Removals of ε – moves from finite automata, Minimization of finite Automata, Regular Expressions: - regular expression, Equivalence of finite automata and Regular Expressions, Arden's theorem. The Pumping Lemma for Regular Sets, Closure properties of regular sets and regular language.

Section-B

Context free grammar: - Reduced forms, Chomsky Normal Form (CNF), Griebach Normal Form (GNF). Pushdown Automata: - NDPDA, DPDA, LBA. Turing Machines: - Deterministic and Non-Deterministic Turing Machines, universal Turing machine, Design of TM Chomsky hierarchy.

Section-C

Compilers and translators, structure of compiler. Lexical Analyser: Lexical Analysis, recognition of tokens, Syntax Analysis: parsing, Parsing Technique: Topdown approach(Recursive Descent, Recursive Predictive and Non Recursive Predictive parsing Techniques). Bottom Up approach: Shift- reduce parsing, operator precedence parsing, LR parsers, SLR, LALR and Canonical LR parser.

Section-D

Syntax Directed Translations: Syntax directed definition, construction of syntax trees, syntax directed translation scheme, and implementation of syntax directed translation, three address code, quadruples and triples. Code Optimization & Code Generation: Code generation, forms of objects code, machine dependent code, optimization, register allocation for temporary and user defined variables. Peephole optimization.

Text Books:

1. Compilers Principle, Techniques & Tools - Alfread V. AHO, Ravi Sethi& J.D.Ullman; - 1998 Addison Wesley.
2. Compiler Design by O.G. Kakde, 1995, Laxmi Publ.

Reference Books:

1. Theory and practice of compiler writing, Tremblay & Sorenson, 1985, Mc. Graw Hill.

Course Title/ Code	**Basics of Entrepreneurship (MCS368B)**
Course Type:	**Elective (Allied)**
Course Nature:	Soft
L-T-P-O Structure	(2-0-0-0)

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

Decision to become an entrepreneur

Introduction to entrepreneurship- Defining entrepreneurship, characteristics of successful entrepreneurs, importance of entrepreneurship, Myths about entrepreneurs, Corporate entrepreneurship, Self Discovery & SWOT analysis, Effectuation –Meaning , Five principles of effectuation, , Defining a Start-up, 4 Ps of a Start up, Reasons of Start-up failure, Basic Model of entrepreneurial process.

SECTION-B

Opportunity discovery

Recognizing opportunities and generating Ideas, Validating the market need, Identify problem worth solving using Jobs to be done(JTBD) methodology, design Thinking- Meaning, Design Thinking Values, Design Thinking Process, Double diamond approach in design thinking

SECTION-C

Customer and Solution-

Customer Vs. Consumer, different market types and their specific requirements, estimate the market size, identify your customer Segment (through STP), Switching costs and psychological biases, understanding Market research for start ups, Customer profile ,Value proposition Canvas- understanding the jobs, pains and gains.

SECTION-D

Business Model & Validation and Business Plan

Business Model- Concept, Elements of Business Model and Lean Approach, Lean canvas template, , Blue Ocean Strategy, difference between Solution Demo and MVP, Business plan- definition and importance, components of Business plan- market, technical and financial, legal and ethical aspects in a Start-Up.

Text book:

Entrepreneurship: Successfully Launching New Ventures, 6th edition, Bruce R. Barringer and R Duane Ireland, Published by Pearson

Course Title/ Code	**3D PRINTING (MEW203B)**
Course Type	ELECTIVE
Course Nature	HARD
L-T-P-O Structure	2-0-0-0

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

Introduction of 3D Printing, Evolution of 3D Printing, What is additive manufacturing, General procedure of 3D Printing

SECTION-B

3D CAD file formats, Stereo lithography (stl) files, Various Printing technologies (SLA, SLS, FDM, Poly jet printing,Color jet Printing, SHS, SLM, LOM, Multi jet Printing, DLP).

SECTION-C

FDM in detail, Operating Plasto 200 - Live demonstration, STL principles, Object placement.

SECTION-D

Object analysis, Slicing and printing, Print settings.

SEMESTER-VIII

SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	**OFFERING DEPARTMENT	*COURSE NATURE (HARD/ SOFT/ WORKSHOP/ NTCC)	COURSE TYPE (CORE/ELECTIVE/ UNIVERSITY COMPULSORY)	L	T	P	O	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
ECH422B-T/P	STATIC TIMING ANALYSIS	NA	ECE	**HARD**	CORE	3	1	2	0	6	5
ECH412B-T/P	MEMS	NA	ECE	HARD	ELECTIVE	3	1	0	0	4	4
ECH413B-T/P	NANOTECHNOLOGY	NA	ECE								
ECH414B-T/P	MOBILE COMMUNICATION	NA	ECE								
ECH415B-T/P	FIBRE OPTIC COMMUNICATION	NA	ECE								
ECH416B-T/P	BIOMEDICAL SIGNAL	NA	ECE								

	PROCESSING										
ECH417B-T/P	MODERN DIGITAL COMMUNICATION TECHNIQUES	NA	ECE								
CSH402B-T/P	BIG DATA	NA	**CST**								
CSH402B-T/P	MACHINE LEARNING	NA	**CST**								
ECH418B-T/P	MECHATRONICS	NA	**ECE**	HARD	ELECTIVE	3	0	0	0	3	3
ECH419B-T/P	PLC PROGRAMMING AND APPLICATIONS	NA	**ECE**								
MEH327B-T/P	NON CONVENTIONAL ENERGY SOURCES	NA	**ME**								
CSW422B	WEB-SERVICES	NA	**CST**								
ECN420	PROJECT PHASE-II/INDUSTRIAL TRAINING	NA	**ECE**	HARD	CORE	0	0	3	0	3	8
						9	2	5	0	15	20

Course Title/Code	**MEMS (ECH412B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	To develop a concept on the scope and recent development of the science and technology of micro- and nano-systems and gain the physical knowledge underlying the operation principles and design of micro and nano- systems

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

UNIT I: INTRODUCTION

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication – Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

Section B

UNIT II: SENSORS AND ACTUATORS-I

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph – Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

UNIT III : SENSORS AND ACTUATORS-II
Piezoresistive sensors – Piezoresistive sensor materials – Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

Section C

UNIT IV: MICROMACHINING
Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies – Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process – Assembly of 3D MEMS – Foundry process.

Section D

UNIT V: POLYMER AND OPTICAL MEMS [9 hours]
Polymers in MEMS– Polyimide – SU-8 – Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon – Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

Text Books:

- Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
- Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
- Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.
-

References:

- NadimMaluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
- Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2001.
- Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
- James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
- Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

Course Title/Code	**NANOTECHNOLOGY (ECH413B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	To understand where increases in the use of nanotechnology has occurred.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

Introduction to physics of solid state: Structure, Energy bands, Localized Particles, Methods of measuring Properties, Structure, Microscopy, Spectroscopy

Section B

Properties of Individual Nano Particles: Introduction, Metal Nanoclusters, Semiconducting Nanoparticles, Rare gas and Molecular crystals, Methods of Synthesis

Section C

Carbon Nanostructures: Introduction, Carbon Molecules, Carbon Clusters, Carbon Nanotubes, Application of Carbon Nanotubes

Section D

Bulk Nanostructured Materials: Solid Disordered Nanostructures, Methods of synthesis, Nanostructured Multilayers, Metal Nanocluster Composite Glass, Nanostructured crystals, Natural Nanocrystals, Computational Prediction of Cluster Lattices, Array of Nano Particles in Zeolites, Crystals of Metal Nano Particles, Nanoparticle Lattices in Colloidal Suspensions, Photonic Crystals

Text/ Reference Books:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

Course Title/Code	**MOBILE COMMUNICATION (ECH414B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Course Objectives	• Understand the basic concepts of mobile computing, Wireless LAN, Bluetooth and WiFi Technologies • Be familiar with the network protocol stack and Learn the basics of mobile telecommunication system • Be exposed to Ad-Hoc networks

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

Fundamentals of Mobile Communication and Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies-MAC Protocols – **Features of all conventional multiple access techniques:** Frequency division multiple access(FDMA), time division multiple access(TDMA),space spectrum multiple access (SSMA), space division multiple access (SDMA),OFDM-PAPR,OFDMA

SECTION-B

Wireless LANs and PANs – IEEE 802.11 Standard – Architecture – Services – Blue Tooth- Wi-Fi – WiMAXMobile IP – DHCP – AdHoc– Proactive and Reactive Routing Protocols – Multicast Routing- Vehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security

SECTION-C

UMTS: Objectives, standardisation and releases, network architecture, air interface specifications, channels, security procedure, W-CDMA air interface, attributes of W-CDMA system, W-CDMA channels.**Advanced techniques for 4G deployment:Multi-antenna Techniques:** Smart antennas, multiple input multiple output systems;**Cognitive radio**: Architecture, spectrum sensing;**Relaying multi-hop and cooperative communications:** Principles of relaying, fundamentals of relaying

SECTION-D

UNIT V MOBILE TRANSPORT AND APPLICATION LAYER IT8602 Syllabus Mobile Communication
Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

5. 3GPP LTE: Introduction, system overview: Frequency bands and spectrum flexibility, network structure, protocol structure;**Physical layer:** Frames, slots, and symbols, modulation, coding, multiple-antenna techniques;**Logical and Physical Channels:** Mapping of data onto (logical) sub-channels;**Physical layer procedures:** Establishing a connection, retransmissions and reliability, scheduling, power control, handover.

Text books/Reference books

1. Theodore Rappaport, “Wireless Communications: Principles and Practice”, Prentice Hall.
2. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communications”, Cambridge University Press.
3. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press.
4. W. C. Lee, Mobile Communications Engineering, New Delhi: Tata McGraw-Hill, Latest Ed.
5. Lee- Mobile Communication & Networking, TMH
6. Ezio Biglieri, “MIMO Wireless Communications”, Cambridge University Press. 7. J. Schiller, “Mobile Communications”, Pearson Education.
8. Shahid K. Diddiqui, “Roaming in Wireless Networks”, McGraw Hill Professional.
9. William Stallings, “Wireless Communications & Networks 2/E”, Pearson.

Course Title/Code	**FIBER OPTIC COMMUNICATION (ECH415B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	Student shall be able to identify, analyze and develop optical fiber system for various applications using simulators.

Syllabus	**Sections**	**Weightage**
	A	25%
	B	25%

	C	25%
	D	25%
	TOTAL	**100%**

SECTION A

Evolution of fiber optic system- Element of an Optical Fiber Transmission link– Total internal reflection-Acceptance angle – Numerical aperture – Skew rays Ray Optics-Optical Fiber Modes and Configurations -Mode theory of Circular Wave guides-Overview of Modes-Key Modal concepts- Linearly Polarized Modes -Single Mode Fibers-Graded Index fiber structure.

SECTION B

Attenuation – Absorption losses, scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides -Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling -Design Optimization of SM fibers-RI profile and cut-off wavelength.

SECTION C

Direct and indirect Band gap materials-LED structures -Light source materials -Quantum efficiency and LED power, Modulation of a LED, lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies -Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers- Power Launching and coupling, Lencing schemes, Fiber -to- Fiber joints, Fiber splicing-Signal to Noise ratio, Detector response time.

SECTION D

Fundamental receiver operation, Pre amplifiers, Error sources – Receiver Configuration– Probability of Error – Quantum limit.Fiber Attenuation measurements- Dispersion measurements – Fiber Refractive index profile measurements – Fiber cut- off Wave length Measurements – Fiber Numerical Aperture Measurements – Fiber diameter measurements.

TEXT BOOKS:

Gerd Keiser, “Optical Fiber Communication” McGraw -Hill International, 4th Edition., 2010.

John M. Senior , “Optical Fiber Communication”, Second Edition, Pearson Education, 2007.

REFERENCES:

1. J.Senior, “Optical Communication, Principles and Practice”, Prentice Hall of India, 3rd Edition, 2008.

2. J.Gower, “Optical Communication System”, Prentice Hall of India, 2001.

3. Ramaswami, Sivarajan and Sasaki “Optical Networks”, Morgan Kaufmann, 2009.

Course Title/Code	**BIOMEDICAL SIGNAL PROCESSING (ECH416B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0
Objective	To educate the students in the application of signal processing methods to biomedical systems and to teach the students how to use a computer workstation as part of a measurement/signal-processing system.

Syllabus	**Sections**	**Weightage**

	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

Neurological Signal Processing: The Brain and its potentials; The Electrophysiology origin of brain waves; the EEG Signal and its characteristics; EEG analysis; Linear prediction theory; The autoregressive (AR) method; Transient detection and elimination-the case of epileptic patients.

Adaptive Filter and Algorithm: A Review of the Wiener filtering problem; Principle of an adaptive filter; Steepest – descent algorithm; Windrow-hoff least –mean-square adaptive algorithm.

SECTION B

Cardiological Signal Processing: Basic electrocardiography; ECG data acquisition; ECG lead system; ECG parameters and their estimation; Use of multi-scale analysis for parameters estimation of ECG waveforms.

SECTION C

Adaptive Noise Canceling: Adaptive noise canceller; Cancellation of 60 Hz interference inelectrocardiography, canceling donor heart interference in heart –transplant electrocardiography, cancellation of the electrocardiography signal from the electrical activity of the chest muscles, canceling method to enhance fetal ECG monitoring ECG Recording and Analysis: Long term continuous ECG recording; The wavelet approximation- discretewavelet series; Discrete wavelet transform (DWT); Multi-resolution analysis; Pyramid algorithm

SECTION D

HRV and Arrhythmia analysis: Heart rate variability-definition; comparison of short-term and long term HRV analysis; Time domain and spectral domain parameters of short-term recording.

Books Recommended

1. Reddy D C. “Modern Biomedical Signal Processing – Principles and Techniques”, TMH,

New Delhi, 2005

2. Akay M. “Biomedical Signal Processing”, Academic press, California,1994.

3. Tompkins W J “Biomedical Signal Processing”, Prentice hall of India, New Delhi, 1999.

4. Bronzino J D “The Biomedical Engineering handbook”, CRC and Free press, Florida, 1995.

5. Arnon Cohen “Biomedical Signal Processing” CrcPr I Llc; 2nd edition, May, 2002.

Course Title/Code	**MODERN DIGITAL COMMUNICATION TECHNIQUES (ECH417B-T/P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	3-1-0-0

Objective	Students will be able to analyze and design a digital communication system by implementation and systematic representation of various modules neccessary for complex and futuristic requirements.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION-A

CONSTANT ENVELOPE MODULATION: Advantages of Constant Envelope Modulation; Binary Frequency Shift Keying-Coherent and Non-Coherent Detection of BFSK; Minimum Shift Keying-; Gaussian Minimum Shift Keying; M-ary Phase Shift Keying; M-ary Quadrature Amplitude Modulation; M-ary Frequency Shift Keying.

SECTION-B

OFDM: Generation of sub-carriers using the IFFT; Guard Time and Cyclic Extension; Windowing; OFDM signal processing; Peak Power Problem: PAP reduction schemes-Clipping, Filtering, Coding and Scrambling.

BLOCK CODED DIGITAL COMMUNICATION: Architecture and performance – Binary block codes; Orthogonal; Biorthogonal, Trans orthogonal – Shannon's channel coding theorem; Channel capacity; Matched filter, Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators, – Linear block codes; Hamming; Go lay; Cyclic; BCH; Reed – Solomon codes.

SECTION-C

CONVOLUTIONAL CODED DIGITAL: Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm, Turbo Coding.

SECTION-D

EQUALIZATION TECHNIQUES: Band Limited Channels- ISI – Nyquist Criterion- Controlled ISI-Partial Response Signals-Equalization algorithms – Viterbi Algorithm – Linear equalizer – Decision feedback equalization – Adaptive Equalization algorithms.

REFERENCES/ TEXT BOOKS:

1. M.K.Simon, S.M.Hinedi And W.C.Lindsey, Digital Communication Techniques, Signal Design And Detection, Prentice Hall India, New Delhi,1995.
2. Simon Haykin, Digital Communication, John Wiley & sons, 1998.
3. Bernard Sklar., 'Digital Communications', second edition, Pearson Education,2001.
4. Theodore S.Rappaport., 'Wireless Communications', 2nd edition, Pearson Education, 2002.
5. Richard Van Nee &Ramjee Prasad., 'OFDM for Multimedia Communications' Artech House Publication,2001.
6. John G. Proakis., 'Digital Communication', 4th edition, McGraw Hill Publication, 2001
7. Stephen G. Wilson., 'Digital Modulation and Coding', First Indian Reprint, Pearson Education, 2003.

Course Title/ Code	**BIG DATA(CSH402B-T/P)**
Course Type:	ELECTIVE (ALLIED)
Course Nature:	HARD

L-T-P-O Structure	3-1-0-0
Objectives	Student will be able to do Big Data Programming and Analytics using Hadoop.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section-A

Introductory Concepts (Digital Data and Big Data): Digital Data Basics,Types of Digital Data (Structured, Semi-Structured, Unstructured), Introduction to Big Data, Why Big Data? Dimensions of Big Data, Challenges with Big Data, Big Data Stack,ScalingProblems.Big data processing tools(AWS).

Hadoop overview:

Brief history of Hadoop, Hadoop 1.0 vs. Hadoop 2.0,Hadoop Components, High level architecture of Hadoop,HadoopStreaming,Hadoop Compression.

Section-B

Big data programming using Hadoop: Hadoop Distributed File System: Architecture, Daemons related to HDFS, working with HDFS command,Special features of Hadoop, Introduction to functional programming, How Map Reduce Works, Mapreduce on YARN, Map Reduce Joins, Map Reduce Work Flows. HDFS and Hadoop Ecosystem.

Section C

Big Data Analytics : Analytics 1.0, Analytics 2.0, Analytics 3.0,Traditional BI vs. Big Data Environment ,Big Data technology Landscape,NoSQLDatabases,NoSQL Vs. RDBMS, New SQL.

Section-D

Frameworks: APACHE HIVE:History of HIVE,HIVE architecture,Hive Primitive Data Types and Collection Types,Hive File Formats ,Hive Query Language – Statements,DDL DML , Fundamentals of APACHE PIG & HBASE ,Business Intelligence on Hadoop.

Text Books:

1. Tom White " Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012.
2. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
3. Michael Minelli (Author), Michele Chambers (Author), AmbigaDhiraj (Author) , Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses,Wiley Publications,2013.

Reference Book:

1. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGraw Hill Publishing, 2012.
2. AnandRajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
3. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley &sons, 2012.
4. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.
5. Pete Warden, "Big Data Glossary", O'Reilly, 2011.
6. Paul Zikopoulos , Dirk deRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corrigan , Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2012.

7. Zikopoulos, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Tata McGraw Hill Publications, 2011.

Course Title/ Code	Machine Learning (CSH314B-T/P)
Course Type:	Elective (ALLIED)
Course Nature:	Hard
L-T-P-O Structure	(3-1-0-0)
Objectives	1. To learn the concept of how to learn patterns and concepts from data 2. To design and analyze various machine learning algorithms and techniques 3. Explore supervised and unsupervised learning paradigms of machine learning 4. To explore Deep learning technique and various feature extraction strategies.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

Supervised Learning (Regression/Classification)
Basic methods: Distance-based methods, Nearest-Neighbors, Decision Trees, Naive Bayes, Linear models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Nonlinearity and Kernel Methods, Beyond Binary Classification: Multi-class/Structured Outputs, Ranking

Section B

Unsupervised Learning
Clustering: K-means/Kernel K-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models)

Section C

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, and Random Forests). Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning

Section D

Scalable Machine Learning (Online and Distributed Learning)
A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference.

Text Books:

1. [T1] Tom M Mitchell, Machine Learning, McGraw Hill Education
2. [T2] Bishop, C. (2006). Pattern Recognition and Machine Learning. Berlin: Springer-Verlag.
3. [T3] Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: WileyInterscience, 2000. ISBN: 9780471056690.
4. [T4] Tom M. Mitchell, Machine learning .ISBN – 9781259096952, McGraw-Hill Series, Edition – First

Reference Books:

1. [R1] Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.
2. [R2] Introduction to Machine Learning - Ethem Alpaydin, MIT Press, Prentice hall of India.

Course Title/Code	**MECHATRONICS (ECH418B-T/P)**
Course Type:	Open Elective
Course Nature:	Hard
L-T-P-O Structure	3-0-0-0
Objective	Students will be able to develop an ability to identify, select, formulate, and design a system or process integrating the knowledge of Mechanical and Electronics to meet desired needs within realistic constraints and solve engineering problems effectively.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION A

Introduction and Basics: What is Mechatronics? A Measurement System with its constituent elements and Hardware; Open and Closed Loop Systems; Sequential Controllers; Micro-processor Based Controllers. A review of Displacement, Liquid Flow, Liquid Level, Temperature Sensors along with Performance Terminology; Selection of Sensors; Introduction to signal conditioning: Signal Conditioning Processes, Inverting Amplifiers, Non-Inverting Amplifiers, Summing, Integrating, Differential, Logarithmic Amplifiers, Comparators, Amplifiers Error, Filtering, Wheatstone Bridge; Digital Signals; Logic Gates, Application of Logic Gates. Introduction to combinational and sequential logic circuits.

Data Presentation Systems – Displays; Magnetic Recording; Data Acquisition Systems; Testing & Calibration; Problems.

SECTION B

Introduction to Electrical Actuation Systems: Switching Devices, Mechanical Switches – SPST, SPDT, DPDT, keypads; Relays, Solid State Switches, Diodes, Transistors, Solenoid Type Devices: Solenoid Operated Hydraulic and Pneumatic Valves. Control of DC Motors, Permanent Magnet DC Motors, Brush less Permanent Magnet DC Motors, AC Motors and speed controls, Stepper Motors, Servo Motors. System Interfacing and data acquisition: Data acquisition systems, Analog to Digital Conversion, Digital to Analog Conversion, Sample and Hold Amplifiers, Interfacing Motor drives.

SECTION C

Introduction and description of modes and types of Controllers: Closed Loop Controllers: Continuous and Discrete Processes, Control Modes; Two- step Mode; Proportional Mode – Electronic Proportional Controllers; Derivative Control – Proportional plus Derivative Control; Integral Control - Proportional plus Integral Control; PID Controller.

Programmable Logic Controllers: Basic Structure of Programmable Logic Controllers; Input/ Output Processing; Programming; Timers, Internal Relays and Counters, Analogue Input/ Output; Selection of a PLC; Problems.

SECTION D

Brief description of Microprocessors and Input/Output Systems: Control; Microcomputer Structure;Programming Languages; Instruction Sets; Assembly Language Programs; Subroutines. Introduction to Micro- controllers; Applications

Input/Output Systems: Interfacing, Requirements, Addressing, Serial/Parallel Interface, Examples of Interfacing.

Mechatronics Applications and Case Studies: A Pick & Place Robot, Automatic Camera, Bar Code Recorder etc.

Text Books/Reference Books:

1. W. Bolton, “Mechatronics – Electronic control systems in Mechanical & Electrical Engineering”, Pearson Education Ltd., 2003.
2.NitaigourPremchandMahalik, Mechatronics principles, concepts and applications, Tata Mc Graw Hill. Reference Books: [R1] Joji P, Pneumatic Controls, Wiley.
3. David g Alciatore, Michael B Histand, “Introduction to Mechatronics and measurement systems”, Mc Graw Hill Education.
4. A Smaili, F Mrad, “Mechatronics – Integrated Technologies for Intelligent Machines, Oxford Higher Education.

Course Title/Code	**PLC AND ITS APPLICATIONS (ECH419B-T/P)**
Course Type:	Open Elective
Course Nature:	Hard
L-T-P-O Structure	3-0-0-0
Objective	Students shall be able to design and program PLC circuits for various PLC industrial and real time applications.

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

Section A

Introduction; definition & history of the PLC; Principles of Operation; Various Parts of a PLC: CPU & programmer/ monitors; PLC input & output modules; Solid state memory; the processor; I/O modules: Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O specifications, The CPU, Memory design, Memory Types, Programming Devices, Selection of wire types and size, Power supplies.
PLC advantage & disadvantage; PLC versus Computers, PLC Application.Programming equipment; proper construction of PLC ladder diagrams; process scanning consideration; PLC operational faults.

Section B

The Binary Concept, AND, OR and NOT functions, Boolean Algebra, developing circuits from Boolean Expression expressions, Producing the Boolean equation from given circuit, Hardwired logic versus programmed logic, Programming word level logic instructions. Converting Relay schematics and Boolean equation into PLC Ladder Programs, Writing a ladder logic program directly from a narrative description.

Different types of Input devices: Switches: Push button Switches, Toggle Switches, Proximity switches, Photo switches, Temperature Switch, Pressure Switch, and Level Switch, Flow Switches, manually operated switches, Motor starters, Transducers and sensors, Transmitters etc. Their working, specification and interfacing with PLC. Different types of Output devices: Electromagnetic Control Relays, Latching relays, Contactors, Motors, Pumps, Solenoid Valves etc. Their working, specification and interfacing with PLC.

Section-C

Processor Memory Organization, Program Scan, PLC Programming languages, Relay type instructions, Instruction addressing, Branch Instructions, Internal Relay Instructions, Programming Examine if Closed and examine If Open instructions, Entering the ladderi diagram, Modes of operation. Creating Ladder Diagrams from Process Control Descriptions. Ladder diagram & sequence listing; large process ladder diagram construction, Industrial Examples: Conveyer Belt, Car Parking System, Automatic Door System, Fan On/Off System, Electric Pump and Motor System, Staircase Lightning.

Section-D

Mechanical Timing relay, Timer instructions, ON delay timer instruction, Off-Delay timer instruction, Retentive Timer, Cascading Timers, examples of timer function industrial application; industrial process timing application.
Counter Instructions, Up-counter, down counter, Up-Down counter, Cascading counters, Incremental encoder counter applications, Combining counter and timer functions, High Speed counter instruction, HSC, PLS, examples of counter function industrial application.

Course Title/ Code	**NON CONVENTIONAL ENERGY SOURCES (MEH327B-T/P)**
Course Type	CORE
Course Nature	HARD
L-T-P-O Structure	3-0-0-0

	Sections	**Weightage**
Syllabus	A	25%
	B	25%
	C	25%
	D	25%
	TOTAL	**100%**

SECTION A

Introduction to Energy Sources: Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources.
Solar Energy : Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond , solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, photo voltaics - solar cells & its applications.

SECTION B

Wind Energy : Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.
Energy from Biomass: Biomass conversion technologies, Biogas generation plants, classification, advantages and disadvantages, constructional details, site selection, digester design consideration, filling a digester for starting, maintaining biogas production, Fuel properties of bio gas, utilization of biogas.

SECTION-C

Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India
Energy from the ocean: Ocean Thermal Electric Conversion (OTEC) systems like open cycle, closed cycle, Hybrid cycle, prospects of OTEC in India. Energy from tides, basic principle of tidal power, single basin and double basin tidal power plants, advantages, limitation and scope of tidal energy. Wave energy and power from wave, wave energy conversion devices, advantages and disadvantages of wave energy.

SECTION-D

Magneto Hydro Dynamic (MHD) Power Generation: Principle of MHD power generation, MHD system, Design problems and developments, gas conductivity, materials for MHD generators and future prospects. 8. Fuel Cells: Introduction, Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, application of fuel cells.
Hydrogen Energy: Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles. Energy Management: Energy economics, energy conservation, energy audit, general concept of total energy system, scope of alternative energy system in India. Term work is based on above mentioned syllabus

Reference Books:

1. Non-conventional energy sources by G.D. Rai, Khanna Publishers
2. Solar Energy: Fundamentals and Applications by H.P. Garg & Jai Prakash, Tata McGraw Hill
3. Solar Energy: Principles of Thermal Collection and Storage by S,PSukhatme, Tata McGraw Hill
4. Alternative Energy Sources by B.L. Singhal Tech Max Publication
5. Non Conventional Energy Resources by S.Hasan Saeed and D.K.Sharma
6. Fuel Cells by Bockris and Srinivasan; McGraw Hill
7. Magneto Hydrodynamics by Kuliovsky and Lyubimov, Addison
8. Solar Engineering of Thermal Processes by Duffic and Beckman, John Wiley

Course Title/ Code	**Web Services (CSW422B)**
Course Type:	**OPEN Elective**
Course Nature:	HARD
L-T-P-O Structure	(3-0-0-0)
Objectives	Student will be able to develop a Web service.

Section-A

Introduction to Web Services: Web services definition, Basic operational model, tools and technologies enabling web services, Difference between Web Service VS other technologies, Benefits and Challenges of using web services. Building block and Architecture of Web Service, Steps of implementing Web Services. Web Service Operational and Communication model.
XML: Introduction to XML, DTD VS XSD, XML Parsing (SAX and DOM), XML Binding API's (JAX-P and JAX-B API).

Section-B

WSDL: Introduction, non-functional service description, WSDL document and Types, WSDL elements, WSDL binding, WSDL port type, Message exchange patterns and formats, limitations of WSDL.
UDDI: UDDI Introduction, UDDI Registries and its use, UDDI Architecture, UDDI Data Model, UDDI data Structures, UDDI with WSDL, limitations of UDDI.

Section-C

SOAP: SOAP Message Structure, envelope and encoding, SOAP message exchange models, SOAP communication and messaging. Building SOAP Web Services, developing SOAP Web Services (JAX-WS), SOAP HTTP binding, Error handling in SOAP, limitations of SOAP.

Section-D

RESTful: Introduction to Restful, REST VS SOAP, JAX-RS Jersey Installation and setup in IDE, JAX-RS Annotation, RESTful implementation (Service and Client deployment).

TEXT BOOKS:

1. Web Services Platform Architecture by SanjivaWeerawarana, et al.
2. WebService Faceplates, by Stephen Mohr, Michael Corning, Erik Fuller, Donald Kackman, Michael John.
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.

REFERENCE BOOKS:

1. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou.
2. XML, Web Services, and the Data Revolution, F.P.Coyle, Pearson Education.
3. Building web Services with Java, 2nd Edition, S. Graham and others, Pearson Education.