MANAV RACHNA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRONICS & ENGINEERING

PROGRAM STRUCTURE

&

DETAILED SYLLABUS

B.Tech. Electronics & Communication Engineering

BATCH: 2016-2020

MANAV RACHNA UNIVERSITY, FARIDABAD

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

B.TECH (ECU01)

190-200 CREDITS FOR DEGREE COURSE

B.TECH IN ELECTRONICS & COMMUNICATION ENGINEERING

SEMESTER - 1

SUBJECT CODES	SUBJECT NAME	**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
ECH101-T	ELECTRICAL ENGINEERING	EC	HARD	CORE	3	1	0	0	4	4
ECH101-P	ELECTRICAL ENGINEERING LAB				0	0	2	0	2	1
PHH102-T	SEMICONDUCTOR PHYSICS	PH	HARD	CORE	3	1	0	0	4	4
PHH102-P	SEMICONDUCTOR PHYSICS LAB				0	0	2	0	2	1
CHH101-T	GREEN CHEMISTRY	CH	HARD	CORE	3	1	0	0	4	4
CHH101-P	GREEN CHEMISTRY LAB				0	0	2	0	2	1
MAH102-P	MATHEMATICS-I	MA	HARD	CORE	3	1	0	0	4	4
MAH102-T	MATHEMATICS-I LAB				0	0	2	0	2	1
HLS101	BUSINESS ENGLISH	HL	SOFT	CORE	1	0	2	0	3	2
MEW102	WORKSHOP	ME	HARD	CORE	0	0	3	0	3	2
FLS103	FRENCH-I	MRCFL	SOFT	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS101	SPANISH-I									
FLS102	GERMAN-I									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**14**	**5**	**13**	**0**	**32**	**24**

SEMESTER - 2

SUBJECT CODES	SUBJECT NAME	**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
ECH102-T	ELECTRONIC DEVICES & CIRCUITS	EC	HARD	CORE	3	1	0	0	4	4
ECH102-P	ELECTRONIC DEVICES & CIRCUITS LAB				0	0	2	0	2	1
PHH105-T	OPTICS & OPTICAL DEVICES	PH	HARD	CORE	3	1	0	0	4	4
PHH105-P	OPTICS & OPTICAL DEVICES LAB				0	0	2	0	2	1
CSH101-T	STRUCTURED PROGRAMMING	CS	HARD	CORE	3	1	0	0	4	4
CSH101-P	STRUCTURED PROGRAMMING LAB				0	0	2	0	2	1
MAH104-T	MATHEMATICS-II	MA	HARD	CORE	3	1	0	0	4	4
MAH104-P	MATHEMATICS-II LAB				0	0	2	0	2	1

HLS102	COMMUNICATIVE ENGLISH	HL	SOFT	CORE	1	0	2	0	3	2
MEW103	ENGINEERING DRAWING/ GRAPHICS	ME	WORKSHOP	ELECTIVE	0	0	3	0	3	2
CSW207	IMAGE EDITING & ANIMATION	CS								
CSW102	HTML5 & CSS	CS								
CHH135	ENVIRONMENTAL SCIENCE	CH	SOFT	UNIVERSITY COMPULSORY	3	0	0	1	3	4
FLS107	FRENCH-II	MRCFL	SOFT	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS105	SPANISH-II									
FLS106	GERMAN-II									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**17**	**5**	**13**	**1**	**35**	**28**

ECO150	SUMMER TRAINING POST 2nd SEMESTER	3

SEMESTER - 3

SUBJECT CODES	SUBJECT NAME	**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
ECH206-T	ELECTROMAGNETIC FIELD & WAVES	EC	HARD	CORE	3	1	0	0	4	4
ECH206-P	ELECTROMAGNETIC FIELD & WAVES LAB				0	0	2	0	2	1
ECH207-T	PRINCIPLES OF DIGITAL ELECTRONICS & CIRCUIT DESIGN	EC	HARD	CORE	3	1	0	0	4	4
ECH207-P	PRINCIPLES OF DIGITAL ELECTRONICS & CIRCUIT DESIGN LAB				0	0	2	0	2	1
ECH208-T	SIGNALS & SYSTEMS	EC	HARD	CORE	3	1	0	0	4	4
ECH208-P	SIGNALS & SYSTEMS LAB				0	0	2	0	2	1
MAH207-T	MATHEMATICS-III	MA	HARD	CORE	3	1	0	0	4	4
MAH207-P	MATHEMATICS-III LAB				0	0	2	0	2	1
CDO201	Professional Competancy Enhancement-I	CDC	OUTCOME	CORE	0	0	0	1	1	0.5
RDO201	INTRODUCTION TO RESEARCH	RESEARCH	OUTCOME	CORE	0	0	0	1	1	1
EDS288	APPLIED PHILOSOPHY	ED	SOFT	ELECTIVE (HUMANITIES BASKET)	1	0	2	0	3	2
EDS289	APPLIED PSYCHOLOGY									
EDS290	APPLIED SOCIOLOGY									
ECW209	PCB DESIGNING	EC	WORKSHOP	ELECTIVE	0	0	3	0	3	2
FLS211	FRENCH-III	MRCFL	SOFT	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS209	SPANISH-III									
FLS210	GERMAN-III									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**14**	**5**	**13**	**2**	**34**	**25.5**

SEMESTER - 4

SUBJECT CODES	SUBJECT NAME	**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
ECH210-T	ANALOG & DIGITAL COMMUNICATION	EC	HARD	CORE	3	1	0	0	4	4
ECH210-P	ANALOG & DIGITAL COMMUNICATION LAB				0	0	2	0	2	1
ECH211-T	NETWORK ANALYSIS & SYNTHESIS	EC	HARD	CORE	3	1	0	0	4	4
ECH211-P	NETWORK ANALYSIS & SYNTHESIS LAB				0	0	2	0	2	1
ECH212-T	ANALOG INTEGRATED CIRCUITS	EC	HARD	CORE	3	1	0	0	4	4
ECH212-P	ANALOG INTEGRATED CIRCUITS LAB				0	0	2	0	2	1
ECH213-T	ELECTRONIC MEASUREMENT & INSTRUMENTATION	EC	HARD	CORE	3	1	0	0	4	4
ECH213-P	ELECTRONIC MEASUREMENT & INSTRUMENTATION LAB				0	0	2	0	2	1
CDO202	Professional Competancy Enhancement-II	CDC	OUTCOME	CORE	0	0	0	1	1	0.5
RDO202	TECHNICAL SEMINAR-I	RESEARCH	OUTCOME	CORE	0	0	0	1	1	1
ECS249	E-WASTE MANAGEMENT	EC	SOFT	ELECTIVE (ENV.ETHICS & SUST.DEV.	1	0	2	0	3	2
CHS234	ENVOIRNMENT SUSTAINABLE DEVELOPMENT	CH								
ECW216	LABVIEW	EC	WORKSHOP	ELECTIVE	0	0	3	0	3	2
CSW204	DATA STRUCTURES	CS								
CSW208	SCRIPTING LANGUAGES	CS								
FLS215	FRENCH-IV	MRCFL	SOFT	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS213	SPANISH-IV									
FLS214	GERMAN-IV									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**14**	**5**	**13**	**2**	**34**	**25.5**

ECO217	SUMMER TRAINING POST 4TH SEMESTER	3

SEMESTER - 5

SUBJECT CODES	SUBJECT NAME	**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
ECH318-T	DIGITAL SYSTEM DESIGN	EC	HARD	CORE	3	1	0	0	4	4
ECH318-P	DIGITAL SYSTEM DESIGN LAB				0	0	2	0	2	1
ECH319-T	DIGITAL SIGNAL PROCESSING	EC	HARD	CORE	3	1	0	0	4	4
ECH319-P	DIGITAL SIGNAL PROCESSING LAB				0	0	2	0	2	1
ECH320-T	ANTENNA & WAVE PROPAGATION	EC	HARD	CORE	3	1	0	0	4	4
ECH320-P	ANTENNA & WAVE PROPAGATION LAB				0	0	2	0	2	1

ECH321-T	MICROELECTRONIC CIRCUITS	EC	HARD	ELECTIVE	3	1	0	0	4	4
ECH322-T	VLSI	EC								
ECH323-T	FUNDAMENTALS OF INFORMATION THEORY & CODING	EC								
CSH210-T	COMPUTER ARCHITECTURE & ORGANISATION	CS								
CSH206-T	OOPS USING JAVA	CS								
CSH314-T	INFOSYS FOUNDATION PROGRAM FP 4.0	CS								
ECH321-P	MICROELECTRONIC CIRCUITS LAB	EC	HARD	ELECTIVE	0	0	2	0	2	1
ECH322-P	VLSI LAB	EC								
ECH323-P	FUNDAMENTALS OF INFORMATION THEORY & CODING LAB	EC								
CSH210-P	COMPUTER ARCHITECTURE & ORGANISATION LAB	CS								
CSH206-P	OOPS USING JAVA LAB	CS								
CSH314-P	INFOSYS FOUNDATION PROGRAM FP 4.0 LAB	CS								
RDO303	TECHNICAL SEMINAR-II	RESEARCH	OUTCOME	CORE	0	0	0	1	1	1
CDO301	ofessional Competancy Enhancement-	CDC	OUTCOME	CORE	0	0	0	1	1	0.5
ECW324	3D-EM (RF)	EC	WORKSHOP	ELECTIVE	0	0	3	0	3	2
ECW325	VERILOG	EC								
CSW325	WEB-SERVICES	CS								
LWS104	CYBER LAW	LW	SOFT	ELECTIVE (LAW BASKET)	1	0	2	0	3	2
LWS101	LAW OF PATENTS									
FLS319	FRENCH-V	MRCFL	SOFT	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS317	SPANISH-V									
FLS318	GERMAN-V									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**14**	**5**	**13**	**2**	**34**	**25.5**

SEMESTER - 6

SUBJECT CODES	SUBJECT NAME	**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
ECH326-T	MICROPROCESSORS & INTERFACING	EC	HARD	CORE	3	1	0	0	4	4
ECH326-P	MICROPROCESSORS & INTERFACING LAB				0	0	2	1	2	2
ECH327-T	CONTROL SYSTEMS	EC	HARD	CORE	3	1	0	0	4	4
ECH327-P	CONTROL SYSTEMS LAB				0	0	2	1	2	2
ECH328-T	DIGITAL IMAGE PROCESSING	EC	HARD	ELECTIVE	3	1	0	0	4	4
ECH329-T	MICROWAVE ENGINEERING									
ECH330-T	CMOS VLSI DESIGN									
ECH328-P	DIGITAL IMAGE PROCESSING LAB	EC	HARD	ELECTIVE	0	0	2	1	2	2
ECH329-P	MICROWAVE ENGINEERING LAB									

ECH330-P	CMOS VLSI DESIGN LAB									
RDO304	PROJECT PHASE-I	RESEARCH	OUTCOME	CORE	0	0	0	1	1	1
CDO302	Professional Competancy Enhancement-IV	CDC	OUTCOME	CORE	0	0	0	1	1	0.5
CSW303	INTRODUCTION TO .NET	CS	WORKSHOP	ELECTIVE	0	0	3	0	3	2
ECW331	SIMULINK	EC								
ECW332	SYSTEM VERILOG	EC								
MCS231	ECONOMICS	MC	SOFT	CORE	1	0	2	0	3	2
MCS232	FUNDAMENTALS OF FINANCE	MC			1	0	2	0	3	2
FLS322	FRENCH-VI	MRCFL	SOFT	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS320	SPANISH-VI									
FLS321	GERMAN-VI									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**11**	**4**	**11**	**5**	**28**	**23.5**

ECO333	SUMMER TRAINING POST 6TH SEMESTER	3

SEMESTER - 7

SUBJECT CODES	SUBJECT NAME	**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
ECH434-T	WIRELESS COMMUNICATION	EC	HARD	ELECTIVE	3	1	0	0	4	4
ECH436-T	SPEECH SIGNAL PROCESSING									
ECH435-T	MEMS									
ECH434-P	WIRELESS COMMUNICATION LAB	EC	HARD	ELECTIVE	0	0	2	0	2	1
ECH436-P	SPEECH SIGNAL PROCESSING LAB									
ECH435-P	MEMS LAB									
ECH437-T	OPTICAL COMMUNICATION	EC	HARD	ELECTIVE	3	1	0	0	4	4
ECH438-T	ADVANCED CONTROL SYSTEMS									
ECH439-T	ADVANCED MICROPROCESSORS									
ECH437-P	OPTICAL COMMUNICATION LAB	EC	HARD	ELECTIVE	0	0	2	0	2	1
ECH438-P	ADVANCED CONTROL SYSTEMS LAB									
ECH439-P	ADVANCED MICROPROCESSORS LAB									
MAH412-T	OPERATION RESEARCH	MA	HARD	ELECTIVE	3	1	0	0	4	4
MAH411-T	NUMERICAL METHODS	MA								
ECH453-T	NEURAL NETWORKS & FUZZY LOGIC	EC								
ECH451-T	IOT SENSORS & DEVICES	EC								
MAH412-P	OPERATION RESEARCH LAB	MA	HARD	ELECTIVE	0	0	2	0	2	1
MAH411-P	NUMERICAL METHODS LAB	MA								
ECH453-T	NEURAL NETWORKS & FUZZY LOGIC LAB	EC								
ECH451-T	IOT SENSORS & DEVICES LAB	EC								
MCS368B	ENTREPRENEURSHIP	MC	SOFT	ELECTIVE	1	0	2	0	3	2
ECN440	MINOR PROJECT	EC	NTCC	CORE	0	0	2	0	2	2
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**10**	**3**	**10**	**0**	**23**	**19**

SEMESTER - 8

SUBJECT CODES	SUBJECT NAME	**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
ECN448	MAJOR PROJECT/ INDUSTRIAL TRAINING	EC	NTCC	CORE	0	0	18	0	18	18
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				0	0	18	0	18	18
Total no. of Credits										**198**

*COURSE NATURE	
	Hard course (H): A course having L-T-P and/or O component ; L(Lecture), T(Tutorial), P(Practical) and O(Outcome)
	Soft Course (S): A course aimed at development of a person's emotional, social, ethical, professional and creative potentials. The
	Workshop course(W): A completely 'hands on' course conducted in laboratory, aimed at developing application/ implementation/
	Non Teaching Credit Course(N): The course involves no teaching and has P and O component. Shall include projects, seminars,

**OFFERING DEPARTMENT NAMES		A course shall be assigned credits as under:
EC	DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING	One credit for each lecture hour; One credit for each tutorial hour ; One credit for each Outcome hour; Two credits for each workshop/ laboratory/practical/project session of 3 hours; One credit for each laboratory or practical or project session of 2 hours
PH	DEPARTMENT OF PHYSICS	
CS	DEPARTMENT OF COMPUTER SCIENCE & TECHNOLOGY	
LW	DEPARTMENT OF LAW	
ED	DEPARTMENT OF EDUCATION	
HL	DEPARTMENT OF HUMANITIES & LANGUAGES	
CH	DEPARTMENT OF CHEMISTRY	
MA	DEPARTMENT OF MATHEMATICS	
ME	DEPARTMENT OF MECHANICAL ENGINEERING	
MC	DEPARTMENT OF MANAGEMENT & COMMERCE	
MRCFL	MANAV RACHNA CENTRE OF FOREIGN LANGUAGES	

*** Electives are subject to change according to expertise available/ required.

Manav Rachna University

Faculty of Engineering

Department of

Electronics & Communication Engineering

Scheme & Syllabus

B. Tech (2015-2016)

MANAV RACHNA UNIVERSITY, FARIDABAD
FACULTY OF ENGINEERING
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
SYLLABUS & SCHEME (ECU01)

ECU01- Semester-I

SUBJECT CODES	SUBJECT NAME	**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
ECH101-T	ELECTRICAL ENGINEERING	EC	HARD	CORE	3	1	0	0	4	4
ECH101-P	ELECTRICAL ENGINEERING LAB				0	0	2	0	2	1
PHH102-T	SEMICONDUCTOR PHYSICS	PH	HARD	CORE	3	1	0	0	4	4
PHH102-P	SEMICONDUCTOR PHYSICS LAB				0	0	2	0	2	1
CHH101-T	GREEN CHEMISTRY	CH	HARD	CORE	3	1	0	0	4	4
CHH101-P	GREEN CHEMISTRY LAB				0	0	2	0	2	1
MAH102-P	MATHEMATICS-I	MA	HARD	CORE	3	1	0	0	4	4
MAH102-T	MATHEMATICS-I LAB				0	0	2	0	2	1
HLS101	BUSINESS ENGLISH	HL	SOFT	CORE	1	0	2	0	3	2
MEW102	WORKSHOP	ME	HARD	CORE	0	0	3	0	3	2
FLS103	FRENCH-I	MRCFL	SOFT	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS101	SPANISH-I									
FLS102	GERMAN-I									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**14**	**5**	**13**	**0**	**32**	**24**

DETAILED SYLLABUS
ECU01 –FIRST SEMESTER

Course Title/ Code	**ELECTRICAL ENGINEERING (ECH101-T, ECH101-P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	Students shall be able to design and construct circuits, take measurement of circuit behavior, compare with predicted circuit models and explain discrepancies.

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

Section A

DC Circuit Analysis and Network Theorems: Circuit concepts, Introduction to network, Concept of linearity and linear network, Active and passive elements, Unilateral and bilateral elements, R, L and C as linear elements, Voltage and current sources, Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Tellegen's theorem, Millman's theorem, Compensation theorem, Reciprocity theorem.

Section B

Steady State Analysis of Single Phase AC Circuits: AC fundamentals- sinusoidal, square and triangular waveforms, Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current, Analysis of series, parallel and series-parallel RLC circuits, Resonance in series and parallel circuits, Bandwidth and quality factor; Apparent, active & reactive powers, Power factor, Causes and problems of low power factor, Concept of power factor improvement.

Section C

Three Phase AC Circuits: Three phase system - its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, Three phase power and its measurement, Measuring instruments: Types of instruments, Construction and working principles of PMMC and moving iron type voltmeters

& ammeters, Single phase dynamometer wattmeter, Introduction to earthing and electrical safety: Need of earthing of equipment and devices, Megger, Important electrical safety issues.

Section D

Single Phase Transformer: Principle of operation, Construction, EMF equation, Equivalent circuit, Power losses, Short Circuit test, Open Circuit Test, Efficiency, Introduction to auto transformer, Electrical Machines: Concept of electromechanical energy conversion, DC machines: Types, EMF equation of generator and torque equation of motor, DC Three Phase Induction Motor: Characteristics and applications, Types, Principle of operation, Slip-torque characteristics, Applications. Single Phase Induction motor: Principle of operation and introduction to methods of starting, Applications, Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

List of Experiments:

1. Familiarization with the components, breadboard, resistor coding and various types of meters.
2. To verify KCL and KVL in a circuit.
3. To verify Thevenin's theorem and Norton's theorem.
4. To verify Superposition theorem and Maximum power transfer theorem.
5. Measurement of various parameters of different AC waveforms (average, RMS, peak value, form factor, peak factor).
6. Measurement of series resonance and parallel resonance.
7. Single phase AC power measurement & project allotment.
8. 3 phase power measurement using two wattmeter methods.
9. Efficiency and voltage regulation of single phase transformer.
10. Open circuit characteristics of DC separately excited shunt generator.
11. Open circuit and short circuit test on single phase transformer.
12. Speed control of DC shunt motor.

Text Books:

1. T.K. Nagsarkar, M S Shukhija, Basic Electrical Engineering, Oxford University Press
2. B L Theraja, A Textbook of Electrical Technology, Vol- I, S Chand Publishing
3. Del. Toro, Principles of Electrical Engineering, PHI Publication.

Reference Books:

1. Edward Hughes, Electrical & Electronics Technology, Seventh Edition, Pearson Education
2. H Cotton, Elements of Electrical Technology, CBS Publications
3. Nahvi, John Edminister, Electric circuits, Schaum series, Tata McGraw Hill
4. Nagrath and Kothari, Theory and problems of Basic Electrical Engineering, Prentice-Hall of India

Course Title/ Code	**SEMICONDUCTOR PHYSICS (PHH102-T, PHH102-P)**
Course Type:	Core (Departmental/Allied)
Course Nature:	Hard

L-T-P-O Structure	(3-1-2-0)
Objectives	To explain the basic principles of Semiconductor Physics and apply them to various Semiconductor devices.

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

Section A

Energy Bands Formation in Solids : Basic Concepts of Quantum Physics, Energy Quantization and Wave-Particle Duality, Schrödinger Equation, Expectation Values, Particle in a Box, Tunnel Effect, Bloch Theorem, Kronig Penney Model (Qualitative), Brilluoin Zones, Energy Bands in Solids, Metals, Insulators and Semiconductors, Holes and Electrons, Effective Mass, Density of states in valence and conduction bands.

Section B

Properties of Semiconductors: Maxwell-Boltzmann Statistics, Bose-Einstein Statistics, Fermi-Dirac Statistics, Fermi Distribution Function, Fermi Energy. Charge carriers in Semiconductors: Electrons and Holes, Charge Carrier Density, Intrinsic and Extrinsic Semiconductors, Direct and Indirect Semiconductors, Fermi Level for Intrinsic and Extrinsic Semiconductors and its Dependence on Temperature and Doping Concentration. Mass Action Law, Conductivity of Intrinsic and Extrinsic Semiconductors, Mobility, Hall Effect.

Section C

Bipolar Junction Diodes : Diffusion Mechanism, P-N Junction Diode: Fabrication Techniques, Ideal Diode, Current Components in a P-N Diode, Quantitative Theory of P-N Diode Currents, Current Voltage Characteristics, Diode Current Equation, Diode Resistance, P-N Diode Switching Times, Junction Breakdown, Zener Diode and its Applications, Tunnel Diode. Organic Semiconductors

Section D

Photoconductivity and Semiconductor Devices: Radiative Transitions, Light Emitting Diodes, Introduction to Photoconductivity (Optical Absorption and Conduction), Photoconductor, Photodiode: Working and Uses. P-N Junction Solar Cell: Fabrication, Characteristics and Uses. Bipolar Junction Transistor: Its Fabrication and Working, CB, CE and CC Configurations. MOSFET: Its Fabrication and Working.

List of Experiments:

1. To determine Planck's constant using photoelectric effect.
2. To determine energy band gap of a semiconductor using Four-Probe Method.

3. To determine the carrier concentration of a semiconductor using Hall Effect setup.
4. To study V-I Characteristics of a P-N junction diode.
5. To determine lattice parameters of a crystal using PowderX software and experimental data.
6. To verify Richardson Equation and hence to find the work function of cathode material of a diode valve.
7. To determine the band gap of a semiconductor diode.
8. To study and plot the forward and reverse bias characteristics of a Zener diode.
9. To study the characteristics of a solar cell and to determine its efficiency.
10. To study the working of zener diode as a Voltage regulator.
11. To study VI and PI characteristics of a diode laser and determine the threshold current for operation.

Text Books:

1. S.M.Sze, Physics of Semiconductor devices, John Wiley and Sons.
2. J.B.Gupta, Electrical Engineering Materials and Semiconductor Devices.
3. H.S.Mani and G.K. Mehta, Introduction to Modern Physics, Affiliated East-West Press Pvt. Ltd.

Reference Books:

1. Sanjeev Gupta, Semiconductor materials and devices, Shubham Publications.
2. Sima Dimitrijev, Semiconductor devices, Oxford University Press.

Suggested video links :

1) Photoconductivity
http://ocw.mit.edu/courses/mechanical-engineering/2-627-fundamentals-of-photovoltaics-fall-2013/tutorial-videos/tutorial-photoconductivity/

2) Working of solar cell
http://ocw.mit.edu/courses/mechanical-engineering/2-627-fundamentals-of-photovoltaics-fall-2013/tutorial-videos/tutorial-solar-cell-operation/

Course Title/ Code	**GREEN CHEMISTRY (CHH101-T, CHH101-P)**
Course Type:	Core (Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	• to introduce concept and discipline of green chemistry • to demonstrate the necessity and viability of the methods of green chemistry

	• to demonstrate how to evaluate a reaction or process and determine "greener" alternatives. • to focus on the application of innovative technology the development of "greener" routes to improve industrial processes and to produce important products.

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

SECTION-A

Introduction to green chemistry: Definition, history, need and goals of green chemistry, Green Chemistry in sustainable development, Importance of Green Chemistry. Limitations/Obstacles in the pursuit of the goals of Green Chemistry. Basic principles of Green Chemistry: Twelve Principles in Green Chemistry with their explanations and examples, Prevention of waste/by products, Atom Economy, Prevention/Minimization of hazardous/toxic products, Designing safer chemicals, Selection of safer solvents and auxiliaries, Design for energy efficiency (use of microwave and ultrasonic radiations), Use of renewable Feedstocks, Avoidance of unnecessary derivatization, Use of catalytic reagents in preference to stoichiometric reagents, Designing biodegradable products, Prevention of chemical accidents (including releases, explosions and fires), Strengthening/Development of green techniques to prevent hazardous substances in chemical process.

SECTION-B

Green lubricants & polymers: Introduction, Properties and Applications of conventional and green lubricants, Synthesis of Green Lubricants. Introduction & Classification of polymers, Biodegradable and non-biodegradable polymers, Synthesis of Green Polymers, Polymer Composites.

SECTION-C

Green synthesis: Comparison with conventional synthesis: Green starting materials, Green reagents, Green solvents and reaction conditions: water as green solvent, Properties of water and their estimation (Hardness, Alkalinity, Dissolved Oxygen), Green catalyst (Biocatalysts, polymer supported & recoverable catalysts, etc.), Synthesis involving basic principles of green chemistry- Synthesis of Biodiesel and other green compounds, Quantitative Solid-solid synthesis.

SECTION-D

Green engineering & its applications: Need and scope of green engineering, Basic principles of green engineering, Elimination of hazardous compounds by green compounds, Eco-friendly materials for computing Case studies of Real World/ Indian Cases: Sony Ericsson: Bromine- and Chlorine-Free Mobile Phones, Bio-based composite resins design for electronic materials: Soy Plastics, US Presidential Green Chemistry Challenge Award Winners.

List of Experiments

1. Synthesis of Green compounds (Biodiesel from vegetable oil).
2. Characterization of Bio-diesel by using Spectrophotometer.

3. Determination of Flash and Fire Point & Viscosity Index of Green Liquid Compounds.
4. To determine Hardness of water sample.
5. To determine Alkalinity & dissolved oxygen of water sample.
6. Synthesis of green reagent Tetra butyl ammonium tribromide (TBATB)
7. Solvent free Aldol Condensation between 3, 4-dimethoxybenzaldehyde and 1-indanone.
8. Preparation of gold nanoparticles using tea.
9. Solvent-free and one-pot synthesis of Phthalocyanine Complex of Copper (II).
10. Extraction of D-limonene from orange peel using liquid carbon dioxide as a solvent.

Reference Books:

1. P. T. Anastas, J. C. Warner, Green Chemistry: Theory and Practice, 1998., Oxford University Press.
2. Concepcion Jimenez Gonzalez, David JC Constable, Green Chemistry and Engineering. 2011, John Wiley & Sons.
3. EMO Chiellini and Roberto Solaro, Biodegradable Polymers and Plastics. 2002, Kluwer Academic Publishers.
4. Paul T. Anastas, Robert H. Crabtree, Green Catalysis. 2009, Wiley-VCH.
5. James H. Clark, Duncan J. Macquarrie, Handbook of green chemistry and technology. 2002, John Wiley & Sons.
6. Roger A. Sheldon, Isabel Arends, Ulf Hanefeld, Green Chemistry and Catalysis. First Edition, 2007, Wiley-VCH.

Course Title/ Code	**MATHEMATICS-I (MAH102-T, MAH102-P)**
Course Type:	Core (Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	The students would be able to apply the mathematical concepts of matrices, Laplace transforms, differential equations and integral calculus required for solving the mathematical problems and their applications.

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

Section A

Matrices & its applications: Elementary transformations, Elementary matrices, inverse using elementary transformations, Rank of a matrix, normal form of a matrix, Linear dependence and independence of vectors, consistency of linear system of equations, Eigen Values and Eigen vectors, properties of Eigen values, Cayley Hamilton theorem, Linear Transformation, Orthogonal transformation, Similar matrices, Diagonalisation of a matrix, Quadratic forms, Complex matrices and their properties.

Section B

Multiple integrals & its applications: Double and Triple Integral :- Evaluation of double & triple integral, evaluation of double integral over the region, evaluation of double integral by changing the order of integration, evaluation of double & triple integral by changing the variable. Beta and Gamma functions:- Definition, properties of Beta and Gamma functions, Recurrence formula, Relation between Beta and Gamma functions, duplication formula, Dirichlet's Integrals.

Section C

Ordinary differential equations & its applications: Existence & uniqueness of Differential equation, Differential equations of first order & first degree, formation of differential equation, Bernoulli's differential equation, Exact differential equation and equations reducible to exact differential equation, Applications(Electric circuits, Newton's law of cooling, Orthogonal trajectories). Differential equations of higher order & first degree , Linear differential equations, Method of Variation of Parameter, Cauchy's linear equation, Legendre's equation, Simultaneous linear Differential equations, Applications of LDE(LCR Circuits, Projectile with Resistance)

Section D

Laplace transforms & its applications: Existence of Laplace Transform, Linearity Property, Laplace Transform of some elementary functions.1st Shifting Property, 2nd Shifting Property, Change of Scale Property. Laplace Transform of Derivatives, Laplace Transform of Integrals. Laplace Transform of t^n. f(t) and f(t)/t. Evaluation of integrals , Laplace Transform of some special functions. Inverse Laplace Transforms, Uniqueness of Inverse Laplace Transform. Inverse Laplace Transform of some special functions, convolution theorem. Application of Laplace transforms: Solution of (i) Ordinary Differential Equations (ii) Integral Equations of convolution type.

List of Experiments:

1. Introduction to MATLAB and use of some simple MATLAB commands.
2. Introduction to some of the fundamentals of MATLAB: Variables, operators, expressions and Arrays(including vectors and matrices)
3. Introduction to graphics: Basic Two-Dimensional Graphs, Labels, Multiple plots on the same axes, Line styles, Markers and color, Axis limits and Subplots.
4. To find the Rank of a matrix, Inverse of a Square matrix and to reduce a matrix into Normal Form.
5. To solve the system of simultaneous linear equations. To find the Eigen values and Eigen vectors of a square matrix.
6. To find the Surface area and volume of solids of revolution by single integration.
7. Evaluation of Double integral and its application.
8. Evaluation of Triple integral and its application.
9. To solve ODE & LDE & plot the graph of the solution of LDE.
10. To solve & plot solutions the system of two & three ordinary differential equations.
11. To solve the Linear differential equations with variable coefficients (Cauchy & Legendre Differential equations) and plot the graph of the solution.
12. To find the Laplace Transform of a function f(t) and plot the same.
13. To find the Laplace Transform of Integrals and some special functions, to find the Inverse Laplace Transform of a function F(s).

Text Books:

1. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, New Delhi.

Reference Books:

1. R.K. Jain & S.R.K. Iyengar, “Advanced Engineering Mathematics”, Narosa Publishing House, New Delhi.
2. Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & sons, New York.
3. Shanti Narayan, “Integral Calculus”, S. Chand publishers, New Delhi.
4. Brian Hahn & Daniel Valentine, “Essential MATLAB for Engineers & Scientists”, Academic Press, Oxford, UK.

Course Title/ Code	**BUSINESS ENGLISH (HLS101)**
Course Type:	Elective (Allied)
Course Nature:	Soft
L-T-P-O Structure	(1-0-2-0)
Objectives	Taken directly from Infosys designed Lesson plans of Business English, the paper attempts to execute the modules over the course of a semester, by end of which students will be well-versed in the basics of English Language grammar and communication skills. The lab-activities that go hand-in-hand with the lessons will help in enhancing the interactive aspect of the paper.

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

Section A

Grammar: Introduction to Grammar, Adverbs, Adjectives, Articles, Noun (Compound, Countable, Uncountable) Active –Passive Voice

Section B

TENSE and SEMANTICS: Tenses, Subject- Verb Agreement, Introduction to Verbs (Auxiliary and Modals, non-finite), Prepositions, Modifiers, Collocation, Synonym, Antonym, Phrasal Verbs, Idioms and Phrases.

Section C

Oral Communication-I: Speech Pattern-1 (Intonation, Word Stress), Speech Pattern-2 (Indianisms, Sentence Stress, Connected Speech), Link Expressions, Question Tags.

Section D

Technical writing-I: ABC of Writing, KISS Concept, Essay Writing, Report Writing, Email Etiquette, Circular Précis Writing, Memos and Notices.

Lab Activities

1. Exercises based on Grammar.
2. Exercises based on Semantics.
3. Introduction to Articulation Skills (Conversation: Telephonic and Face-to-Face).
4. Listening to Understand (Hearing vs. Listening).
5. Listening for Inter-personal Effectiveness.
6. Techniques & Levels of Reading Comprehension.
7. Essay Writing Session.
8. Report Writing and Email Etiquette.
9. Circular, Memos and Notice Writing.
10. Business QUIZ &Idioms and Phrases.
11. Individual Presentation.
12. Feedback and Poster- Creation.

Suggested Text Readings:

1. High School English Grammar and Composition. Wren and Martin: S.Chand and Co.
2. A Textbook of English Phonetics for Indian Students. T.Bala Subhrmaniam: Macmillan
3. English Vocabulary in use.Macarthy: Foundation Books, Oxford Uni. Press.
4. English Grammar, Competition and Correspondence. M.A. Pink and A.C. Thomas: S.Chand & co.

Course Title/ Code	**WORKSHOP (MEW102)**
Course Type:	Core (Allied)
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3-0)

Objectives	To impart and develop necessary skills related to manufacturing operations in the Workshops.

List of exercises/experiments in workshop:

1. **Introduction to plant layout and safety measures.**
2. **Measuring Instruments:** To operate and study different type of measuring tools used in meteorology and determine least count of verniercallipers, micrometers and vernier height gauge.
3. **Introduction to Jigs and Fixtures of Different types and their uses**
4. **Machine tools/ Metal cutting:** To prepare Jobs and study different types of machine tools (Lathe, Shaper, Milling, Drilling, Grinding machines) with regards to their construction and operations.
5. **Lathe process:** To prepare a job on a lathe involving facing, outside turning, step turning, Taper Turning, and study of Tool Signature (i.e. Geometry of cutting tool).
6. **Shaping Process:** To prepare a horizontal surface/ vertical surface/ slot or V-grooves on shaping machine.
7. **Milling Process:** To prepare a job involving side and face milling on milling machine.
8. **Sheet Metal Process:** To prepare sheet metal job giving knowledge of development of layout and introduction to gauge thickness of sheets.
9. **Introduction of Drilling, Reaming and Tapping operations along with the related cutting tools**
10. **Fitting shop:** To study different types of fitting tools and marking tools used in fitting processes, along with their operations andto prepare a job.
11. **Welding Shop: Introduction of Various aspects of Welding .**To prepare joints for welding suitable for butt welding, Lap welding and V-Joint.
12. **Carpentry Shop:** To study different types of carpentry tools and introduction to pattern making, pattern allowances, types of patterns and preparation of simple types of at least two wooden joints.
13. **Foundry Shop: Introduction to Foundry and its different Tools used.**To prepare a mould and core assembly ; to pour metal in the mould and fettle the casting

Text books:

Metal, Materials, Numerical Quantity, Forms - Westermann tables.

Course Title/ Code	**French (FLS103)**
Course Type:	**University compulsory**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
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

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

Section-A

- Les Salutations & forms of politeness
- Alphabets
- Taking leave expressions

Section-B

- Les pronoms sujets
- Les verbes ER
- Self introduction

Section-C

- Les noms
- Verbes Avoir, Etre, Aller & Faire
- Les articles define et indefini

Section-D

- Les moin de l'annee
- les jours de la semaine

- Repondez aux questions

Course Title/ Code	**German (FLS102)**
Course Type:	**University compulsory**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
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

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

Section-A

- Salutations/Greetings
- Introduction

Section-B

- Introduction cntd.
- Alphabets
- Numbers 1-20

Section-C

- Personal pronouns
- Hobbies and professions

Section-D

- Café related vocabulary and dialogues
- Revision personal pronouns
- Common verbs and their conjugations

Course Title/ Code	**Spanish (FLS101)**
Course Type:	**University compulsory**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
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 Spanish-speaking world and the student's native culture

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

Section-A

- Presentation on Spanish language
- Greetings and goodbye's
- Spanish letter
- Introduction of Verbo SER

Section-B

- Uses of Verbo SER
- Introduction of Nationality
- Professions and vocabulary related to professions.
- Adjectives related to Verbo SER.
- Counting till number 20.

Section-C

- Introduction of Articles and Indefinite articles
- Interrogatives
- Adjectives to describe things and place and Counting till number 90

Section-D

- Introduction of Verbo ESTAR
- Uses of Verbo ESTAR with respect to positioning of objects
- Prepositions related to the positioning of an object

Reference Book: Aula internacional 1, Modern Spanish Grammar

ECU01- Semester-II

	SEMESTER – 2									
SUBJECT CODES	**SUBJECT NAME**	****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**
ECH102-T	ELECTRONIC DEVICES & CIRCUITS	EC	HARD	CORE	3	1	0	0	4	4
ECH102-P	ELECTRONIC DEVICES & CIRCUITS LAB				0	0	2	0	2	1
PHH105-T	OPTICS & OPTICAL DEVICES	PH	HARD	CORE	3	1	0	0	4	4
PHH105-P	OPTICS & OPTICAL DEVICES LAB				0	0	2	0	2	1
CSH101-T	STRUCTURED PROGRAMMING	CS	HARD	CORE	3	1	0	0	4	4
CSH101-P	STRUCTURED PROGRAMMING LAB				0	0	2	0	2	1
MAH104-T	MATHEMATICS-II	MA	HARD	CORE	3	1	0	0	4	4
MAH104-P	MATHEMATICS-II LAB				0	0	2	0	2	1
HLS102	COMMUNICATIVE ENGLISH	HL	SOFT	CORE	1	0	2	0	3	2
MEW103	ENGINEERING DRAWING/ GRAPHICS		WORKSHOP	ELECTIVE	0	0	3	0	3	2
CSW207	IMAGE EDITING & ANIMATION	CS								
CSW102	HTML5 & CSS	CS								
CHS102	ENVIRONMENTAL SCIENCE	CH	SOFT	UNIVERSITY COMPULSORY	3	0	0	1	3	4
FLS107	FRENCH-II	MRCFL	SOFT	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS105	SPANISH-II									

FLS106	GERMAN-II									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**17**	**5**	**13**	**1**	**35**	**28**

DETAILED SYLLABUS
ECU01 –SECOND SEMESTER

Course Title/ Code	**ELECTRONIC DEVICES AND CIRCUITS (ECH102-T, ECH102-P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	• To deliver the knowledge about physics of basic semiconductor devices and to enhance comprehension capabilities of students through understanding of electronic devices. • To provide indepth knowledege of the principle, operation and applications of the analog building blocks like diodes, bipolar junction transistors and field-effect transistors etc.

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

Section A

Introduction to P-N Junction Diodes and Applications: P-N Junction-Device structure, Equilibrium picture, DC forward and reverse characteristics, Small-signal equivalent circuit, Switching characteristics, Diffusion & transition capacitances, Breakdown mechanisms in p-n junction, Concept & Mathematical Computation of Half-wave rectifier, Full-wave rectifier, Bridge rectifier, Clippers, Clampers, and Voltage multiplier circuits, Zener diode: Breakdown mechanism, Characteristics, Effect of temperature, Application as voltage regulator, Difference between Zener and Avalanche Diode, Logic Gates.

Section B

Bipolar Junction Transistors (BJT) and Circuits: BJT: Device structure and physical operation, Transistor action and amplification, BJT configurations and their characteristics (Common Base, Common Emitter and Common Collector configurations), Modes of operation- Forward active, Saturation, Cutoff, Reverse active, Transistor DC load line, Quiescent point, BJT biasing circuits- Fixed bias, Emitter bias, Self bias and Potential divider bias.

Section C

Field Effect Transistors and Circuits: Construction and operation of JFETs, JFET characteristics, MESFET- Device structure, Principle of operation and V-I characteristics, Construction and operation of MOSFETs, Depletion and enhancement type MOSFETs, Characteristics of enhancement and depletion type MOSFETs.

Section D

Basic Principles of Special Devices:, LDR, Photodiode, Solar cell, LED, LASER diode, DIAC, TRIAC, IGBT, SCR, Schottky barrier diode , IPIN diode, Gunn diode, Varactor diode, IMPATT diode, Tunnel diode.

List of Experiments:

1. Familiarization with electronic components (resistors, capacitors, diodes, transistors, various IC's etc) and measuring instruments (CRO, Function Generator, Multimeter, Digital Trainer Kit etc.).
2. To plot V-I characteristics of a given P-N junction diode and calculation of cut-in voltage, static and dynamic resistances.
3. To design half wave and full wave rectifier of given specifications.
4. Characterization of a Zener diode and its application as a voltage regulator.
5. To design clipper and clamper circuits of given specifications.
6. Measurement of input and output characteristics of BJT operating in CE configuration.
7. To plot transfer and drain characteristics of JFET.
8. To plot transfer and drain characteristics of MOSFET.
9. To plot dark and illuminated characteristics of given solar cell.
10. Study of V-I characteristics of Tunnel diode.
11. Project.

Text Books:

1. Donald A. Neamen, Semiconductor Physics and Devices, Tata McGraw Hill, Third Edition
2. Anant Agrawal, Foundations of Analog and Digital Circuits, Elsevier
3. Streetman & Banerjee, Solid State Electronic Devices, PHI

Reference Books:

1. S M Sze, Semiconductor Devices: Physics and Technology, Wiley, Second Edition
2. David Bell, Electronic Devices and Circuits, Oxford, Fifth Edition.

3. S. Slivahanan and N. Suresh Kumar, Electronic Devices and Circuits, McGraw Hill, Third Edition
4. Boylestad & Nashelsky, Electronic Devices and Circuit Theory, Pearson

Course Title/ Code	**STRUCTURED PROGRAMMING (CSH101-T, CSH101-P)**
Course Type:	Core (Departmental)
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 and the Integrated Development Environment (IDE), Eclipse. Introduction to Programming, test driven development Scratch: Introduction, statements, expressions, conditions, selection, iteration, variables, functions, arrays, threads and events. UNIX: Basic commands- pwd, ls, cd, rm, cat, less, mkdir, rmdir; permissions, root Eclipse: Integrated Development Environment (IDE) C language: Character set, Variables and Identifiers, Built-in Data Types, Variable Definition, Arithmetic operators and Expressions, Constants and Literals, Simple assignment statement, Basic input/output statement, Simple 'C' programs.

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. 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. One dimensional arrays: Array manipulation; Searching, Insertion, Deletion of an element from an array; Finding the largest/smallest element in an array; Two dimensional arrays, Addition/Multiplication of two matrices, Transpose of a square matrix; 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 Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions. Students will become familiar with the concepts.

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. Application of 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. 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. Students will be able to use these techniques to develop programs. Concept of Files, File opening in various modes and closing of a file, Reading from a file, writing onto a file.

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, linked lists, and stacks. 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. Linked list, Stack.

List of Experiments:

1. Swap two numbers
2. Sum an array of numbers
3. Parse program parameters from the Unix command line
4. Fibonacci series, Factorial
5. GCD
6. Sieve of Eratosthenes
7. Square Root
8. Sorting
9. Decimal to binary conversion
10. Linked lists
11. Program to support humans playing chess against each other.
12. Stacks and queues
13. Manipulating files

Text Books:

1. Yashwant Kanetkar ,Working with C, BPB Publications, 2003
2. Yashwant Kanetkar , Let us C,

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/

Web tutorials

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

Course Title/ Code	**OPTICS AND OPTICAL DEVICES (PHH105-T, PHH105-P)**
Course Type:	Core (Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	Students will be able to describe and measure the wave properties of light using different optical devices

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

	TOTAL	**100%**

Section A

Theory of Interference: Coherent Sources, Coherence (Spatial and Temporal), Interference by Division of Wave Front and Amplitude, Fresnel Biprism, Interference in Thin Films (Uniform and Non-Uniform Thickness), Newton Rings, Michelson's Interferometer, Applications (Resolution of Closely Spaced Spectral Lines, Determination of Wavelength), Role of Anti-Reflection and High Reflection Dielectric Coatings in Interference.

Section B

Diffraction: Difference between Fresnel and Fraunhofer Diffraction, Fraunhofer Diffraction at Single Slit, Intensity, Plane Transmission Diffraction Grating (Construction, Intensity Analysis and Applications), Absent Spectra, Dispersive Power, Resolving Power and Rayleigh Criteria, Effects of Diffraction in Optical Imaging. Polarization: Polarized and Unpolarized Light, Brewster's Law, Malus Law, Double Refraction and Doubly Refracting Materials, Production, Detection and Analysis of Different Types of Polarized Light, Different types of Polarizers: Nicol Prism, Sheet Polarizer, Retardation Plates (Quarter and Half Wave Plates), Optical Activity, Origin of Optical Activity, Specific Rotation, Polarimeters.

Section C

Laser: Absorption, Spontaneous Emission, Stimulated Emission, Einstein Coefficients and Possibility of Amplification, Kinetics of Absorption, Population Inversion, Different types of Pumping, Main Components of Laser: Active Medium, Pumping Source, Optical Resonator, Principle of Laser Action, Characteristics of Laser Beam, Threshold Pumping Rates for Three and Four Level Lasers, Different types of Lasers (Ruby laser, Helium-Neon Laser, Semiconductor Diode Laser, Excimer Laser (ArF)), Applications of Laser in various Fields: Laser Welding, Laser Cutting, Laser Drilling, Laser Printing, Laser Cooling, Laser in Communication, Thin Film Deposition using Laser (Pulsed Laser Deposition).

Section D

Optical Fiber: Propagation of Light through Optical Fiber, Numerical Aperture and Acceptance Angle, Types of Optical Fibers, Optical Fiber Manufacturing Processes, Attenuation and Signal Losses (Absorption Losses, Scattering Losses and Bending Losses) Dispersion (Intermodal and Material Dispersion), Bandwidth, V-Number, Optical Fiber Communication System, Merits and Disadvantages of Optical Fibers, Applications of Optical Fibers, Fiber Optic Sensors : Temperature Sensors (Intensity Modulated Sensor, Phase Modulated Sensor).

List of Experiments:

1. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
2. To determine the dispersive of the material of a given prism using mercury light.
3. To determine the resolving power of a prism.
4. To determine wavelength of sodium light using Newton's Rings.
5. To determination Wavelength of Sodium Light using Michelson's Interferometer.
6. To determine the wavelength of (1) Sodium and (2) Mercury Light using Plane Diffraction Grating.
7. To determine the Resolving Power of a Plane Diffraction Grating.
8. To determine the dispersive power of a Plane Diffraction Grating.

9. To determine the specific rotation of a given sugar solution using Laurent half shade polarimeter.
10. To determine the refractive index of a liquid using a Laser.
11. To determine the wavelength of a laser light using a Plane Diffraction Grating.
12. To study the attenuation coefficient, Numerical Aperture and Power loss of signal when transmitted from transmitter to Receiver end.

Text Books:

1. Dr. Subrahmanyam, Brijlal and M. N. Avadhanulu , A text book of optics, S. Chand & Company Ltd. New Delhi.
2. M.S. Khurana, Fundamentals of Engineering Physics, Volume I, MR Publishing House.

Reference Books:

1. Jenkins and white Fundamentals of optics
2. Ajoy Ghatak Optics
3. William T. Silfvast, Laser Fundamentals, Cambridge University Press.

Suggested video links:

1) Diffraction grating http://vlab.amrita.edu/?sub=1&brch=281&sim=334&cnt=1
2) Optical fibre NA http://vlab.amrita.edu/?sub=1&brch=189&sim=343&cnt=1
3) Newton's rings http://vlab.amrita.edu/?sub=1&brch=189&sim=335&cnt=1

Course Title/ Code	**MATHEMATICS - II (MAH104-T, MAH104-P)**
Course Type:	Core (Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	The students would be able to apply the concepts of function of several variables, Fourier Transform, Vector Calculus and Partial Differential Equations required for solving the mathematical problems and their applications.

Syllabus	**Sections**	**Weightage**
	A	25%

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

Section A

Function of several variable: Successive Differentiation, Leibnitz's theorem, Taylor's &Maclaurin's series for function of single variable. Definition of Function of several variables, limit & continuity, partial derivatives, total derivatives, Jacobian, Homogeneous functions, Euler's theorem & its applications, Taylor's series for function of two variables, maxima & minima for function of two variables, Lagrange's method of undetermined multipliers, Differentiation under the integral sign.

Section B

Vector calculus: Differentiation of vectors, scalar and vector point function, Gradient of a scalar field and directional derivatives, Divergence and curl of a vector field and their physical interpretations, Integration of vectors, Line integral, surface integral and volume integral, Green's theorem, Stokes theorem and Gauss Divergence theorem (without proof) and their applications.

Section C

Fourier series & fourier transforms: Periodic functions and introduction of Fourier series**,** Euler's Formulae and condition for Fourier expansion, Fourier expansion of odd and even functions, Change of interval, Half range sine and cosine series. Introduction to Fourier integral, Fourier transform, Shifting Theorem for both Time and frequency axes, Fourier transforms of integrals, Convolution theorem, Fourier transform of Dirac delta function.

Section D

Partial differential equations: Formation of partial differential equations, Lagrange' linear partial differential equation, first order non-linear partial differential equation, Charpit's method. Method of separation of variables and its applications to wave equation, one dimensional heat equation and two-dimensional heat flow (steady state solutions only). Applications of Partial Differential Equations Method of separation of variables for solving partial differential equations, Wave equation up to two dimensions, Laplace equation in two-dimensions, Heat conduction equations up to two-dimensions.

List of Experiments

1. MATLAB Fundamentals: Decisions – if statement, if-else, Input and Output.
2. To define Numerical functions of Several Variables (Two or Three Variables) in Matlab.
3. To Plot functions of Several Variables.
4. Graphing the polar coordinates in functions of Several Variables or the graphing the function over a given surface.
5. To plot the parametric representations of Surfaces.
6. To find derivatives, partial derivatives & directional derivatives of functions.
7. To find limit, continuity & differentiability of function of several variables.
8. To find Maxima & Minima of functions of Several Variables using Matlab and Lagrange's Multiplier Method.

9. To find gradient of a scalar field(through graph also)
10. To find directional derivatives, divergence & curl (through graph also)
11. To evaluate line integrals & surface integrals
12. To find the Fourier series expansion of a given periodic functions and plot the same
13. To find the Fourier Transform of given function

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi.

Reference Books:

1. R.K. Jain & S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, New Delhi.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & sons, New York.
3. M.D. Raisinghania, "Ordinary & Partial Differential Equations", S. Chand & Company, New Delhi.
4. Brian Hahn & Daniel Valentine, "Essential MATLAB for Engineers & Scientists", Academic Press, Oxford, UK.

Course Title/ Code	**COMMUNICATIVE ENGLISH (HLS102)**
Course Type:	Core (Allied)
Course Nature:	Soft
L-T-P-O Structure	(1-0-2-0)
Objectives	This course aims to take off from the threshold of the previous paper dealt in Semester I. Dealing extensively with requirements of Industry, the paper aspires to equip students with the nuances of technical writing, excellent communication flair and presentation skills. Eventually, the agenda is to bridge the gap between college and work-place.

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

Section A

LEXIS and SYNTAX :Homonym, Homophones, Words often confused, Foreign Words, s Sentence, Kinds of Sentence, Parts of Sentence, The Phrase, The Clause, Synthesis of Simple Sentence, Spotting the Errors (Articles, Pronoun, Preposition, Adjective, Verb)

Section B

Oral communication-II: Importance of Speech Sounds, IPA Symbols (Vowels and Consonants), Phonetic Transcription, Phoneme and Syllables.

Section C

Technical writing-II : Business Letters, Job Application and CV Writing, Paraphrasing, Punctuation, Situation Writing, Paragraph Writing, Developing Outlines.

Section D

Literature: Goodbye Party for Miss. Pushpa T.S.- Nissim Ezekiel; Why Scientists and Engineers Need Literature- Troy Camplin; The Time-MACHINE- H.G.Wells

LAB ACTIVITIES:

1. Exercise on Lexis.
2. Exercise on Syntax
3. Exercise on Spotting the Errors
4. One- Man Task
5. Role-Play Activities
6. Mock-Interview
7. Paragraph Writing
8. Situation Writing
9. Slogan Writing
10. Phonetic Transcription
11. Synthesizing Sentences
12. Presentation (Book Review/ Movie Review)

Suggested Text Readings:

1. High School English Grammar and Composition. Wren and Martin: S.Chand and Co.
2. A Textbook of English Phonetics for Indian Students. T.Bala Subhrmaniam: Macmillan
3. English Vocabulary in Use. MaCarthy: Foundation Books, OUP
4. English Grammar, Competition and Correspondenc. M.A. Pink and A.C.Thomas: S.Chand and Co.
5. Reading Between the Line: Students Book. MacRae: Foundation Books. CUP, New Delhi
6. Goodbye Party for Miss Pushpa T.S. Nissim Ezekiel. Modern Indian Literature; An Anthology, New Delhi
7. Why do Scientists and Engineers Need Literature. Troy Camplin. http://www.popecenter.org/commentaries/article.html?id=2830
8. Time Machine. H.G.Wells. Penguin Classics Literature. 2005 edition. Bombay.

Course Title/ Code	ENGINEERING DRAWING/GRAPHICS (MEW103)
Course Type:	Elective (Allied)
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3-0)
Objectives	To create and interpret sketches of engineering objects.

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

Section-A

Introduction to Engineering Drawing: Concept of Engineering drawing, drawing instruments, types of projections, first and third angle of orthographic projection, sheet layout, types of scales, types of lines & selection of line thickness, selection of pencils, importance of lettering. Projection of Points: Introduction, Projection of points in different quadrants. Projection of Line: Projection of straight line - parallel to one or both reference planes, inclined to the H.P. and/or V.P., the determination of their true lengths, the true inclination to the H.P. and V.P./traces of lines.

Section-B

Projection of Planes: Projection of planes - parallel to one reference plane/inclined to one plane but perpendicular to other/inclined to both reference planes. Projection of Solids: Types of solids - polyhedral & solids of revolution in simple position with axis perpendicular to a plane/with axis II to both planes/with axis II to one & inclined to other plane.

Section-C

Section of Solids and Development of Solids: Projection of section of polyhedra and solids of revolution, their true shape. Development of surface of polyhedra and solids of revolution, their truncated portions. Orthographic and Isometric Projections: Orthographic & isometric projections - introduction, isometric scale, isometric view of plane figures, solids. Orthographic projection from Isometric views.

Section-D

Introduction to Computer-Aided Designing: Basic commands - object selection methods, erase, move, copy, offset, fillet, chamfer, trim, extend, mirror; display commands: zoom, pan, redraw, and regenerate; simple dimensioning and text, simple exercises. Basics of 2-D and 3-D solid modeling, orthographic, iso-metric projection drawing and sectional views of simple machine elements.

Text Books:

1. N.D. Bhatt, Elements of Engineering Drawing, Charotar Publishing House, Anand
2. P.J. Shah, Engineering Drawing, S. Chand, New Delhi
3. P.S. Gill, Engineering Drawing and Drafting, Milenium Edition; S.K. Kataria & Sons
4. T. Jeyapoovanm, Engineering Drawing using AUTPCAD 2007, Vikas Publishing House

Reference Books:

1. M.B.Shah, B.C.Rana, Engineering Drawing, Pearsons
2. French & Vierck, Fundamentals of Engineering Drawing, McGraw-Hill
3. James A Leach, AutoCad 2008 instructor, TMHN New Delhi

Course Title/ Code	**IMAGE EDITING & ANIMATION (CSW207)**
Course Type:	**Open Elective**
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3-0)
Objectives	• The students will learn the skills to edit an image & create animation.

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

Section-A

Understanding Photoshop: Images & Types of Images, Image Size and Resolution, Creating a Digital Collage, Working with Files, Rulers and Guides, Changing Print Size of an Image.Working with Colors, Selections, Shapes and Painting , Adjusting Monitor Display, Converting between Color Modes, Softening and Refining Selections, Saving, Loading,

Deleting, Moving, Copying Pasting and Extracting Selections, Drawing with Pen Tool, Creating Brush, Filling and Stroking Selection and Layers. Transforming and Typing: Rotating, Cropping, and Flipping Images, Transforming Objects, Retouching and Liquefying, Leading and Kerning, Type Selection, Pasteurization, Text Wrapping.

Section-B

Working with Layers: Creating and Deleting Layers, Selecting, Grouping and Linking Layers, Moving Copying and Locking Layers, Merging Layers: Layer Effects and Styles, Adjustment and Fill Layers, Masking Layers. Designing Web Pages: Creating Slices, Image Maps, Rollover and Animation, Creating Slices for Rollovers, Applying and Creating Rollover Styles, Animation Twining, Working with Layers, and Optimizing Images.

Section-C

Flash: Introduction, Overview of tool, symbols, Simple Animation using Shape, Motion, Guided Twining and Frame by Frame Animation, Layers, Text Effect, Fade in- Fade out, Zooming Effect, Alpha Ripple Effect, Photo Effects: Simple photo effect, motion photo masking, Special Effect: outline effect, shape effect, onion peel effect, shading effect, masking. Flash Animation Using Text and Voice.

Section-D

Basics of Flash: Assigning Actions: Working with Actions Toolbox, Working with the Script Navigator, working with the Script Pane, Working with Formatting, Using Code Hinting, Help Panel. Coding, Working with Strings, Numbers and Booleans, Casting Data, Declaring and Naming Variables , Working with Operators, Using Comments: Working with Statements, Control statements, Array, Functions Introduction to Action Script Coding- Variables and its scope in flash, working with data type variables, Arithmetic operations with numbers and string data type, Conditional Logic: If Else, Switch Cases, Loops, Arrays and Functions. Event Handler.

LIST OF EXPERIMENTS:

1. Controlling your image and workflow using Photoshop.
2. Implementation of 2-D transformation using Photoshop.
3. Design a project using Masking, Image Manipulation and Layer Effects.
4. Create a Frame by frame animation.
5. Implementing the concept of layers.
6. Motion & Shape Tweening.
7. Guided Motion Tweening Concept.
8. Working with the Flash effects.
9. Create a simple animation in Flash with Actionscript.
10. Create a Form using Action Script.
11. Design the web page using Action Script.
12. Animated Project.

Text Books:

1. Shalini Gupta, Photoshop CS2-In Simple steps
2. Robert , Micromedia Flash 8 Bible

Reference Book:

3. Vikas Gubta & Kogent Solutions Inc. : Multimedia and Web Design.
4. Paul Marino : 3D Animation and Film making Using Game engines.

5. Antony Bolante : Adobe After effects 5 for windows After Indian edition 2002 Published by G.C. Jain for Techmedia.
6. Arena Animation: Image Editing using Photoshop.
7. Arena Animation: Animation using Flash.

Course Title/ Code	**HTML5 & CSS (CSW102)**
Course Type:	**Elective**
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%**

Section-A

INTRODUCTORY CONCEPTS: Internet, Intranet, Extranet, Web Browser and WWW, W3C, HTTP, Cookies, Session, IP Address, Domain Name, Web Server, website and webpage structure. Markup Language, HTML editor: Dreamweaver, Introduction to HTML tags: html, head, body, div, br, hr, p, text formatting, text styles, layouts, marquee, lists: ordered, unordered and definition lists, hyperlinks: http/https/ftp, images, images as hyperlinks, adding graphics, audio and video, table, Frames, iframes, color names, values & shades, HTML entities, symbols, charset, Forms.

Section-B

Intro HTML 5.0: What Is HTML5, History: A Little Retrospective, The WHATWG, Vision and Philosophy behind HTML5, HTML vs HTML5, Getting Started with HTML5: The State Of Browser Support, Structure of a Web Page: HTML5 DOCTYPE, Page Encoding, HTML5 Markup, New And Updated Elements, Structural Elements, New Attributes, Deprecated Elements And Attributes.

Section-C

HTML 5.0 Form, Graphics & Media: HTML5 DOM, Form: new input types & attributes, form validation, HTML canvas and SVG: Drawing shapes, Text & images, working with pixels, Embedding media**:** Audio and Video based On Plug-in, New Audio/Video Markup, Attributes And Methods, Audio/Video Events & Controls, Plug-ins in HTML inserting YouTube videos.

Section-D

CSS & CSS3: Introduction to CSS, Syntax, Selectors, Pseudo classes, Applying CSS to backgrounds, Text, Fonts, Links, Lists, Tables, Box Model: Border, Margin, Padding, Dimension, Display, Positioning, Align, CSS to Images and image Opacity, CSS Media Types, CSS Attr Selectors. CSS3: Introduction**,** Rounded Corners, Border Images, Backgrounds, Colors, Gradients, Shadows, Fonts and text effects, 2D transforms, 3D Transforms, Transitions & Animations.

List of labs:

Lab 1: HTML: Basic Tags
Lab 2: HTML: Graphics &Tables
Lab 3: HTML: Frames & Form**s**
Lab 4: HTML5.0: Basic Tags
Lab 5&6: HTML5.0: DOM & Forms
Lab 7: HTML: Canvas &SVG
Lab 8: HTML: Media
Lab 9: HTML: API's
Lab 10, 11, 12: CSS
Lab 13, 14: Minor Project

Text Books:

1. Pro HTML5 and CSS3 Design Patterns Paperback – 2012 by Dionysios Synodinos, Michael Bowers, Victor Sumner
2. Murach's HTML5 and CSS3 Paperback – 2012 by Zak Ruvalcaba
3. Dive Into HTML5 by Mark Pilgrim.

Reference Book:

1. Hello! HTML5 & CSS3: A user-friendly reference guide Paperback by Rob Crowther.
2. HTML5 Guidelines for Web Developers by Klaus Förster.

Course Title/ Code	**ENVIRONMENTAL SCIENCE (CHH137)**
Course Type:	University Compulsory

Course Nature:	Soft
L-T-P-O Structure	(3-0-0-1)
Objectives	• to make the student identify the areas of environmental degradation • to make the student identify the impact of environmental degradation on the surroundings • to apply the concepts such as sustainable development in real life. • to help the engineering student to correlate his field with various aspects of environment.

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

SECTION A

SCOPE & IMPORTANCE OF EVS: Definition and Scope of Environmental Sciences, Importance of EVS in Various Branches of Engineering & Sciences: Computer Science and Technology, Mechanical Engineering, Electronics & Communications Engineering, Civil Engineering and Applied Sciences.

SECTION B

ECOSYSTEM DYNAMICS: structure and functions of ecosystem: Trophic Level, Food Chain, Food Web, Ecological Pyramids, Energy Flow, Biogeochemical Cycles, Ecological Succession: Basic Concept, Types, Stages. Types of ecosystems: Aquatic Ecosystem (Lake), Terrestrial Ecosystem (Grassland). Biodiversity: Hot Spots, Threats, In Situ and Ex Situ Conservation, population and its characteristics: Population Growth, Age Structure Pyramids.

SECTION C

POLLUTION PREVENTION AND SUSTAINABILITY: Air pollution: Sources of Air Pollution, Methods of Monitoring and Control of Air Pollution. Effect of Air Pollution on Human Beings, Plants, Animals, Materials and Atmosphere. Photochemical Smog, Ozone Layer Depletion, Green House Effect, Acid Rain.
Water pollution: Sources and Consequences of Water Pollution, Physio-Chemical and Biological Monitoring of Water Quality (TDS, TSS, BOD, COD). Eutrophication. Soil pollution: Control Measures, Over Usage of Chemical Pesticides, Bio- Magnification. Sustainable development: Definition, Energy Conservation In Agriculture And Industrial Sectors, Smart City Concept, Petro-Crops.

SECTION D

ENVIRONMENTAL TECHNIQUES & ASSESSMENT: Flame Photometry, Paper Chromatography, Remote Sensing and its Applications, Role of GIS in Disaster Management. Statistical Analysis: Mean, Median, Mode, and Standard Deviation Environmental Impact Analysis (EIA): Aims & Objectives, ISO- 14000 and ISO- 18000 Standards and Certification, National Green Tribunal Act, Environmental Priorities in India and Environmental Regulations for Small and Large Scale Industries.

FIELD VISITS & PROJECT WORK

- Visit To Waste Water Treatment Plants & Report.
- Visit To Any Industry For Pollution Control Methods & Report.
- Vermicomposting & Solid Waste Management Techniques.
- A Report On Biodiversity In Campus And Their Different Uses.

LIST OF PRACTICALS:

1. To analyse the TDS, TSS in given sample of water.
2. To determine BOD in a water sample.
3. To determine COD in water sample.
4. To analyse a sample for metal ions using flame photometer.
5. To separate the components in a mixture using paper chromatography.
6. To study vegetation abundance and frequency of an ecological sample using quadrant method.
7. Calculate mean, mode, median of the given data.
8. Calculate standard deviation of the given data.
9. To study the various acts: Wildlife Protection Act 1972, The Water (Prevention and Control of Pollution) Act 1974, Prevention and Control of Air Pollution Act 1981, Forest Conservation Act 1981, Environment (protection) Act 1986, Hazardous waste (Management and Handling) Rules, 1989, Bio-Medical Waste (Management and Handling) Rules, 1998.
10. Case studies of eco-marketing: kfc, coca cola, mc d, tropicana, nestle, ceres fruit juice (methodologies for sustainable environment & advantages).
11. Herbarium preparation of biodiversity in a given sample area.
12. To study the efficacy of different bioadsorbents: saw dust, vegetable waste, fruit peels, tea waste.
13. Air sampling and its quality analysis.

Reference Books:

1. Sarita Sachdeva, Environmental Studies, M.R. Pub. House
2. Kaushik & Kaushik, Perspectives in Environmental Studies , New age international publishers Ltd.-New Delhi
3. J.P. Sharma, Comprehensive Environmental Studies, Laxmi Pub.
4. Erach Bharucha, Text Book of Env. Studies, Universities Press
5. John Grant, The Green marketing Manifesto, Wiley Pub.
6. Shashi Chawla, Text Book of Env. Studies, Mc Graw Hill Pub.
7. www.haryana-online.com

Course Title/ Code	**Spanish (FLS105)**
Course Type:	**University compulsory**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
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

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

Section-A

- Introduction of Colours
- Vocabulary related to clothes and wardrobe
- Difference between verbo SER and ESTAR
- Usage of SER and ESTAR with similar adjectives

Section-B

- Introduction of verbo HABER
- Usage of verbo HABER
- Demonstrative adjectives
- Usage of demonstrative adjectives

Section-C

- Type of living and vocabulary related to living
- Counting upto 1000

Section-D

- Introduction of verbo TENER
- Usage of verbo TENER
- Vocabulary related to the family and marital status

Reference Book: Aula internacional 1, Modern Spanish Grammar

Course Title/ Code	**German (FLS106)**
Course Type:	**University compulsory**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
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

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

SECTION - A

- **Ordinal & Cardinal numbers**
- **Months, days, and Feiertage**

SECTION - B

- **Verbs: to be and to have**
- **Vocabulary (Family) short essay on family, friends etc.**

SECTION - C

- **Vocabulary (classroom)**
- **Definite and indefinite articles**

SECTION - D

- **Countries, languages, directions**
- **Past of the verb 'to be'**

Reference Book: 1. Studio D A1, Cornelsen Verlag

2. Tangaram A1

Course Title/ Code	**French (FLS107)**
Course Type:	**University compulsory**
Course Nature:	Soft

L-T-P-O Structure	(1-1-0-0)
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

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

Section-A

- Countings (0-1000)
- Timings
- Seasons & expressions

Section-B

- Colours
- Les pluriels
- Adjectives to describe a person
- Professions

Section-C

- Short essay on family & friend
- Les verbes S'appeler & Se presenter

Section-D

- Prepositions
- Asking & telling the way

ECU01- Semester-III

SUBJECT CODES	SUBJECT NAME	**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
ECH206-T	ELECTROMAGNETIC FIELD & WAVES	EC	HARD	CORE	3	1	0	0	4	4
ECH206-P	ELECTROMAGNETIC FIELD & WAVES LAB				0	0	2	0	2	1
ECH207-T	PRINCIPLES OF DIGITAL ELECTRONICS & CIRCUIT DESIGN	EC	HARD	CORE	3	1	0	0	4	4
ECH207-P	PRINCIPLES OF DIGITAL ELECTRONICS & CIRCUIT DESIGN LAB				0	0	2	0	2	1
ECH208-T	SIGNALS & SYSTEMS	EC	HARD	CORE	3	1	0	0	4	4
ECH208-P	SIGNALS & SYSTEMS LAB				0	0	2	0	2	1
MAH207-T	MATHEMATICS-III	MA	HARD	CORE	3	1	0	0	4	4
MAH207-P	MATHEMATICS-III LAB				0	0	2	0	2	1
ECW209	PCB DESIGNING	EC	WORKSHOP	ELECTIVE	0	0	3	0	3	2
CDO201	Professional Competancy Enhancement-I	CDC	OUTCOME	SOFT	0	0	0	1	1	1
RDO201	INTRODUCTION TO RESEARCH	RESEARCH	OUTCOME	SOFT	0	0	0	1	1	1
CHS234	SUSTAINABILITY STRATEGIES (PURDUE UNIVERSITY)	CS	SOFT	ELECTIVE(HUMANITIES BASKET)	1	0	2	0	3	2
FLS211	FRENCH-III	MRCFL	SOFT	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS209	SPANISH-III									
FLS210	GERMAN-III									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**14**	**5**	**13**	**2**	**34**	**25.5**

DETAILED SYLLABUS
ECU01 –THIRD SEMESTER

Course Title/ Code	**ELECTROMAGNETIC FIELDS & WAVES (ECH206-T, ECH206-P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	To provide the basic skills required to understand, develop, and design various modern engineering applications involving electromagnetic fields and waves such as wireless, guided wave (fiber optics, Microwave etc.).

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

Section A

Elements of Vector Calculus: Coordinate systems and transformation, Vector calculus: Differential length, Area and volume, Line surface and volume integrals, Del operator, Gradient of a scalar, Divergence of a vector and divergence theorem, Curl of a vector and Stoke's theorem, Laplacian of a scalar.

Section B

Electrostatics: Properties of materials, Convection and conduction currents, Polarization in dielectrics, Dielectric constants, Continuity equation and relaxation time, Boundary condition. Electrostatic boundary value problems, Poisson's and Laplace's equations, General procedure for solving Poisson's or Laplace's equations, Method of images/Uniqueness theorem. Magnetostatics: Application of ampere's law, Magnetic flux density, Maxwell's equation, Maxwell's equation for static fields, Magnetic forces, Materials and devices, Forces due to magnetic field, Magnetic torque and moment, Magnetization in materials, Magnetic boundary conditions.

Section C

Time Dependent Fields & Waves: Displacement current, Maxwell's equation in final form, Time-varying potentials, Time-harmonic fields. Waves in general, Plane waves in free space, Wave propagation in lossy dielectrics, Plane waves in lossless dielectrics, Plane waves in good conductors, Power and Poynting vector, Reflection of a plane wave in normal incidence, Reflection of a plane wave at oblique incidence.

Section D

Transmission Lines: Transmission line parameters, Transmission line equations, Smith chart; Input impedance, SWR and power, S-parameters, Some applications of transmission lines, Transients on transmission lines, EM spectrum.

List of Experiments: (All Experiments performed with the help of **"vlab**.co.in"**)**

1. Coulomb's Law

The main objectives of this experiment are the following:
1. To Verify the Inverse Square Law: F ~ 1/R2
2. To Verify the Force and Charge Relationship: F ~ q1q2
3. To Determine Coulomb's constant: k for free space.
4. To measure the force on a charge due to multiple charges.

2. Electrostatic Fields I

The main objectives of this experiment are the following:
1. To measure the electric field due to a point charge at any point in the space. Plot the graph of electric field as a function of distance and charge. Also observe the distribution of electric field as a function of distance.
2. To measure the electric field due to a uniformly distributed infinite line charge at any point in the space. Plot the graph of electric field as a function of distance and line charge density. Observe the difference between the plots of point charge. Also observe the distribution of electric field as a function of distance.
3. To measure the electric field due to a uniformly distributed finite line charge at any point in the space. Plot the graph of electric field as a function of distance and line charge density. Observe the difference between the plots of infinite line charge.

3. Electrostatic Fields II

The main objectives of this experiment are the following:
1. To measure the electric field due to a infinite surface charge at any point in the space. Plot the graph of electric field as a function of distance and surface charge density.
2. To measure the electric field due to a uniformly distributed volume charge at any point in the space. Plot the graph of electric field as a function of distance and volume charge density.
3. To measure the electric field due to a spherical conductor. Plot the graph of electric field as a function of distance. Observe the difference between the plots of volume charge. Also observe the distribution of electric field as a function of distance

4. Boundary Conditions

The main objectives of this experiment are the following:
To determine change in Electric field and Flux density and refracted angle when a wave travels from one medium to other which have relative dielectric constant ε_{r1} and relative dielectric constant ε_{r2}.

5. Electric Field in Material Space

The main objectives of this experiment are the following:
1. To measure the electric field inside a conductor.
2. To measure the polarization and electric fields at various distances inside a dielectric due to a charge placed at center.

6. Magnetostatic Fields

The main objectives of this experiment are to determine magnetic field intensity at various points due to:
1. To calculate the magnetic field at a point in space due to finite line current.
2. To calculate the magnetic field at a point in space due to infinite line current
3. To calculate magnetic field due to a infinite current sheet.
4. To calculate magnetic field due to two parallel infinite current sheets

7. Application of Faraday's Laws

The main objectives of this experiment are the following:
1. Estimate EMF when a bar magnet moves through a stationary loop.
2. Estimate EMF when a loop rotates in constant magnetic flux
3. To relate the EMF applied and the speed of loop placed in a magnetic field

8. Wave Propagation

The main objectives of this experiment are the following:

1. To observe the propagation of wave in various materials
2. To measure the amplitude of E field at a particular location in space or any material as time varies.

9. Distance and Altitude Measurement

The main objectives of this experiment are the following:
1. To determine the distance between two flying objects i.e. planes by sending and receiving the waves from one planes.
2. To determine the altitude of the plane from the ground.

10. Plane Waves- Reflection and Refraction

The main objectives of this experiment are the following:
1. To find out how a wave travels from one material to another.
2. To find out how a parallel polarized wave gets reflected and transmitted at boundary.
3. To find out how a perpendicular polarized wave gets reflected and transmitted at boundary.

4. To calculate and observe the critical angle in both the cases.

Lab project by students (Phenomenon of Electromagnetic Fields & Waves).

Text Books:

1. M. N. O. Sadiku, Elements of Electromagnetic, 4th Ed, Oxford University Press
2. K. G. Balmain and E. C. Jordan, Electromagnetic Waves and Radiating Systems, 2nd edition PHI

Reference Books:

1. W. H. Hayt, J. A. Buck and M J Akhtar, Engineering Electromagnetics, 8th edition TMH
2. David K. Cheng, Electromagnetic Fields and Waves, 2nd Edition
3. Fawwaz T. Ulaby, Fundamentals of Applied Electromagnetics, 6th Edition.
4. Karl E. Lonngrenn et al, Engineering Electromagnetics, 2nd Edition.

Course Title/ Code	**PRINCIPLES OF DIGITAL ELECTRONICS & CIRCUIT DESIGN (ECH207-T, ECH207-P)**
Course Type:	Core (Departmental)

Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	To design combinational and sequential circuits optimally as per the desired specifications.

	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

Memory and Programmable Logic Devices: RAM, ROM, PROM, PLA, PAL, FPGA, CPLD, Digital Logic Families: Switching mode operation of p-n junction, Bipolar and MOS devices, Bipolar logic families: RTL, DTL, DCTL, HTL, TTL, ECL, MOS and CMOS logic families, Tristate logic, interfacing of CMOS and TTL families.

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 & Adder as Subtractor
6. Design of Arithmetic Logic Unit (ALU)
7. Design a binary to gray code converter and BCD to excess-3 converter
8. Design of Combinational circuits- MUX and DEMUX.
9. Analysis of basic flip-flops. Design a shift register using flip-flops
10. Design a modulus N counter and a ring counter
11. Mini Project

Text Books:

1. M. Morris Mano and M. D. Ciletti, Digital Design, 4th Edition, Pearson Education
2. 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

Course Title/ Code	**SIGNALS AND SYSTEM (ECH208-T, ECH208-P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	Students will be able to analyze various types of signals in their frequency domain mathematically.

	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, Sampling: sampling theorem, aliasing, signal reconstruction, continuous time and discrete time convolution.

Section B

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.

List of Experiments:

1. a) Introduction to MATLAB and signal processing toolbox.
   b) WAP to generate and visualize the following functions using MATLAB: impulse function, unit step, unit ramp, exponential, sinusoidal, cosine signal & sinc function.
2. WAP to generate and visualize, 1.5 seconds of a 50 Hz saw tooth & square wave with a sample rate of 10 kHz.
3. WAP to generate and visualize, 2 seconds of a triangular & rectangular pulse with a sample rate of 10 kHz and a width of 20 ms.
4. WAP for checking linearity, causality and stability of various systems.
5. WAP to explain the sampling process, aliasing effect and reconstruction of the c-t signal.
6. WAP to find convolution of two sequences, verify the result mathematically.
7. Write a program to determine and plot the CTFT of a signal and its Inverse. Plot frequency response also.
8. Write a program to determine and plot the DTFT of a signal and its inverse. Plot frequency response also

9. Write a program to compute Laplace transform, its inverse and verify its properties
10. Write a program to compute Z- transform, its inverse and verify its properties.
11. Write a program to solve given difference equation using Z-transform.
    $y[n]+0.5y[n-1]+2y[n-2]=0.9^{n}u[n]$, $y[n]=0$, $n<0$
12. Given the difference equation representation of a LSI system, obtain the impulse response and step response
13. Mini Project

Text Books:

1. V Oppenheim, A S Willsky and S Hamid Nawab, Signals & System, Pearson Education, Second Edition, 2003
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
2. P. Ramesh Babu, R. Ananda Natarajan, Signals And Systems, SciTech publications

Course Title/ Code	**MATHEMATICS-III (MAH207-T, MAH207-P)**
Course Type:	Core (Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Pre-requist	MATHEMATICS-II
Objectives	The students would be able to apply the concepts of function of several variables, statistical techniques, Z- transforms and linear programming required for solving the mathematical problems and their applications.

Syllabus	**Sections**	**Weightage**

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

Section A

Functions of complex variable: Function of a complex variable, limit, continuity and differentiability of a complex function, Analytic function, C-R equations, Necessary and sufficient conditions for an analytic function, Harmonic functions and their applications.
Line integral in a complex plane, Cauchy's integral theorem and Cauchy's Integral formula. Zeroes and singularities of an analytic function, Taylor series , Laurent's series Residues , Residue Theorem and its use in evaluation of complex integrals and Evaluation of Real Integrals. [1. Integral of rational function of $\cos\theta$ & $\sin\theta$ over (0, 2π) 2.Improper integral of rational functions.]

Section B

Z-transforms: Introduction, Basic Theory of Z-transforms, Z-transforms of various sequences, existence of Z-transforms, Properties of Z-transforms, Inverse Z transforms, differentiation of Z -transforms, Convolution of sequences, solution of difference equations using Z-transforms.

Section C

Statistical techniques: Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, fitting of straight lines, Polynomials, Exponential curves, Correlation, Linear, non –linear and multiple regression analysis, Binomial, Poisson and Normal distributions, Tests of Significance: Chi-square test, t-test& F-test.

Section D

Linear programming problem: Linear programming problems formulation, solving linear programming problems using (i) Graphical method (ii) Simplex method (iii) Dual simplex method.

List of Experiments:

1. To plot the complex variable functions and analyze the graph.
2. To perform contour integrals.
3. To locate the Zeroes, Poles and computation of residues of a complex variable functions.
4. To find the Z-Transform of a sequence (Discrete time signal).
5. To find the Inverse Z-Transform and plot the graph.
6. To solve Difference equation by MATLAB and plot the solution.
7. To solve the LPP involving the inequality constraints.
8. To solve the LPP involving the equality constraints.
9. To solve the LPP using the Simplex method.
10. To fit a straight line by the method of Least squares.

11. To find correlation coefficient for the given data.
12. To find the regression coefficients and equations of regression lines.
13. To find the value of t- variate for the given sample.
14. To find the value of F- variate for the given sample.

Text Books:

B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi.

Reference Books:

1. R.K. Jain & S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, New Delhi.
2. Erwin Kreyszig, " Advanced Engineering Mathematics", John Wiley & sons, New York.
3. James Brown & Ruel Churchill,"Complex variables &Applications", McGraw-Hill.
4. J K Sharma, "Operations Research: Theory and Applications", Macmillan.
5. William W. Hines, Douglas C. Montgomery, David M. Goldman, "Probability and Statistics in Engineering", Wiley India Private Limited.
6. Brian Hahn & Daniel Valentine, "Essential MATLAB for Engineers & Scientists", Academic Press, Oxford, UK.

Course Title/ Code	**PCB DESIGNING (ECW209)**
Course Type:	Core (Departmental)
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3)
Objectives	Design and analysis of digital and analog circuits using design software.

List of Experiments:

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	**Sustainability Strategies – PURDUE UNIVERSITY(CHS234)**
Course Type:	**University compulsory**
Course Nature:	Soft
L-T-P-O Structure	(1-0-2-0)
Objectives	The objective of the course is to equip the students with a vision to develop business approaches that create long-term social value (as opposed to stockholder, stakeholder, environmental or corporate social responsibility biases) by embracing opportunities and managing risks.

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

MODULE 1: INTRODUCTION TO SUSTAINABILITY, THE PLANET ASPECT, AND VARIOUS CONCEPTS AND TRADEOFFS

Learning Objectives: Define sustainability, analyze why sustainability is a lucrative strategy for firms, and assess the past, present, and future of sustainability constructs.
Lectures:
L 1.1: Introduction to the Course
L 1.2: Corporations

Learning Objectives: Introduce the concept of integrated reporting and analyze the role of reporting in helping a company to create a sustainable strategy.
Lectures:
L 2.1: Sustainability and Novo L 2.2: Sustainability News
L 2.3: Novo and the PPP Model

Learning Objectives: Compare and contrast the two aspects of "Planet."
Lectures:
L 3.1: Operationalize Sustainability L 3.2: Sustainability in the News
L 3.3: Energy and Sustainability
L 3.4: Companies and Sustainability

Learning Objectives: Differentiate social and financial objectives and tradeoffs, as well as analyze the environment stewardship program at REI, its objective, and philosophy of implementation.
Lectures:
L 4.1: Sustainability and the Planet
L 4.2: Sustainability and the News L 4.3: Strategy

MODULE 2: PROFIT AND COST SAVING | PEOPLE, TRENDS, AND STRATEGY OF SUSTAINABILITY
Learning Objectives: Assess the direct connection between sustainability and profitability as well as view the examples of companies who purport connection.
Lectures:
L 5.1: Profit
L 5.2: Concepts
L 5.3: Sustainability Externalities

Learning Objectives: Explain the integration of assessment of sustainability savings in the LBO industry, how LBO industry can contribute to sustainability, and how sustainability initiatives often lead to cost savings and increased profitability.
Lectures:
L 6.1: Sustainability Concepts in Business Models
L 6.2: Situational Outlook on Sustainability
L 6.3: KKR

Learning Objectives: Identify what constitutes "People" vis-à-vis Sustainability, the trends in "People" aspects, and consider those trends.
Lectures:
L 7.1: People Component of the Three P's
L 7.2: Creating Shared Value
L 7.3: People Aspect of Public Statements by Companies

Learning Objectives: Analyze incorporating sustainability into participatory strategy and decision making as well as how Allied Electronics embedded sustainability into their strategy.
Lectures:
L 8.1: National Sustainability
L 8.2: Altron
L 8.3: Compensation within Sustainability

MODULE 3: REALMS, TRENDS, AND TOOLS OF SUSTAINABILITY

Learning Objectives: Introduce trends and tools in the sustainability realm and describe the importance of marketing vis-à-vis sustainability.

Lectures:

L 9.1: Sustainability Strategies

L 9.2: Can Marketing be a Sustainable Concept? L 9.3: Student Presentation – Disney

L 9.4: Student Presentation – Foxconn

L 9.5: Student Presentation – The Body Shop

L 9.6: Student Presentation – Fiji Water

Learning Objectives: Explain how Interface levered its sustainability efforts into a lucrative revenue stream and assess being proactive vice meeting letter of the law in sustainability.

Interface

Lectures**:**

L 10.1: Twitter Chatter and Company Sustainability

L 10.2: InterfaceRAISE and Ray Anderson

L 10.3: Putting a Face to Sustainability

MODULE 4: FUTURE OF SUSTAINABILITY AND COMPANY IMPLEMENTATION

Learning Objectives: Describe where the concept of sustainability is headed as well as concepts you may be able to use in your own business/company.

Lectures:

L 11.1: Future Sustainability Trends

L 11.2: Sustainability Trends

L 11.3: Student Presentation – Closed Loop Manufacturing

L 11.4: Student Presentation – Social Sustainability

L 11.5: Student Project – Future of Sustainability

L 11.6: Reviewing and Speaking about Previous Student Projects

Learning Objectives: Appreciate how Dow embedded sustainability into its DNA, and analyze how a company has evolved its sustainability strategy over time.

Lectures:

L 12.1: DOW and Sustainability

L 12.2: Trends and DOW

L 12.3: President Obama and Sustainability

MODULE 5: B-CORPS

Learning Objectives: Compare and contrast different corporate structures and assess what is going on in the B-Corp world and the impact on sustainability.

B-CORPS

Lectures:

L 13.1: B-Corps

L 13.2: B-Corps (continued – 1)

L 13.3: Sustainability and Transparency
L 13.4: B-Corps (continued – 2)

Learning Objectives: Evaluate the impact of current social media trends on Sustainability Strategies and the impact of popular internet/social media sites on power consumption and the implications, and open up discussion on society's obligations in the area of sustainability as well as corporations et al.
Lectures:
L 14.1: Industry and Sustainability
L 14.2: Power and Sustainability

EVALUATION SCHEME: The students undergo continuous evaluation system. Each lecture culminates in to a quiz/an assignment. The weightage of the assignments is 60%. The weightage of the final exam conducted at the end of the course is 40%. Then student must get 70% marks in total (assignments - 60% & final exam - 40%) in order to quality the course. On qualifying, the students would be awarded with the certificate by Purdue university under Purdue NExT programme and the digital badge (which can be uploaded on the social media profiles like LinkedIn, etc.)

Course Title/ Code	**French (FLS211)**
Course Type:	**University compulsory**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
Objectives	At the end of the course, students will be able to 1. Ask and clearly tell their nationalities and identify the names of different countries in French. 2. Write and read a post card entailing simple information. 3. Learn Basic vocabulary that can be used to discuss about different countries, people, nationalities, countries, etc 4. Express their likes and dislikes. Also will have understanding of simple conversations in restaurants and how to order food and drinks. 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. Exchange personal information like name, number, residence, profession, etc 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.

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

	C	25%
	D	25%
	TOTAL	**100%**

Section-A

- Les noms du pays
- Nationalities

Section-B

- Names of the places
- Writing a post card

Section-C

- Talking & expressing liking & dislikings
- Ordering food at a restaurant

Section-D

- Les articles contractes “À” et “De”
- Giving& Asking Personal Informations
  Like-

1. name
2. age
3. residence
4. nationality
5. profession
6. email address
7. languages spoke
8. Telephone

Course Title/ Code	**German (FLS210)**

Course Type:	**University compulsory**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
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

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

SECTION A

- **Types of houses – apartment, bungalows etc.**
- **Vocabulary (Household)**

SECTION B

- **Accusative case**
- **Possessive pronouns**

SECTION C

- **Time, daily routine**
- **Make appointments**

SECTION D

- **Letter writing**

Reference Book: 1. Studio D A1, Cornelsen Verlag
2. Tangaram A1

Course Title/ Code	**Spanish (FLS209)**
Course Type:	**University compulsory**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
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 possessives 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., domestic animals, climate and festivals) 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 the weather, talk about birthdays and festivals using the present tense of verbs 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

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

Section-A

- Possessive adjective and its use
- Vocabulary related to home and living
- Vocabulary related to domestic animals

Section-B

- Demonstrative adjective and its use
- Introduction to climate
- Vocabulary related to climate
- Vocabulary related to birthdays and festivals

Section-C

- Introduction of dates
- Days in a week
- Months in a year

Section-D

- Introduction of present form of AR ending verbs
- Introduction of present form of ER ending verbs
- Introduction of present form of IR ending verbs

Reference Book: Aula internacional 1, Modern Spanish Grammar

ECU01- Semester-IV

SUBJECT CODES	SUBJECT NAME	**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
ECH210-T	ANALOG & DIGITAL COMMUNICATION	EC	HARD	CORE	3	1	0	0	4	4
ECH210-P	ANALOG & DIGITAL COMMUNICATION LAB				0	0	2	0	2	1
ECH211-T	NETWORK ANALYSIS & SYNTHESIS	EC	HARD	CORE	3	1	0	0	4	4
ECH211-P	NETWORK ANALYSIS & SYNTHESIS LAB				0	0	2	0	2	1
ECH212-T	ANALOG INTEGRATED CIRCUITS	EC	HARD	CORE	3	1	0	0	4	4
ECH212-P	ANALOG INTEGRATED CIRCUITS LAB				0	0	2	0	2	1
ECH213-T	ELECTRONIC MEASUREMENT & INSTRUMENTATION	EC	HARD	CORE	3	1	0	0	4	4
ECH213-P	ELECTRONIC MEASUREMENT & INSTRUMENTATION LAB				0	0	2	0	2	1
CDO202	Professional Competancy Enhancement-II	CDC	OUTCOME	CORE	0	0	0	1	1	0.5
RDO202	TECHNICAL SEMINAR-I	RESEARCH	OUTCOME	CORE	0	0	0	1	1	1
EDS288	APPLIED PHILOSOPHY	ED	SOFT	ELECTIVE (HUMANITIES BASKET)	1	0	2	0	3	2
EDS289	APPLIED PSYCHOLOGY									
EDS290	APPLIED SOCIOLOGY									
ECW216	LABVIEW	EC	WORKSHOP	ELECTIVE	0	0	3	0	3	2
CSW204	DATA STRUCTURES	CS								
CSW208	SCRIPTING LANGUAGES	CS								
FLS215	FRENCH-IV	MRCFL	SOFT	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS213	SPANISH-IV									
FLS214	GERMAN-IV									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**14**	**5**	**13**	**02**	**34**	**25.5**

DETAILED SYLLABUS
ECU01 –FOURTH SEMESTER

Course Title/ Code	**ANALOG & DIGITAL COMMUNICATION (ECH210-T, ECH210-P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	• Understand the design tradeoffs and performance of communications systems • Evaluate the noise produced by various sources and its effect on communication signals • Demonstrate the output of modulation techniques on MATLAB • Compare the distinctive features of a PCM signal with and without companding • Assess the channel capacity by studying constellation diagrams of digital modulation 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 compander, 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.

List of Experiments:

1. Introduction to communication toolbox and observe the waveforms of various signals in Simulink
2. (a) (i) Develop a AM modulator and Demodulator Circuit for given data using MATLAB.
   (ii) Plot the graph for modulated & demodulated output.
   (b) (i) To generate a DSB-SC signal for given data using MATLAB
   (ii) Plot the graph for modulated & demodulated output.
3. (i) To generate a SSB-SC signal for given data using MATLAB
   (ii) Plot the graph for modulated & demodulated output.
4. (i) Develop a FM modulator and Demodulator Circuit for given data using MATLAB.
   (ii) Plot the graph for modulated & demodulated output.
5. To modulate and demodulate Frequency modulation signals using voltage controlled oscillator on trainer kit.
6. To modulate and demodulate AM signals and calculate the modulation index using on trainer kit.
7. To generate the PAM/PWM/PPM signals on trainer kit and observe the waveforms on CRO
8. To generate Analog TDM for at least 4 channels on trainer kit and observe the waveforms on CRO
9. To generate pulse code modulation signal on trainer kit observe the waveform on CRO.
10. To generate ASK, FSK and PSK signals using trainer kit and observe the waveform on CRO
11. Mini project

Text Books:

1. B P Lathi and Zhi Ding, Modern Digital and Analog Communication Systems, Oxford
2. Simon Haykins, Communication systems (4th ed), John wiley & sons.

Reference Books:

1. Kennedy, Electronic Communication systems, TMH.
2. Frenzel, Communication Electronics, TMH.

3. Singh and Sapre, Communication Systems, TMH
4. Herbert Taub and Donald Shilling, Principle of communication systems, Tata McGraw-Hill

Course Title/ Code	**NETWORK ANALYSIS AND SYNTHESIS (ECH211-T, ECH211-P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	To analyze and synthesize electrical networks from given input and to generate desired output.

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

Section A

Introduction: Introduction to basic signals and systems, Thevenin's and Nortons's theorem, Superposition theorem, Reciprocity theorm, Millman's theorm, 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 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, all 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 network, 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, Mc Graw Hill Education.
2. D Roy Choudary, Network and Systems, New Age International.

Reference Books:

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

Course Title/ Code	**ANALOG INTEGRATED CIRCUITS (ECH212-T, ECH212-P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Pre-requist	ELECTRONIC DEVICES & CIRCUITS
Objectives	Analysis, design and development of circuits and sub-systems for Analog Signal Processing

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

Section A

BJT Single Stage Amplifiers: BJT as an amplifier and switch, BJT circuits at DC, Biasing in BJT amplifier circuits, Small-signal operation and models, Discrete circuit BJT amplifiers, Internal capacitances and high frequency model, Frequency response of CE amplifier, MOSFET single stage amplifiers, MOSFET as an amplifier and a switch, MOSFET circuits at DC, Biasing in MOSFET amplifier, Small signal operation and models, Basic MOSFET amplifier configuration, Internal capacitances and high frequency models, Frequency response of CS amplifier.

Section B

Feedback Amplifiers (FBA): General feedback structure, Properties of negative feedback, Four basic feedback topologies, Series-Shunt FBA, Series-Series FBA, Shunt-Shunt FBA and Shunt-Series FBA, Determining the loop gain. Differential Amplifiers: MOS differential pair, **S**mall signal operation of the MOS differential pair, Other non-ideal characteristic of the differential amplifier (DA), Frequency response of the DA

Section C

Op-Amp: Ideal Op-Amp, Inverting and non-inverting configurations, Difference and instrumentation amplifier, Effect of finite open loop gain and bandwidth on circuit performance, Large signal operation of Op-Amp, DC imperfections, Integrators and differentiator, Logarithmic and antilogarithmic amplifier, Analog multiplier, Sample and hold Circuit. Oscillators: Basic principle of sinusoidal oscillators, Op-Amp RC oscillator circuits: Wien bridge, Phase shift, LC and crystal oscillators.

Section D

Filters: Filter transmission, Types and specification, Filter transfer function, First-order and second-order filter functions, Second order LCR resonator, Realization of LP, HP, BP, all pass and notch function using LCR resonator. Power Amplifiers: Classification of output stages, Class-A output stage, Class-B output stage, Class-AB output stage, Class-C output stage, Class-D power amplifier

List of Experiments:

1. Implementation of voltage divider biasing of a BJT.
2. Design and implementation of a single stage RC coupled amplifier using BJT and determine its R_{in}, Ro and gain-frequency response to meet given specification.
3. Design and implementation of a single stage CS amplifier using MOSFET and determine its R_{in}, Ro and gain-frequency response to meet given specification.
4. Design and implementation of a two stage RC coupled amplifier using BJT and determine its R_{in}, Ro and gain-frequency response to meet given specification.
5. To design a BJT voltage-series feedback amplifier and determine its gain, frequency response, input and output resistance with and without feedback.
6. To design a BJT current-shunt feedback amplifier and determine its gain, frequency response, input and output resistance with and without feedback.
7. To design a MOS differential amplifier and plot its frequency response.
8. Design and testing of op-amp applications (a) Inverting, (b) Non-inverting (c) Summing (d) Integrator (e) Differentiator.
9. Design and testing of op-amp applications (a) Difference Amplifier (b) Instrumentation Amplifier.
10. Design and testing of a RC phase shift oscillator to meet given specification using op-amp.
11. Design and testing of a LC- Hartley and Colpitts oscillator to meet given specification using op-amp.

12,13. Mini project.

Text Book:

1. Sedra & Smith, Microelectronic Circuits, 6th Edition, Oxford University Press

Reference Books:

1. Anant Agrawal, Foundations of Analog and Digital Circuits, Elsevier
2. Coughlin & Driscoll, Operational Amplifiers and Linear Integrated Circuits, Longman Higher Education

Course Title/ Code	**ELECTRONIC MEASUREMENT & INSTRUMENTATION (ECH213-T, ECH213-P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	The students will be able to select and deploy instruments for measurement and control of physical quantities.

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

Section A

Instrumentation Scheme & Characteristics: Generalized instrumentation systems- Units & standards, Calibration methods, 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: Introduction of CRO, Cathode ray tube, Block diagram of CRO, Electrostatic deflection, Time base generators, Measurement of phase, voltage and frequency using CRO, Basic CRO circuits, Dual trace and dual beam oscilloscope, Sampling and storage oscilloscopes.

Section B

DC & AC Measurement: 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 instruments: Electronic voltmeter, Electronic multimeter, 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.

Section C

Signal Generators & Analyzers: Sweep frequency generator, Frequency synthesized signal generator & Function generator, Pulse generator, Wave analyzer and its types, Harmonic analyzer and its types, Spectrum analyzer. Display devices: Nixie tube, LED & LCD, Discharge devices.

Section D

Transducers & Signal Conditioning: Principles & classification of transducers, Guidelines for selection and applications of transducers, Different types of transducers: Displacement, Strain gauge, LVDT, Potentiometer, Capacitive, Inductive piezoelectric, Temperature, Hall effect transducers. Measurement of parameters: Measurement of temperature, Pressure, Flow, Level, Speed, Torque measurement. Introduction to signal conditioning, AC & DC Signal conditioning, Introduction to Data acquisition and conversion systems.

List of Experiments:

1. To Measure frequency and phase of a signal from Lissajous pattern using CRO.
2. Study of distortion factor meter and determination of the percentage distortion of the given signal
3. To measure a displacement using linear variable differential transformer (LVDT)
4. Measurement of Q-factor L, R using LCRQ meter.
5. Generation & analysis of different wave signals using function generator.
6. (a) Measurement of distance using capacitive pick up.
   (b) Measurement of distance using inductive pick up
7. (a) Measurement of speed of DC motor using magnetic pick up
   (b) Speed measurement by proximity sensor method.
8. Measurement of speed of DC motor using photo electric pick up
9. Temperature measurement by using (i) RTD
   (ii) Thermistor
   (iii) Thermocouple
10. (a) Measurement of liquid level in a water tank.
    (b) Measurement of pressure using strain gauge.
11. Project

Text Books:

1. A K Sawhney, Electrical & Electronics Measurement & Instrumentation, Dhanpat Rai & Company
2. E O Doebilin, Measurement Systems, McGraw Hill

Reference Books:

1. Helfric & Cooper, Modern Electronic Instrumentation & Measuring Techniques, PHI publication.
2. HS Kalsi, Electronic Instrumentation, TMH Publication.

Course Title/ Code	**Lab VIEW (ECW216)**
Course Type:	Elective (Departmental)
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3-0)
Objectives	Students would be able to analyze & develop the concept of graphical programming language in real time environment using Lab VIEW.

List of Experiments:

1. Introduction to virtual instrumentation concepts, concept of distributed virtual instrumentation systems and conventional virtual instrumentation systems. Overview of virtual instruments such as the front panel and the block diagram, palletes, datatypes and representation.
    i. Types of control and indicator.
    ii. Solving formula in three different ways.
    iii. Conversion from radian to degrees.
2. Creating of sub VI
    i. To create a VI to compute full adder logic using half adder logic as sub VI.
    ii. To create a VI to find the roots of a quadratic equation using sub VI and also to find the values of the roots and the nature of the roots.
    iii. To create the front panel and block diagram to show the trigonometric values (sine, cosine and tangent).
3. Introduction to FOR and WHILE loops
    i. Create a VI using for loop which changes the color of a color box automatically for the number of iterations.
    ii. Programs regarding tunneling concept (while loop).
    iii. Animate a dog running using picture ring control.
4. Introduction to arrays & clusters
    i. Operation of matrix
    ii. Polymorphism
5. Introduction to plotting data.
    i. To create a VI for temperature measurement system.
    ii. To create a VI plot response of RLC circuit.
6. Introduction to strings
    i. To create a VI for password matching
    ii. Occurrence matching.
7. Introduction to case sequence.
    i. 7 Segment display
    ii. Sequence structures (LED display)
8. Introduction to file I/O's & DAQ associated examples.
    i. Interfacing input output devices (IR sensors, LDR, switch, LCD, LED) with LABview using DAQ.
9. IMAQ machine vision tool.
    i. Acquisition and processing of a live image.

10. Project (Room Automation).

Reference Books:

1. Jovitha Jerome, Virtual Instrumentation using Lab VIEW, PHI
2. John Essick, Hands on introduction to Lab VIEW for Scientists & Engineers, Oxford publication

Course Title/ Code	**DATA STRUCTURES (CSW204)**
Course Type:	Elective (Allied)
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3-0)
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. 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, radix 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.

Section-C

Stacks: Introduction to Stacks, array representation of stack, operations on stack: PUSH, POP. Queues: Queues, Circular queues, array representation of Queues, priority queues, dequeue, circular queue, operations on queue: insertion and deletion.

Section-D

Non-Linear Structures: Trees definition, characteristics concept of child, sibling, parent child relationship etc, binary tree, operation on binary tree: insertion, deletion, searching and traversal of binary trees, traversing: Preorder, Postorder and Inorder, Introduction to binary search tree. Graphs: Relation between tree & graph, directed and undirected graph, connected and disconnected graph, Euler graph, Hamiltonian 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.
3. 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	**SCRIPTING LANGUAGES (CSW208)**
Course Type:	Elective (Allied)
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3-0)
Objectives	Student will be able to develop a dynamic Website.

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

Section-A

XML (EXTENSIBLE MARKUP LANGUAGE): Introduction to XML, XML-DTD: Using a DTD in an XML Document, Element Type Declaration, Attribute Declaration, and Entity Declaration. XML-Schema: Schema Structure, Element definition, declaring simple and complex elements.

Section-B

Xpath: Introduction, Xpath Expressions, XSLT: Introduction, XSLT Elements, Conditional Processing, Variables and Parameters. XQuery. JAVASCRIPT: Advantages of JavaScript; writing JavaScript into HTML; Attaching an External JavaScript File, Working with Data Types and Variables, operators and expressions; arrays and functions in JavaScript: Creating & Calling Functions ,Sending Parameters to a Function; condition checking, loops, If Structure, If Else Structure, For Loop, While Loop, dialogue boxes.

Section-C

HTML Form validation, event handling. PHP (Hypertext Preprocessor): Installation of LAMP Package, Introduction to PHP, Variable rules, Storing & retrieving information in variables, Decision making in PHP: Comparison operators, if construct, while construct, for construct

Section-D

PHP (Hypertext Preprocessor): Working with arrays, Functions, Declaring functions, Passing data by reference, Handling HTML forms with PHP, Validating form data, Decisions and Loop:, Functions, Strings, Arrays, Database Connectivity with MySql, Working with Databases and Tables**.**

List of Experiments:

1: Revision of HTML & HTML5.0: Basic Tags.
2: XML: Basics & XML-DTD
3: XML-DTD
4 & 5: XML-Schema
6 & 7: XPATH, XSLT
8 & 9: Basic Java Script Concept
10: Advance Java Script Concept
11-14: PHP Programming
➔ **Project**

Text Books:

1. David Barron, “The World of Scripting Languages”, Wiley
2. Green Law, “Internet Fundamentals”, Pearson Publication.

Reference Book:

1. Uttam K. roy, “Web Technologies”, Oxford Publication.
2. Zed Shaw, ”Learn Python the Hard Way”

Course Title/ Code	Applied Psychology (EDS 289)
Course Type:	Elective
Course Nature:	Soft
L-T-P-O Structure	(1-0-2-0)
Objectives	1. To define psychology and its application across various fields. 2. To understand the conceptual framework of attitude and personality along with cherishing out their attitude and personality development. 3. To conceptualize psychology in social and organizational settings. 4. To maintain and reform group dynamics.

Applied Psychology (EDS 289)

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:

- Arrow, K. J. (1995). *Barrier to Conflict Resolution.* NY: W. W. Norton.
- Bandra, A., & Walters, R. H. (1963). *Social Learning and Personality Development*. New York: Holt, Rinehart, & Winston.
- Bandra, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice- Hall, Inc.
- Baron, R. A., Byrne, D. (1997). *Social Psychology* (8th Ed.). Boston, MA: Allyn & Bacon.
- Baron, R. A. (2001). *Psychology* (5th ed.). London: Pearson.
- Cialdini, R. B. (2001). *Influence: Science and Practice* (4th Ed.). Boston, MA: Allyn & Bacon.
- Feldman, R. S. (2008). *Essentials of Understanding Psychology*. New Delhi: Tata McGraw Hill.
- Friedkin, N. (1998). *A structural theory of social influence.* Cambridge: Cambridge University Press.
- Gage, N. L., & Berliner, D. C. (1992). *Educational Psychology* (5th Ed.). Boston, MA: Houghton Mifflin Co.
- Hall, C. S., Lindzey, G. & Campbell, J. B. (2004). *Theories of Personality* (4th Ed.). New York: Wiley.
- Hunt, R. R., & Ellis, H. C. (2006). *Fundamentals of Cognitive Psychology*. New Delhi: Tata McGraw Hill.
- McDavid, J. M., & Harari, H. (1994). *Social Psychology: Individuals, Groups, and Societies*. New Delhi: CBS Publishers.
- Millward, L. (2005). *Understanding Occupational and Organizational Psychology.* London: Sage Publications.
- Morgan, C. T., King, R. A., Weisz, J. R., & Schopler, J. (1993). *Introduction to Psychology*. (7th Ed.). New Delhi: Tata McGraw Hill.
- Woolfork, A. E. (2014). *Educational Psychology* (12th Ed.). Boston: Allyn & Bacon.

Applied Psychology Practical (EDS 289)

1. Prepare a story using different pictures in order to understand the personality
2. Prepare a SWOT Chart to identify strength and weakness of oneself
3. Role of psychology be proved as an asset in professional development
4. Give a brief account of your personality before and after the transaction of course content.
5. Identify different stereotype present in our Society and present your views on it.
6. Collect any five articles on discrimination prevalent in Society
7. List out Company incentives provided to their employee for work motivation.
8. Prepare a street play on social issues to understand the group dynamics
9. Reflection activities to understand the emotions and personality
10. List out the Do's and Don'ts of the Interview
11. Role of body language in attitude formation.
12. Situational Activities: Suppose you are captain of your football team. Draw out inputs to motivate your team, and maintain the team- spirit.
13. Write a brief note on any one attitude you want to change in yourself and the strategies to accomplish it.
14. The psychometric tests to be conducted by learners:
    - Sociometry test

- Personality testing (16PF)
- Vineland Social Maturity Scale
- Rorschach inkblot test
- Thematic Appreciation Test
- Color personality Test

15. Any other suitable activities.

Course Title/ Code	**APPLIED PHILOSOPHY (EDS 288)**
Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-0-2-0)
Objectives	To enable students to 1. Confront the philosophical problems implicit in the experience of self, others and the society. 2. read critically the philosophy of influential philosophers with respect to society, Science and success in life 3. Understand and apply concepts and theories of moral philosophy. 4. Reflect philosophically and ethically on their own personal, professional and civic lives. 5. Formulate for himself or herself a philosophy of life or world-view consistent with the objectives of liberal society.

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.* Jalandhar: Ahim Paul Publishers.

Applied Philosophy Practical (EDS 288-P)

Suggested activities:

•Prepare and present a report on 'philosophy of life' from the perspective of a young adult.

•Quiz and interactive sessions on various philosophical perspectives of contemporary philosophers.

•Organization of and participation in street plays /dramas/ declamation/ debates/ any other suitable activity on any theme of Philosophical perspectives of Socio-Political scenario in India.

•Group discussions on any suitable topics concerning contemporary society like aggression among youth, Over-ambitiousness in young generation, misuse of democracy, implications of secularism etc. and to reflect upon different viewpoints.

•Preparation of quotation boards to display quotes of great philosophers in the college premises.

•Picture interpretation and philosophical reflection on social themes like juvenile crime, begging in India, Social networking etc.

•Readings from the autobiographies and other publications of great philosophers e.g. 'Wings of Fire' followed by discussion session.

•Showing Videos on Unique personalities: life and philosophies followed by reflection exercises.

•Any other suitable activity.

Course Title/ Code	**APPLIED SOCIOLOGY(EDS290)**
Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-0-2-0)
Objectives	1. To develop the skills to think "objectively" and analytically about ways in which social forces affect our everyday lives. 2. To understand the perspectives of persons with different cultural, ethnic and social background. through Social Change 3. To be able to identify and discuss the differences between the three major theoretical paradigms used by sociologies in the analysis of society. 4. To be able to know about fundamental concepts of sociology.

UNIT-1:-Introduction

Sociology: Meaning, Nature and Scope

Relationship of Sociology with other subjects

Application of Sociology in corporate world

UNIT -2:- Social change and social processes

Social Change: Meaning, Concept and nature of Social Change

Processes : Urbanization

Modernization

Globalization

Industrialization

Liberalization

UNIT-3:- THEORIES AND APPROACHES OF SOCIOLOGY

Different Theories and approaches: Positivist Approach

Labeling Theory

Structural Function Theory

Social /Conflict Theory

Social Darwinism Theory

UNIT-4:- FUNDAMENTAL CONCEPTS

Fundamental Concepts in Sociology: Social Stratification

Social Change,

Social Control,

Equality,

Equity,

Co-operation and Conflict,

Association

Social Structure: Family,

Caste

Ethnicity

REFERENCES

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2. Barnes,H.E.1959. Introduction to the history of sociology, Chicago: The University of Chicago Press.
3. Coser, Lewis A 1979. Masters of sociological thought. New York: Harcourt Brace Jovanovich.
4. Cotterell.Roger,1992. Oxford University Press, New Delhi
5. Fletcher, Ronald. 1994. The making of sociology (2 volumes) Jaipur:Rawat
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7. Lucy Mair, 1997 An Introduction to social anthropology, Oxford University Press, New Delhi (chapter 1 & 2)
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10. Zeitlin, Irving 1998(Indian edition); Rethinking sociology: A critique of contemporary theory; Jaipur:Rawat 90
11. Bottomore, T.B.1986 Introduction to Sociology(Revised edition), London: Alien and Unwin.
12. Firth, R 1056 Human Types:London:Thokas Nelson and Sons Ltd.
13. Giddens, A 1997 Sociology Cambridge: Polity Press
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15. London:Routledge and Kegan Paul Merton, R.K.1968, Social theory and social structure Glencoe, III Free Pre3ss and New Delhi:American Publishing Co(Pvt) Ltd.
16. Henslin M.James, 1996 Essential of Sociology: A down to Earth Approach, Allyn and Bacon, Massachussetts.

Applied Sociology Practical

- Prepare and present a report on "importance of sociology in relation with the corporate sector'' with the perspective of a young adult.
- Preparation of quotation board with the help of displaying the pictures and quotes of famous sociologists
- Case study
- Discuss the impact of modernization, industrialization and globalization on the day-today life.
- Showing Videos on the life and philosophies of Famous sociologists to tell the students about their different theories
- Field Study
- Any other suitable activity

Course Title/ Code	**Spanish (FLS213)**
Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
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 possessives 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., describing a person and daily routine,) 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 a person, daily routine, talk about recreation, movies and sports 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

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

Section-A

- Inroduction of irregular verb in present tense
- Adjectives to describe a person
- Vocabulary related to describe relationships
- Verb Saber and Conocer and their difference

Section-B

- Reflexive verbs

- Vocabulary related to daily routine
- Expressions related to home
- Introduction to Gerund

Section-C

- Introduction of verb Gustar
- Introduction to Gustar like verbs
- Use of Gustar to express opinions
- Introduction to Pronominal verbs

Section-D

- Vocabulary related to recreation
- Vocabulary related to movies and TV programs
- Vocabulary related to sports

Reference Book: Aula internacional 1, Modern Spanish Grammar

Course Title/ Code	**German (FLS214)**
Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
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

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

SECTION A

- **Separable verbs**
- **Past of verb 'to have**

SECTION B

- **Orientation/directions in a building**
- **Changing prepositions**

SECTION C

- **Professions and functions**
- **Visiting cards vocabulary**

SECTION D

- **Berlin**
- **Orientation/directions in a city**

- **Reference Book: 1. Studio D A1, Cornelsen Verlag**
  2. Tangaram A1

Course Title/ Code	**French (FLS215)**
Course Type:	**Elective**
Course Nature:	Soft

L-T-P-O Structure	(1-1-0-0)
Objectives	At the end of the course, students will be able to 1. Ask and clearly tell their belongings in French. 2. Learn Basic vocabulary that can be used to discuss about different things using regular and irregular verbs 3. Book an appointment and make reservation in hotels, etc 4. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. 5. Provide basic information about familiar situations, objects and topics of interest 6. Express or/and justify opinions using equivalents of different verbs 7. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture.

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

Section-A

- AdjectiveDemonstrative

Section-B

- Verbs in Present Tense –
  - ER Ending verbs
  - IR Ending verbs
  - RE Ending verbs

Section-C

- Verbs in Present Tense – Irregular Verbs
- Adjective Interrogative (Quel et Quelle)

Section-D

- How to take an appointment
- How to book a reservation in hotel, for a stall in a fair etc

SUBJECT CODES	SUBJECT NAME	**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
ECH318-T	DIGITAL SYSTEM DESIGN	EC	HARD	CORE	3	1	0	0	4	4
ECH318-P	DIGITAL SYSTEM DESIGN LAB				0	0	2	0	2	1
ECH319-T	DIGITAL SIGNAL PROCESSING	EC	HARD	CORE	3	1	0	0	4	4
ECH319-P	DIGITAL SIGNAL PROCESSING LAB				0	0	2	0	2	1
ECH320-T	ANTENNA & WAVE PROPAGATION	EC	HARD	CORE	3	1	0	0	4	4
ECH320-P	ANTENNA & WAVE PROPAGATION LAB				0	0	2	0	2	1
RDO303	TECHNICAL SEMINAR-II	RESEARCH	OUTCOME	CORE	0	0	0	1	1	1
ECH321-T	MICROELECTRONIC CIRCUITS	EC	HARD	ELECTIVE	3	1	0	0	4	4
ECH322-T	VLSI	EC								
ECH323-T	FUNDAMENTALS OF INFORMATION THEORY & CODING	EC								
CSH210-T	COMPUTER ARCHITECTURE & ORGANISATION	CS								
CSH206-T	OOPS USING JAVA	CS								
CSH314-T	INFOSYS FOUNDATION PROGRAM FP 4.0	CS								
ECH321-P	MICROELECTRONIC CIRCUITS LAB	EC	HARD	ELECTIVE	0	0	2	0	2	1
ECH322-P	VLSI LAB	EC								
ECH323-P	FUNDAMENTALS OF INFORMATION THEORY & CODING LAB	EC								
CSH210-P	COMPUTER ARCHITECTURE & ORGANISATION LAB	CS								
CSH206-P	OOPS USING JAVA LAB	CS								

CSH314-P	INFOSYS FOUNDATION PROGRAM FP 4.0 LAB	CS								
CDO301	Professional Competancy Enhancement-III	CDC	OUTCOME	CORE	0	0	0	1	1	0.5
ECW324	3D-EM (RF)	EC	WORKSHOP	ELECTIVE	0	0	3	0	3	2
ECW325	VERILOG	EC								
CSW325	WEB-SERVICES	CS								
LWS104	CYBER LAW	LW	SOFT	ELECTIVE (LAW BASKET)	1	0	2	0	3	2
LWS101	LAW OF PATENTS									
FLS219	FRENCH-V	MRCFL	NTCC	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS217	SPANISH-V									
FLS218	GERMAN-V									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**14**	**5**	**13**	**2**	**34**	**25.5**

DETAILED SYLLABUS
ECU01 –FIFTH SEMESTER

Course Title/ Code	**DIGITAL SYSTEM DESIGN (ECH318-T, ECH318-P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Pre-requist	PRINCIPLES OF DIGITAL ELECTRONICS & CIRCUIT DESIGN
Objectives	To design, synthesize and simulate the complex digital hardware systems using Hardware Description Language.

	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 behavioral, dataflow, structural and mixed modeling.

Section B

VHDL Statements: Behavioral Modeling**:** Process statement, 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, VHDL Programmable logic devices: ROM, PLA, PAL, GAL, PEEL, CPLD and FPGA, Design implementation using CPLD and 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	**DIGITAL SIGNAL PROCESSING (ECH319-T, ECH319-P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Pre-requist	SIGNALS & SYSTEMS
Objectives	• Analyze signal spectra using DFT /FFT and apply FFT to filtering applications. Calculate transforms in discrete domain. • Design Digital IIR and linear phase FIR filters. • Analyze the errors in Digital filters due to finite word lengths.

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

Section A

Introduction of Digital Signal Processing: Basic operations in DSP & their applications, Discrete Fourier Transform- Introduction and properties, Computation by direct method, Relation between DFT and DTFT, FFT (DIT & DIF), Composite radix FFT, Circular convolution: overlap add and overlap save method, Discrete Cosine Transforms.

Section B

FIR Filter Design: Symmetric and Anti-symmetric FIR filters, Design of linear phase FIR filters using windows, rectangular, hanning, hamming, barlett, blackman, kaiser, Design of linear phase FIR filters using frequency sampling method, frequency response of FIR filters, Design of equiripple linear phase FIR filters, FIR differentiators, Hilbert transformers, Structures of FIR filters.

Section C

IIR Filter Design: Analog IIR filters, Digital IIR filter design by impulse invariance, Digital IIR filter design by bilinear transformation, Digital IIR filter design by backward difference method, Frequency transformations in the analog and digital domain, Structures of IIR digital filters.

Section D

Finite Word Length Effects in Digital Filters: Introduction, fixed point and floating point representation of numbers, Rounding and Truncation errors, Quantization effects, Output noise power, Coefficient quantization effects in direct form realization of IIR & FIR filters, Limit cycle oscillations, Product quantization, Introduction to multi-rate digital signal processing, Introduction to DS processors, Types, Architecture and advantages, TMS320C54x.

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 $(n) = [1,2,3,0]$, 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 $x(n) = (1,2,4)$, 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 $(n) = (1,2,4)$, 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 a 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 $[1, \frac{3}{4}, \frac{17}{8}, \frac{3}{4}, 1]$
11. Introduction to DSP starter kit and Code Composer Studio and Generation of basic signals.
12. Project

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

Course Title/ Code	**ANTENNA & WAVE PROPAGATION (ECH320-T, ECH320-P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2)
Pre-requist	ELECTROMAGNETIC FIELD & WAVES
Objectives	Student shall be able to identify, analyze and develop applications of various antennas for wave propagation over ground, through troposphere and ionosphere measuring by the effects in microwave systems, satellite, space and radar links.

	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, Field regions, Gain, Directivity, Resolution, Aperture, Beam-width, Effective height, Efficiency, Bandwidth etc. Friis transmission formula, Wave polarization, Point Source: Power and field pattern, Radiation density & intensity, Antenna temperature.

Section-B

Antenna Theory: Reciprocity theorem for antenna, Fields & radiation resistance of short dipole, Input impedance of antenna, Types of antennas, Wave equation for radiated fields, Field and pattern of an infinitesimal (Hertzien) small, Half-wave dipole, Small loop antenna, Relation between current distribution and field pattern of an antenna, Linear 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. Practical Antenna: parabolic feed antenna, conical, helix, log periodic, horn, microwave antennas etc.

Section-D

Matching Techniques & Wave Propagation: Broadband dipoles and matching techniques, Traveling wave and broadband antenna, Frequency independent antennas and antenna miniaturization, Ground waves propagation, Space waves propagation, Effect of earth, Duct formation, Ionospheric and sky wave propagation.

List of Experiments:

1. To plot radiation pattern of parabolic reflector antenna and calculate gain & HPBW.
2. To plot radiation pattern of planar antennae (Monopole, Dipole) and calculate gain & HPBW.
3. To plot radiation pattern of co-polarization and cross-polarization patch antennae and calculate gain & HPBW.
4. To plot radiation pattern of array (Broadside, End-fire) antennae and calculate gain & HPBW.
5. To plot radiation pattern of collinear array antennae and calculate gain & HPBW.
6. To plot radiation pattern of wired (Yagi-Uda, loop) antennae and calculate gain & HPBW.
7. To plot radiation pattern of aperture antennae and calculate gain & HPBW.
8. To plot radiation pattern of waveguide slot antenna and calculate gain & HPBW.
9. To plot radiation pattern of waveguide horn antenna and calculate gain & HPBW.
10. Design and analysis of Bluetooth (2.45 GHz) antenna on EM-simulator

(Lab project by students (Antenna design, fabrication and testing)

Text Books:

1. J D Kraus, Antennas and Wave Propagation, 2nd Edition, McGraw-Hill
2. Constantine A Balanis, Antenna Theory: Analysis & Design, 2nd Edition, Wiley Publication

Reference Books:

1. R E. Collin, Antenna & Radio wave Propagation, International Edition, McGraw-Hill
2. Jordan & Balman, Electromagnetic Waves & Radiating Systems, 2nd Edition, PHI

Course Title/ Code	**MICROELECTRONIC CIRCUITS (ECH321-T, ECH321-P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2)
Pre-requist	ANALOG INTEGRATED CIRCUITS
Objectives	• To analyze and design circuits with nonlinear elements, including BJTs and MOSFETs, with an emphasis on design oriented analysis techniques. • To understand the principles of operation for MOSFETs and BJTs, including the physical meaning of device model parameters and limitations of models. • Develop an understanding of the connection between device-level and circuit-level performance of microelectronic systems.

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

Section A

IC Amplifiers– I: IC design philosophy, Comparison of the MOSFET and the BJT, Basic Gain cell, IC Biasing: Current sources, Current mirrors and Current-steering circuits, High frequency response: General considerations, Common-source and common-emitter amplifiers with active loads, High Frequency Response of CS and CE amplifiers.

Section B

IC Amplifiers – II: Common gate and common base amplifiers with active loads, Cascode amplifiers, CS and CE amplifiers with source (emitter) degeneration, Source and emitter followers, Some useful transistor pairings, Other wideband amplifier configurations, Current mirror circuits with improved performance.

Section C

Signal Generators and Wave Shaping Circuits: Bistable multivibrators, Generation of square and triangular waveforms using astable multivibrators, Generation of a standardized pulse—monostable multivibrator, Integrated circuit timers, Nonlinear waveform shaping circuits, Precision rectifier circuits.

Section D

Data Converter Circuits: Data converters- an introduction, D/A converter ciruits, A/D converter ciruits, Schmitt trigger, PLL,VCO, Gilbert analog multiplier and its application.

List of Experiments:

1. Designing of LP, HP, BP, AP and Notch filter using OP-AMP for given cut-off frequency and calculate the associated parameters.
2. Implement the CS and CE amplifiers with active load and verify its frequency response.
3. Implement the CE amplifier and compute its high frequency response, also investigate its bias-point stability
4. Implement the CB and CG amplifiers with active load and verify its frequency response
5. Implement the Folded Cascade Amplifier and verify its frequency response
6. Design Wilson current mirror & Wilder current mirror for given specification and draw its V-I characteristics.
7. Designing of Square and Triangular waveforms and standard pulse using multivibrators for the given specification.
8. Implement a monostable multivibrator & astable multivibrator using 555 Timer.
9. Simulate and obtain the output waveform of digital to analog convertor using Pspice.
10. Design a Gilbert analog amplifier for various applications.
11. Project.
12. Project.

Text Books:

1. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits Theory and Applications, Oxford (6^{th} Edition)
2. Richard C. Jaeger and Travis N. Blalock, Microelectronic Circuit Design, McGrawHill (4^{th} edition)

Reference Books:

1. Howe, R. T. and C. G. Sodini, Microelectronics: An Integrated Approach, Upper Saddle River, NJ: Prentice Hall, 1996.
2. Jacob Millman and D. Halkias, Integrated Electronics Analog Digital Circuits, McGraw Hill.
3. Robert Boylestad and Louis Nashelsky, Electronic Devices And Circuit Theory, Upper Saddle River, NJ: Prentice Hall

Course Title/ Code	**VLSI (ECH322-T, ECH322-P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Pre-requist	ANALOG INTEGRATED CIRCUITS
Objectives	• To introduce the concepts and techniques of modern integrated circuit design • To design static CMOS combinational and sequential circuit at transistor level including layout.

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

Section A

Introductory Concepts: Evolution of VLSI, Moore's law, MOS transistor theory- MOS structure, Enhancement and Depletion MOSFET, MOS transistor current voltage relations, Threshold voltage, Second order effects, Fabrication process flow, NMOS and CMOS fabrication and Scaling of MOS circuits.

Section B

MOS Inverters: Resistive load inverter, Inverters with n-type MOSFET load, CMOS inverter operation and its analysis, BICMOS logic circuits and latch up in CMOS circuits, MOS Inverters - Switching characteristics, Noise margin concepts, Delay time definitions, Calculation of delay times, Inverter design with delay constraints and power consumption.

Section C

Combinational Logic Design: Static CMOS design, Ratio logic, Pass transistor logic, CMOS transmission gate logic, Dynamic logic, Speed and power dissipation of dynamic logic, Signal integrity issues in dynamic design, Cascading dynamic gates, Domino logic, N-P CMOS logic, Stick diagrams and layout design rules.

Section D

Sequential Logic Design: Static latches and registers- bi-stability principle, MUX based latches, Static SR flip-flops and master-slave edge-triggered register, Dynamic latches and registers – Dynamic transmission gate edge triggered registers, C^2MOS, True single phase clocked register, Pulse registers, Sense amplifier based registers and concept of pipelining in sequential circuits.

List of Experiments:

1. Introduction to CAD tool.
2. To plot the output characteristics & transfer characteristics of an n-channel and p-channel MOSFET.
3. (i) To design and plot the static (VTC) and dynamic characteristics of a digital CMOS inverter.
   (ii) Estimation of Current, Delay and Power of a CMOS Inverter.
4. To design and plot the dynamic characteristics of 2-input NAND and NOR logic gate and compare the performance of the two gates in terms of power delay product.
5. Simulate and study the effect of supply voltage scaling on delay, power and power-delay product of a full adder circuit using CMOS technology.
6. To design and plot the characteristics of a 4x1 digital multiplexer using transmission gate transistor logic.
7. To design and plot dynamic characteristics of XOR gates using static and dynamic CMOS technology and compare the performance of the two circuits in terms of power delay product.
8. Design the layout of a CMOS inverter in the layout editor.
9. To design and plot the characteristics of a positive and negative latch based on multiplexers.
10. To design and plot the characteristics of a master-slave positive and negative edge triggered registers based on multiplexers.
11. Project

Text Books:

1. Jan M. Rabaey, Digital Integrated Circuits, PHI Ltd.
2. S.M. Kang & Y. Leblebici, CMOS Digital Integrated Circuits-Analysis & Design, TMH Ed. 2003.

Reference Books:

1) K. Eshraghian & Pucknell, Introduction to VLSI, PHI.
2) Neil Weste, Principles of CMOS VLSI design, Addison Wesley.
3) S.M. SZE, VLSI Technology, 2nd Edition, TMH, 2003.
4) Wayne Wolf, Modern VLSI Design, Pearson Education.
5) John .P. Uyemura, Introduction to VLSI Circuits and Systems, JohnWiley.

Course Title/ Code	**FUNDAMENTALS OF INFORMATION THEORY AND CODING (ECH323-T, ECH323-P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard

L-T-P-O Structure	(3-1-2-0)
Objectives	To analyze various techniques of encoding and decoding information and types of channels to transmit the information.

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

Section A

Random Signal Theory: Representation of random signals, Concept of probability, Probability of joint occurrence, Conditional probability, Discrete probability theory, Continuous random variables, Probability distribution function, Probability density function, Joint probability density functions. Random Process:-Statistical average and moments, Ergodic processes, Correlation function, Power spectral density, Central limit theory, Response of linear system to random signals.

Section B

Information Theory : Introduction to information and entropy, Information rate, Conditional and joint entropies, Discrete memory less channels, Mutual information, Markov sources, Channel capacity, Source coding theorem, Data compaction, Prefix coding, Kraft McMillan inequality, Huffman coding, Lempel Ziv coding.

Section C

Channel Coding Techniques: Channel coding theorem, Differential entropy and mutual information for continuous ensembles, Information capacity theorem and its implications, Information capacity of a colored noise channel. Discrete memory less channels and channel coding theorem revisited.

Section D

Source Coding Techniques: Linear Block codes, Repetition codes, Syndrome decoding, Hamming codes, Dual code, Cyclic codes, Maximal length codes, CRC codes, BCH codes, Reed-Solomon codes, Golay codes, Convolution codes: Code tree, Trellis and state diagram.

List of Experiments: **Tool: MATLAB R2012b (Simulink 8.0)**

1. Application of MATLAB to coding theory
2. Learning basic commands of MATLAB
3. Encoding messages for a forward error correction system with a given Linear block code and verifying through simulation
4. Decoding encoded words for a forward error correction system with a given Linear block code and verifying through simulation

5. Encoding the messages for a system with a given cyclic polynomial code and verifying through simulation
6. Decoding the messages for a system with a given cyclic polynomial code and verifying through simulation
7. Understanding the concept of loss less data compression technique using Huffman Coding
8. Learning basic model designs with Simulink.
9. Encoding the data bits using a Binary Cyclic block encoder in Simulink
10. Decoding the code words using a Binary Cyclic block decoder in Simulink
11. Encoding the data bits using a Binary Linear block encoder in Simulink
12. Decoding the code words using Binary Linear block decoder in Simulink

Text Books:

1. Simon Haykins, Communication Systems, 4th edition Wiley, 2001.
2. J G Proakis, Digital Communications, Mc Graw Hill, 2001.

Reference Books:

1. T M Gover, J M Thomos, Elements of Information Theory, Wiley, 1999.
2. Arijit Saha, Nilotpal Manna, Surajit Mandal, Information Theory, Coding and Cryptography, Pearson Education, 2013.
3. Schaum's Outlines, Analog and Digital Communications, Second Edition.
4. J. H. Van Lint, Introduction to Coding Theory, Springer.

Course Title/ Code	**COMPUTER ARCHITECTURE & ORGANIZATION (CSH210-T, CSH210-P)**
Course Type:	Elective (allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	Students will be able to understand the design and working of various components constituting a computer system.

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

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 CoherenceI/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).

List of Experiments:

1. To recognize various components of PC.
2. To understand how different components of PC are connected to each other to work properly(cabinet, SMPS, HDD, PROCESSOR,MOTHERBOARD, IDE cable, ROM etc.)
3. To study Fault analysis point of H/W training kit.
4. To simulate Half adder and Full adder
5. To simulate a multiplexer.
6. To print factorial of a no and Fibonacci series.
7. To print the reverse of a string and check whether it is palindrome or not by using macro.
8. To check whether a number is even, odd or prime using assembly code.
9. To print square and cube of first n natural numbers using assembly code.
10. To design a simple calculator.

Text Books:

1. M. Mano, Computer System Architecture, 2001, Prentice-Hall.

2. David A. Patterson and John L. Hennessy, Computer Organization and Design, 2nd Ed., Morgan Kauffmann.
3. John P. Hayes, Computer Architecture and Organization, 3rd Ed, TMH.

Reference Books:

1. William Stallings, Operating Systems Internals and Design Principles,4th edition, 2001, Prentice-Hall Upper Saddle River, New Jersey
2. Carl Hamacher, Zvonko Vranesic, Computer Organization, 5th Edi,2002, SafwatZaky.
3. A.S. Tanenbaum, Structured Computer Organisation, 4th edition, Prentice-Hall of India, 1999, Eastern Economic Edition.
4. W. Stallings, Computer Organisation & Architecture: Designing for performance, 4th edition, 1996, Prentice-Hall International edition.
5. Nicholas Carter, Computer Architecture- 2002, T.M.H.

Course Title/ Code	**OBJECT ORIENTED PROGRAMMING USING JAVA(CSH206-T, CSH206-P)**
Course Type:	Elective (allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2)
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, 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, Input Stream, Output Stream, File Input Stream, File Output Stream, 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. E Balagurusamy , Programming With Java Primer, TMH Publication
2. Herbert Schildt, Java; the complete reference, 7th editon, TMH.
3. H. M. Deitel and P. J. Deitel, Java How to Program, Prentice Hall, 7th Edition, 2007

Reference Books:

1. Steven Holzner, Java2 Programming Black Book
2. C. S. Horstmann and G. Cornell, Core Java 2 (Volume I-Fundamentals), Prentice Hall, 7th Edition, 2004.
3. Kathy Sierra, Head First Java

Course Title/ Code	**INFOSYS FOUNDATION PROGRAM FP4.0 (CSH314-T, CSH314-P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(0-0-3)
Objectives	• Do Problem Solving using algorithms • To design and test simple programs to implement Object Oriented concepts using Java • To design simple data store using RDBMS concepts and implement basics of Software Engineering and Web Technology.

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

Section-A

Problem Solving Techniques - Introduction to problem solving - Computational problem and it's classification - Logic and its types - Introduction to algorithms Implementation of algorithms using flowchart - Searching and sorting algorithms - Introduction and classification to Data Structures - Basic Data Structures - Advanced Data Structures.

Programming Basics **:** Identifiers, variables, data types, operators, control structures. Tools: Understanding basic programming constructs using Scratch Tool - Flowcharts implementation through RAPTOR tool

Section-B

Programming Basics: type conversion, casting, arrays, strings. Introduction to UML : Use case diagrams – Class diagrams. Object Oriented Concepts fundamentals: class & object – instance variables & methods – access specifiers – reference variables – parameter passing techniques – constructors – this reference – static – command line arguments. Relationships : Inheritance – types of inheritance – aggregation – association – Static Polymorphism : method overloading – constructor overloading. Tools: Eclipse IDE for Java programming Basics of Data Integration

Section-C

Relationships : Dynamic polymorphism : method overriding – abstract – interface – introduction to packages Industry Coding Standards and Best Practices – code tuning & optimization – clean code & refactoring. RDBMS- data processing – the database technology – data models- ER modeling concept –notations – converting ER diagram into relational schema. SQL – DDL statements – DML statements – DCL statements

Section-D

RDBMS- Logical database design - normalization (1NF, 2NF and 3NF), SQL – Joins - Sub queries – Views - Database design Issues – SQL fine tuning
Introduction to user interface and web technologies : web fundamentals – types web content – HTML – text formatting tags in HTML – HTML form elements - and tags - text formatting using CSS : embedded CSS, inline CSS and external CSS – JavaScript and its features. Software Engineering: Definition – role of software and software crisis – SDLC models: waterfall model, incremental model and spiral model – software testing – static & dynamic testing – types testing : unit testing, integration testing, system testing, performance testing and regression testing

LIST OF EXPERIMENTS:

The Lab assignments for all the 3 Focus Areas (Object Oriented Programming using Java, Relational Database Management System, Web Technologies):

1. Programs using Java Language
2. RDBMS Queries using SQL – DDL, DML, DCL, joins, views
3. Web Technology using HTML, CSS and JS

Text Books:

1. Foundation Program book, Infosys Ltd.

Reference Book:

1. Dromey, R.G., How to solve it by computers, Prentice Hall, 2005
2. Alfred V. Aho, Ullman, Hopcroft, Data Structures and Algorithms, Addison-wesely.
3. Lipschutz, Seymour & G A V Pai, Data Structures, Tata McGraw – Hill
4. Kernighan., Ritchie, ANSI C Language, Prentice Hall of India, New Delhi, 1992.
5. Yashwant Kanetker, Let Us C, by Yashwant Kanetker, Second Edition
6. Henry F Korth, Abraham Silberschatz, “Database system concepts”, Second ed., McGraw-Hill International editions, Computer Science series, 1991
7. Elmasri, Navathe, "Fundamentals of Database Systems", Third ed, Addison Wesley
8. Herbert Schildt, Java The Complete Reference, McGraw Hill

9. Thomas Powell, HTML & CSS: The Complete Reference, Fifth Edition (Complete Reference Series) Paperback
10. Craig Grannel, The Essential Guide to CSS and HTML Web Design
11. David Flanagan, JavaScript: The Definitive Guide, 6th Edition Activate Your Web Pages
12. Thomas Powell, JavaScript: The Complete Reference Paperback
13. Roger S Pressman, Software Engineering: A Beginner's Guide Paperback

Course Title/ Code	**3-D EM (RF) (ECW324)**
Course Type:	Elective (Departmental)
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3)
Objectives	Design, analysis, optimization, fabrication and characterization of Microstrip/CPW Antennas applicable to Wimax, WLAN, Mobile, Laptop etc.

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

Instructions to students:
i) Analyze/ design the solutions to the problems manually (pen and paper approach)
ii) Implement the solution using the RF Circuit tool and extract the results
iii) Compare the results in step-(i) and step-(ii) and prepare a report containing manual solution, print of simulation graph etc.

NOTE: The students would be required to work out exercises in group of not more than two, and rest of the exercise have to be completed independently. The below problem is indicative only. Similar problems may be added by the instructor to avoid copying.

- CAD-3D Simulator: Hands on Session, GPS Antenna for Global Navigation Satellite System (GNSS).
- Microstrip Patch Antenna for WiMAX Application, Compact Dual-Band Microstrip Antenna for IEEE 802.11A WLAN Application.

- UWB Antennas for Modern Wireless Communications, Dual Wideband Printed Monopole Antenna for WLAN/WiMAX.
- PIFA antennas for Mobile & Laptops Application, Antenna for medical applications.

Text Book:

1. J. D. Kraus, Antennas and Wave Propagation, 2nd Edition, McGraw Hill
2. Constantine A. Balanis, Antenna Theory: Analysis & Design, 2nd Edition, Wiley Publication

Reference Journals:

- IEEE Trans. Antennas & Propagation
- IEE Antennas & Wireless Propagation Letters
- IEEE Antennas & Propagation Magazine
- IEE/IET Proc. Microwaves, Antennas & Propagation
- IEE/IET Electronics Letters
- PIER, PIER B, JEMWA, MOTL-Wiley etc.

Note: Subscription of J-Gate, IEEE, Elsevier etc. Journal publications is available in University Library.

Course Title/ Code	**VERILOG (ECW325)**
Course Type:	Elective (Departmental)
Course Nature:	Workshop
L-P-O Structure	(0-0-3)
Objectives	To understand the concept of VLSI Design and solution techniques to the key design issues.

List of Experiments:

1. Learn use of ModelSim simulator by writing the Verilog code to simulate a half adder; where a, b are 1-bit inputs and sum,carry are 1-bit outputs.
2. Write the Verilog code for a Full Adder that takes in three 1-bit inputs, a, b and carry in, and gives sum and carry out 1-bit outputs. Write the code for a test bench for the adder, and give appropriate inputs to test all possible combinations.
3. Simulate the code for the D flip flop.
4. Write the Verilog code for a JK Flip flop, and its test bench.
5. Write the hardware description of a 4-bit PRBS (pseudo-random binary sequence) generator using a linear feedback shift register and test it
6. Write the hardware description of a 8-bit register with shift left and shift right modes of operation and test its operation.
7. Write the hardware description of a 8-bit register with parallel load and shift left modes of operation and test its operation.

8. Write the hardware description of a 4-bit down counter and test it.
9. Write the hardware description of a 4-bit mod-13 counter and test it.
10. Write the hardware description of a 4-bit adder/subtractor and test it. An adder/subtractor is a piece of hardware that can give the result of addition or subtraction of the two numbers based on a control signal. Assume that the numbers are in 2's complement notation.
11. Projects:
    a. 32 bit booth multiplier
    b. 32 bit carry look ahead adder
    c. 8:3 encoder with priority
    d. Sequence detector using FSM flow
    e. Traffic light controller using task
    f. 4-bit binary to gray counter converter
    g. Linear feed back shift register (8 bit)
    h. Memory design RAM/ROM
    i. BCD to binary conversion
    j. Binary to BCD conversion

Course Title/ Code	**WEB SERVICES (CSW325)**
Course Type:	Elective (Allied)
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3-0)
Objectives	Student will be able to develop a Web service.

Section-A

Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services. Web Services building blocks**: C**ore building blocks of web services, basic steps of implementing web services. Web Services life cycle web services communication. Introduction to the tool for implementation of Web Services**.** Describing Web Services- WSDL: introduction, non-functional service description, WSDL document, WSDL elements

Section-B

Web Services Architecture – Web services Architecture and its characteristics, standards and technologies available for implementing web services, web services communication models. Describing Web Services- WSDL binding, WSDL port type, limitations of WSDL. Core fundamentals of SOAP – SOAP Message Structure, SOAP envelope, SOAP encoding, SOAP message exchange models, SOAP communication and messaging.

Section-C

Developing Web Services using SOAP – Building SOAP Web Services, developing SOAP Web Services, SOAP HTTP binding, SOAP communication model, Error handling in SOAP, limitations of SOAP. Discovering Web Services –UDDI: UDDI Registries, uses of UDDI Registry, UDDI Architecture, UDDI Data Model.

Section-D

Discovering Web Services; UDDI data Structures, Programming with UDDI: UDDI with WSDL, limitations of UDDI. Web Services compositions: WSC-Static & Dynamic, WSC tools-WSFL, XLANG, and BPEL4WS

List of Experiments:

1. Write a program to implement WSDL Service (Hello Service. WSDL File)
2. Write a program the service provider can be implement a single get price (), static bind () and get product operation.
3. Write a program to implement the operation can receive request and will return a response in two ways.
    a) One-Way operation
    b) Request - Response
4. Write a program to implement to create a simple web service that converts the temperature from Fahrenheit to Celsius (using HTTP Post Protocol)
5. Create a web service for currency conversion (at five currencies) with appropriate client program.
6. Write a program to implement business UDDI Registry entry.
7. Write a program to implement
    a) Web based service consumer
    b) Windows application based web service consumer
8. **Mini Project**

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.
   Building web Services with Java, 2nd Edition, S. Graham and others, Pearson Education

Course Title/ Code	Law of Patents and Traditional Knowledge (LWS101)
Course Type:	Elective
Course Nature:	SOFT
L-T-P-O Structure	1-0-2-0
Objectives	The objective of this paper is to orient the students about the basics of patents law and practice for engineering students.

	Sections	Weightage
Syllabus	A	20%
	B	20%
	C	30%
	D	30%
	TOTAL	**100%**

Section A

1. The Concept of patents: objective of patents, theories of patent protection: economic and moral justifications for patent
2. Historical development of patent law in India
3. International instruments dealing with patent protection:
   3.1. Paris Convention for Protection of Industrial Property
   3.2. Patent Cooperation Treaty (PCT)
   3.3. TRIPS Agreement
   3.4. Budapest Treaty for Microorganisms

Section B

1. Patentable Subject matter
2. Patentability of Computer Programs, Algorithms and Mathematical Formulae
3. Pharmaceutical Patent, Patentability of diagnostic method
4. Patentability of Traditional Knowledge

Cases:

- *Novartis A.G. v. Union Of India & Others,* AIR 2012
- *Diamond V. Chakrabarty* (447 U.S. 303 (1980).

5. Criteria for patent: novelty, inventive step, and industrial application

Section C

1. Procedure for filing of patents: national filing
2. International filing of patents: PCT
3. Revocation of patents
4. Opposition to patents

Section D

1. Infringement of patents
2. Remedies for infringement of patents
3. Exceptions/defenses to infringement of patents
4. Licensing of patents: basics, and statutory provisions
5. Traditional Knowledge: Meaning and basics, Traditional Knowledge Digital Library (TKDL), interaction with patent law, case studies on TK: patenting of turmeric, neem, basmati rice

Textbook:

1. B.L. Wadhera, B.L. Wadhera, Law Relating to Intellectual Property, Universal Publishing Company, 5th Edition.
2. Narayanan, P., Patent Law (Kolkata: Eastern Law House, 1998)

Books for reference:

1. Elizabeth Verkey, Law of Patents, Eastern Book Company, 2nd Edition, 2012.
2. Ahuja V.K., Law Relating to Intellectual Property Rights, 1st Ed. (2007, 3rd Reprint 2010), Lexis Nexis.
3. Feroz Ali Khader, The Law of Patents-With a Special Focus on Pharmaceuticals in India, LexisNexis, 2nd Edition, 2011.
4. Intellectual Property Laws, Bare Act, (not older Ed. than 2009), Universal Law Publishing Co.
5. Gopalakrishnan N.S, Intellectual Property Law, 2008.
6. Singh Raghbir, Law Relating to Intellectual Property, 2nd Edi, 2008, Vol, I, II, III, Universal.
7. Correa, Carlos M., Intellectual Property Rights, the WTO and Developing Countries: The TRIPS Agreement and Policy Options (Penang: Third World Network, 2000);

Course Title/ Code	**Cyber Laws (LWS104)**
Course Type:	Elective
Course Nature:	SOFT
L-T-P-O Structure	1-0-2-0
Objectives	The objective of this paper is to orient the students about the basics of cyber law and practice for engineering students.

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

Section A

Introduction: Overview of Computer and Web Technology, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level

Section B

Cyber Crimes & Legal Framework: Cyber Crimes against Individuals, Institution and State, Hacking: Digital Forgery, Cyber Stalking/Harassment Cyber Pornography, Identity Theft & Fraud , Cyber Terrorism, Different offences under IT Act, 2000

Section C

Digital signature and Electronic Signature and Data Protection , Concept of public key and private key , Certification authorities and their role, Creation and authentication of digital signature - Concept of electronic signature certificates, electronic records and electronic signatures

Section D

E Contracting: Salient features of E-contract, Formation of E-contract and types: E-mail Contracting, Indian Approach on E-contracts, E-commerce: Salient Features and advantages, Models of E-commerce.

Books:

1. Vishwanathan Suresh T., "The Indian Cyber Law" Second Edition 2001:- Bharat Law House.
2. Prasad T.V.R. Satya, : "Law Relating to Information Technology (Cyber Laws)" 1st edition 2001:- Asia Law House.
3. Syed Shakil Ahmed and Reheja Rajiv, " A Guide to Information Technology" (Cyber Laws & Ecommerce) Edition 2001:- Capital Law House
4. Kamath Nandan, "Law Relating to Computers Internet & E-commerce (A guide to Cyber Laws & the Information Technology Act, 2000 with Rules & Notification)", 2nd Edition, Reprint : 2002:- Universal Book Traders

Course Title/ Code	**French (FLS319)**
Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
Objectives	At the end of the course, students will be able to 1. Invite somebody for lunch, dinner, birthday party, anniversary, etc. 2. Learn Basic vocabulary that can be used to discuss about daily routine using pronominal verbs. 3. Accept and refuse invitations. 4. Ask questions by using three forms of interrogation. 5. Provide basic information about activities, likings and disliking. 6. Express or/and justify opinions and give responses using equivalents of different verbs 7. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture.

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

Section-A

- Inviting somebody for lunch, dinner, movie & how to accept & refuse in different ways

Section-B

- Pronominal verbs

Section-C

- Les trois forms d'Interrogation et « Qu'est-ce que c'est » ; « Qui est ce »
- Les prépositions de lieu et pays

Section-D

- Repondez aux questions (responding the questions)
- Parler de ses gouts et de ses activities

Course Title/ Code	**Spanish (FLS317)**
Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
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 possessives 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., travel, shopping ,diseases) 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 travel, shopping and diseases. Also use comparatives and superlatives 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

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

Section-A

- Introduction of verb IR + infinitive
- Vocabulary related to travel
- Vocabulary related to shopping and market
- Prepositions (advanced level)

Section-B

- Introduction to Comparatives and Superlatives

- Indefinite Adjectives and Pronouns
- Ordinal Numbers

Section-C

- Introduction of Present perfect tense
- Difficulties and problems in learning Spanish
- Suggestions to overcome them

Section-D

- Introduction of parts of body
- Vocabulary related to diseases
- Expressions related to parts of body
- Gestures

Reference Book: Aula internacional 1, Modern Spanish Grammar

Course Title/ Code	**German (FLS318)**
Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
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

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

SECTION A

- Describing a route
- Accusative prepositions
- Modal verbs

SECTION B

- Present perfect
- Describing an incident

SECTION C

- Vacation vocabulary
- Describing a vacation

SECTION D

- Vocabulary (fruits and vegetables)
- Market and supermarket (shopping)
- Comparison and superlative
- Question word “Welch_”

Reference Book: 1. Studio D A1, Cornelsen Verlag
2. Tangaram A1

ECU01- Semester-VI

SUBJECT CODES	SUBJECT NAME	**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
ECH326-T	MICROPROCESSORS & INTERFACING	EC	HARD	CORE	3	1	0	0	4	4
ECH326-P	MICROPROCESSORS & INTERFACING LAB				0	0	2	1	2	2
ECH327-T	CONTROL SYSTEMS	EC	HARD	CORE	3	1	0	0	4	4
ECH327-P	CONTROL SYSTEMS LAB				0	0	2	1	2	2
ECH328-T	DIGITAL IMAGE PROCESSING	EC	HARD	ELECTIVE	3	1	0	0	4	4
ECH329-T	MICROWAVE ENGINEERING									
ECH330-T	CMOS VLSI DESIGN									
ECH328-P	DIGITAL IMAGE PROCESSING LAB	EC	HARD	ELECTIVE	0	0	2	1	2	2
ECH329-P	MICROWAVE ENGINEERING LAB									
ECH330-P	CMOS VLSI DESIGN LAB									
CSW303	INTRODUCTION TO .NET	CS	WORKSHOP	ELECTIVE	0	0	3	0	3	2
ECW331	SIMULINK	EC								
ECW332	SYSTEM VERILOG	EC								
CDO302	Professional Competancy Enhancement-IV	CDC	OUTCOME	CORE	0	0	0	1	1	0.5
RDO304	PROJECT PHASE-I	RESEARCH	OUTCOME	CORE	0	0	0	1	1	1
MCS231	ECONOMICS	MC	SOFT	CORE	1	0	2	0	3	2
MCS232	FUNDAMENTALS OF FINANCE									
FLS222	FRENCH-VI	MRCFL	SOFT	UNIVERSITY COMPULSORY	1	1	0	0	2	0
FLS220	SPANISH-VI									
FLS221	GERMAN-VI									
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**11**	**4**	**11**	**5**	**28**	**23.5**

DETAILED SYLLABUS
ECU01 –SIXTH SEMESTER

Course Title/ Code	**MICROPROCESSORS & INTERFACING(ECH326-T, ECH326-P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-1)
Objectives	Students will be able to build microprocessor based systems using 8085 and 8086.

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

Section-A

Architecture of 8-Bit Microprocessor: General architecture of microprocessors, Introduction to Intel 8085 microprocessor, Pin description and internal architecture. Instruction Set: Addressing modes, Instruction set of 8085: Data transfer, Arithmetic, Logical, branch, stack and machine control groups of instruction set, Unspecified flags and instructions, Assembly language programming.

Section-B

History and Evolution: Background history of microprocessors, Introduction to basic features, Memory & I/O systems & interfacing: RAM, ROM, EPROM. I/O systems, I/O mapped I/O, Memory mapped I/O, Memory mapping. Interrupts: Interrupt structure of 8085A microprocessor, Processing of vectored and non-vectored interrupts, Latency time and response time, Handling multiple interrupts, Operation and control of microprocessor**:** Timing and control unit, Op-code fetch machine cycle, Memory read/write machine cycles, I/O read/write machine cycles, Interrupt acknowledge machine cycle, State transition diagram.

Section-C

Intel 8086 Microprocessor: Pin Functions, Architecture, Characteristics and basic features of family, Segmented memory, Directives and macros, MIN/MAX Modes of 8086, Clock generator 8284, Interrupt structure of 8086. DMA Controller: Direct memory access operation, Programmable DMA controller 8257: Features of 8257, Internal block diagram of 8257 programmable DMA controller, Interfacing of 8257 with 8085, Control word register of 8257, Status word register, Types of DMA cycles, Types of DMA transfer, 8237: Functional description, DMA operation, IDLE cycle, Active cycle, Transfer types, Register description, Programming. Programmable keyboard and display controller: Functional diagram and PIN diagram of 8279, Block and signal description of Intel 8279, Interfacing of 8279 with 8085, Operating modes of 8279, Status word of 8279.

Section-D

Programmable Peripheral Interface: Intel 8255, Pin configuration, Internal structure of each port bit, Modes of operation, Bit SET/RESET feature. Programmable Interval Timer: Intel 8253, Pin configuration, Internal block diagram of counter and modes of operation, Counter read methods, Programming, READ-BACK command of Intel 8254. Universal Synchronous and Asynchronous Receiver and Transmitter Intel 8251: Introduction, Data transmission signals, Method of communication-serial vs parallel, Types of serial data transfer, Modes of communication, Data communication terminology, Modems, Format of serial data transfer, Universal synchronous and asynchronous receiver and transmitter (USART) Intel 8251, Operating features of 8251, Detailed operation description.

List of Experiments:

1. Demonstration of 8085 kit, interfacing kits and simulators.
2. Problems related to data transfer instructions of 8085 microprocessor.
3. Problems related to data transfer instructions of 8085 microprocessor.
4. Problems related to arithmetic instructions of 8085 microprocessor.
5. Problems related to arithmetic instructions of 8085 microprocessor.
6. Problems related to logical instructions of 8085 microprocessor.
7. Problems related to logical instructions of 8085 microprocessor.
8. Problems related to branch instructions of 8085 microprocessor.
9. Problems related to branch instructions of 8085 microprocessor.
10. Write a program to control the operation of stepper motor using 8085and 8255 PPI.
11. Write a program to control the traffic light system using 8085and 8255 PPI.
12. Write a program to control the operation of ADC/DAC using 8085 and 8255 PPI.
13. Demonstration of 8086 kit.

Text Books:

1. Ramesh S Gaonkar, Microprocessor Architecture, Programming & Applications with 8085, Wiley Eastern Ltd.
2. Brey, The Intel Microprocessors 8086- Pentium processor, PHI

Reference Books:

1. Hall, Microprocessors and interfacing, TMH
2. Badri Ram, Advanced Microprocessors and Interfacing, TMH

3. A. K. Ray and K. M. Bhurchandi, Advanced Microprocessor and Peripherals, TMH

Course Title/ Code	**CONTROL SYSTEMS (ECH327-T, ECH327-P)**
Course Type:	Core (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-1)
Objectives	• Students will be able to perform time domain and frequency domain analysis of control systems required for stability analysis. • Students will be able to design the compensation technique that can be used to stabilize control systems effectively.

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

Section A

Control System Modelling: Basic elements of control system – Open loop and closed loop systems, Differential equation–Transfer function, Modeling of electric systems, Translational and rotational mechanical systems, Block diagram reduction techniques,Signal flow graphs, Effect of feedback on sensitivity (to parameter variations), Stability, External disturbance (noise), Overall gain etc.

Section B

Time Response Analysis: Typical test signals, Time response of first order systems to various standard inputs, Impulse and step response analysis of second order systems, Time domain specifications of a general and an underdamped 2nd order system, 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 compensators.

Section-D

Basic Modes of Feedback Control: Proportional, Integral and Derivative PID Controllers. Hardware: **C**ontrol hardware and their model, Synchros, AC and DC tacho-generators, Servomotors, Stepper motors, & their applications, Magnetic amplifier, State Variable Analysis**:** State space representation of continuous time system, State equations, Transfer function from state variable representation, Solutions of the state equations, Concepts of controllability and observability.

List of Experiments:

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

Text Books:

1. K. Ogata, Modern Control Engineering, Prentice Hall India.
2. Norman S. Nise, Control Systems Engineering, Wiley Publications.

Reference Books:

1. B. C. Kuo, Automatic Control Systems, PHI Publications.
2. J.Nagrath and M.Gopal, Control System Engineering, New Age International Publishers.
3. Hassan Saeed, Automatic Control Systems, S.K Kataria and Sons.

Course Title/ Code	**DIGITAL IMAGE PROCESSING (ECH328-T, ECH328-P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-1)
Pre-requist	DIGITAL SIGNAL PROCESSING
Objectives	Students will be able to process various digital images in spatial and frequency domain using MATLAB.

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

Section A

Fundamentals of Digital Image: Introduction, Applications of image processing, Components of digital image processing system, Structure of human eye, Image formation in the human eye, Image sensing and acquisition, Image sampling and quantization, Digital image representation, Spatial and intensity resolution, Classes and image types, Basic relationship between pixels, Introduction to color image processing. Image Enhancement in the Spatial Domain: Basic Gray level transformations, Histogram processing, Arithmetic and logic operations, Spatial filtering: Introduction, Smoothing and sharpening filters

Section B

Image Enhancement in Frequency Domain: Introduction to 2-D DFT, Properties of 2-D DFT, Filtering in frequency domain: Smoothing and sharpening filters, Homomorphic filtering. Image Restoration: A model of restoration process, Noise models, Restoration in the presence of noise only-Spatial filtering, Periodic noise reduction by frequency domain filtering, Estimating the degradation function, Weiner filtering, Inverse filtering.

Section C

Image Data Compression: Fundamentals, Redundancies: Coding, Interpixel psycho-visual, Fidelity criteria, Image compression model (block diagram), Error free compression, Lossy compression, Image compression standards. 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

Section D

Image Segmentation: Detection of discontinuities: point, line and edge detection, Edge linking and boundary detection, Thresholding, Region based segmentation. Representation and description: Image representation schemes, Chain codes, Signatures, Boundary segments, Skeletons, Boundary descriptors and Regional descriptors.

List of Experiments:

1. Introduction to MATLAB and Image processing toolbox.
2. Write a MATLAB code for:
    i. Shrinking zooming & cropping of an image.
    ii. Increasing and decreasing brightness of an image
    iii. Increasing and decreasing contrast of an image
3. Write a MATLAB code to:
    i. Read an image & perform histogram equalization of the input image and analyse the result.
    ii. To determine image negative, image thresholding & gray level slicing with background.
4. Write a MATLAB code for spatial domain filtering of an image using following filters:
    i. Average filter
    ii. Gaussian filter
    iii. Median filter
    iv. High Boost Filter
    v. Unsharp filter
5. Write a MATLAB code for frequency domain filtering of an image using following filters:
    i. Butterworth LPF
    ii. Butterworth HPF
    iii. Gaussian LPF
    iv. Gaussian HPF
6. Write a MATLAB code to read an input image and perform:
    i. Frequency domain band pass filtering
    ii. Frequency domain band stop filtering
7. Write a MATLAB code to read an image and then degrade the image by adding white guassian noise and then apply
    i. inverse filter
    ii. weiner filter to restore it.
8. Write a MATLAB code for image compression using Discrete Cosine Transforms.
9. Write a MATLAB code for performing following morphological operations on an image:
    i. dilation & erosion

ii. opening & closing
iii. hit or miss

10. Write a MATLAB code to read an input image and compute edges using following edge detectors: Robert, prewitt, sobel, log, canny Compare the results.
11. Project

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson, Second Edition, 2004.
2. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson 2002.

Reference Books:

1. Chanda and Majumdar, Digital Image Processing and analysis, PHI, Second Edition,.
2. Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.
3. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB, Pearson Education, Inc., 2004.
4. D.E. Dudgeon and RM. Mersereau, , Multidimensional Digital Signal Processing, Prentice Hall Professional Technical Reference, 1990.
5. William K. Pratt, Digital Image Processing, John Wiley, New York, 2002
6. Milan Sonka et. al, Image Processing, Analysis And Machine Vision, Brookes/Cole, VikasPublishing House, 2nd edition, 1999,

Course Title/ Code	**MICROWAVE ENGINEERING (ECH329-T, ECH329-P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-1)
Objectives	• To study multi- port RF networks and RF transistor amplifiers. • To study passive microwave components and their S- Parameters. • To study Microwave semiconductor devices & applications. • To study Microwave sources and amplifiers.

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

	D	25%
	TOTAL	**100%**

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

Microwave Measurements: Measurement of power: Calorimetric method & Bolometer method, Measurement of wavelength, impedance, SWR, attenuation and phase shift. Radar Systems: Radar range equation, Pulse repetition frequency, Unambiguous range and velocity, Factors influencing maximum range, Effect of noise, Radar displays, Moving target indicator (MTI) Radar, FMCW Doppler radar, Blind speed.

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	**CMOS VLSI DESIGN (ECH330-T, ECH330-P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-P-O Structure	(3-1-2-1)
Pre-requist	MICROELECTRONIC CIRCUITS, VLSI
Objectives	• To understand the fundamental concepts of modern CMOS VLSI design. • To design complex and high performance CMOS systems from system level to circuit level.

	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, Macrocells, Megacells and intellectual property, Array based implementation approaches – Prediffused arrays and Prewired arrays. Coping with Interconnect: Introduction, Capacitive parasitics – Capacitance & Reliability, Capacitance & Performance, Resistive parasitics – 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 signaling, 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- Adderessable 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. Design & Simulate a 4 input NAND gate with transistor widths chosen to achieve equal rise and fall resistance as a unit inverter. Show why the logical effort is 6/3.
2. Design & Simulate a 3 input dual rail domino OR/NOR gate.
3. Design & Simulate the propagation delay of an 8 input dynamic NOR gate driving a fan out of 4.
4. Design & Simulate 4 bit priority Encoder.
5. Design & Simulate a comparator computing A-B = k.
6. Design & Simulate a 2 input XOR gate using a ROM.
7. Design & Simulate a 2 input XOR using a PLA.
8. Design & simulate a sense amplifier.

9. Design & Simulate the Comparator using differential amplifier.
10. Design & Simulate the 4 bit CMOS DAC.

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.

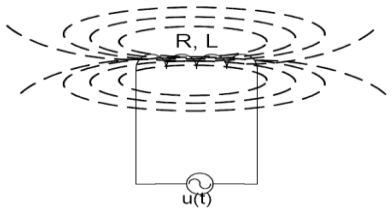
Reference Books:

1. R. J. Baker, H. W. Li, and D. E. Boyce, CMOS circuit design, layout, and simulation. New York: IEEE Press, 1998.
2. 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	**SIMULINK (ECW331)**
Course Type:	Elective (Departmental)
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3)
Objective	• To model linear and non-linear systems • Functional verification of design flow

List of Experiments: Tool: MATLAB R2012b

1. Introduction to Simulink.
   Consider the coil shown in the figure.



The voltage supply is equal to: $u(t) = i(t) R + d\psi(t)/dt$. Assuming that the inductance of the coil is constant, the above equation is: $u(t) = i(t)R + L\, di(t)/dt$. What is the response of the current to a sudden change of the voltage, assuming zero initial conditions?

2. Computation of the Fourier spectrum of the sum of two sinusoids:
   $y(t)=A_1 \sin(2\pi fc_1 t)+A_2 \sin(2\pi fc_2 t)$
   where fc_1=10kHz, fc_2 = 12kHz.
3. Simulate the RLC circuit for given resonance frequency and display the various waveforms as we change the frequency dynamically.
4. Simulate a system for different modulation techniques (Amplitude Modulation, Frequency and Phase modulation and Pulse code modulation)

5,6,7. Design programmable FIR filter and its HDL code generation.

8,9,10. Compensator Design for Systems Represented by Frequency Response Data.

Reference Books:

1. Mohammad Nuruzzaman, Modeling and Simulation In SIMULINK for Engineers and Scientists, Author House
2. Ottmar Beucher, Introduction to MATLAB and SIMULINK: A Project Approach, Firewall Media.

Course Title/ Code	**SYSTEM VERILOG (ECW332)**
Course Type:	Elective (Departmental)
Course Nature:	Workshop
L-P-O Structure	(0-0-3)
Objectives	• To learn advanced and cutting edge state-of-the-art knowledge of EDA tool and implementation in SoC verification. • To read and understand research publications in the technical area of SoC verification, beyond that of the traditional textbook level. • To conduct independent project and to equip for scholarly research in SoC verification.

List of Experiments:

1. Familiarization with Linux operating system and vi Editor Commands.
2. Familiarization with system-verilog HDL simulation tool under Linux Operating system.
3. Structural Modeling, simulation and verification of a Master-Slave Flip-Flop.
4. Modeling, simulation and verification of edge triggered flip-flops.
5. Behavioral Modeling, simulation and verification of 4-bit Counter.
6. Modeling, simulation and verification of Scalable Multiplexer.
7. Modeling, simulation and verification of Carry Select Adder.
8. Modeling, simulation and verification of registers.
9. Modeling, simulation and verification of Arithmetic Logic Unit.
10. Modeling , simulation and verification of a Sequence Controller
11. Lab based project work by forming project groups:
    i. Project Synopsis on completion of Lab.8

ii. Design & Implementation of project idea using simulator environment after Lab.9
iii. Project report submission, presentation and evaluation.

Text Books:

1. Janick Bergeron, Eduard Cerny, Alan Hunter, Andy Nightingale, Verification Methodology Manual for System Verilog, Springer.
2. Stuart Sutherland, Simon Davidmann, Peter Flake, P. Moorby, System Verilog for Design: A Guide to Using System Verilog for Hardware Design and Modeling, Springer.
3. Chris Spear, System Verilog for Verification: A Guide to Learning the Test Bench Language Features.

Reference Books:

1. Mintz, Mike, Ekendahl, Robert, Hardware Verification with System Verilog: An Object Oriented Framework.
2. Bergeron, Janick, Writing Test benches using System Verilog, 2006.
3. Meyyappan Ramanathan, A Practical Guide for System Verilog Assertions.
4. Christian B. Spear, System Verilog for Verification: A Guide to Learning the Test Bench Language Features, 3rd Edition, ISBN: 978-1461407140, Springer 2012.
5. Mark Glasser, Harry Foster, Tom Fitzpatrick, Adam Rose, Dave Rich, Morgan Kaufmann, Open Verification Methodology Handbook: Creating Test Benches in System Verilog and System C, ISBN: 978-0123743985, 2009.
6. Faisal Haque, Jonathan Michelson, Khizar Khan, The Art of Verification with System Verilog Assertions, ISBN: 978-0971199415, Verification Central, 2006.

Course Title/ Code	**INTRODUCTION TO .NET(CSW303)**
Course Type:	Elective (Allied)
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3-0)
Objectives	Students shall be able to learn database driven web application concepts using ASP.NET and Microsoft SQL Server to design and develop the websites.

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

Section –A

Introduction to .NET Technology & Various Control: Overview of .NET Framework, tools available in tool box of the web form, Simple application using web controls, Simple application using web controls, Simple application using custom controls. Master Page, Content Pages and Validating User Input: Implementation of the master page and

add the same master page in the main project, Create the various form of specific application and embedded the data in the project, Implement various validations for control using scripting language, implementation of various validations for control using scripting language.

Section -B

Concepts of Database Access and Database Handling: Creating tables in the database, database connectivity, Display records by using database, Insertion and deletion of records from the database, View and searching the data on web form. Server Control and Tracing in ASP.NET **:** Using server control, Adding Event Procedure to web server control, Tracing in ASP.NET web application, Remote debugging.

Section-C

Creating User Control and Accessing Data: Addion of User Controls to an ASP.NET Web Form ,Creating User Controls ,Displaying a DataSet in a List-Bound Control , Accessing Data with DataReaders and DataSets. Datagrid Control: Create the datagrid and add data, Fetching of the data from the database to datagrid, Addition data into the datagrid, Create a master form in datagrid of the project, Embedded the data from the datagrid to the controls on the form.

Section -D

State Management: State management in web applications, Work with Application data, Session data, use of SQL Server and ASP.NETState Server to store Session and Application data. Deploying a Web Project: Preparing a Website for Deployment,Publishing a Website,Moving database to a remote server, Build real life application with reports.

Text Books:

1. Beginning ASP.NET in C# by Wrox
2. Professional ASP.NET 2.0by BillEvjen

Reference Books:

3. Beginning ASP.NET by ImarSpaanjaars
4. Visual C# 2008: How to Programby Paul J. Deitel, Harvey M. Deitel Prentice Hall, 2009

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

	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	**Fundamentals of Finance (MCS232)**

Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-0-2-0)
Objectives	

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

SECTION A

Introduction to Finance ; Forms of Business Organisation ; 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	**German (FLS321)**
Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
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

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

SECTION A

- Clothes

- Shopping (Dialogue)

SECTION B

- Colours
- Adjective endings
- Weather

SECTION C

- Body and body parts
- Sports
- Common Diseases
- Dialogue at the doctors - Appointment (Over phone, formal and informal)

SECTION D

- Imperative
- Personal pronouns (Accusative)
- Modal verb (May/might)

Reference Book: 1. Studio D A1, Cornelsen Verlag
2. Tangaram A1

Course Title/ Code	**Spanish (FLS320)**
Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
Objectives	1. At the end of the course, students will be able to 2. Exchange greetings and do introductions using formal and informal expressions 3. Understand and use possessives and answer simple questions 4. Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary 5. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., festivals, food, recipes) with

	repetition when needed 6. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. 7. Describe festivals of Spain and Latin America, talk about food and recipes in short discourse using sentences and vocabulary 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 Spanish-speaking world and the student's native culture

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

Section-A

- Direct and indirect Pronouns
- Introduction of verbs that express obligations
- Introduction of famous festivals of Spain and Latin America

Section-B

- Introduction of famous dishes of Spain and Latin America
- Vocabulary related to food.
- How to write recipes

Section-C

- Introduction of Simple past tense
- Conjugation of regular and irregular verbs in past tense
- Introduction of Imperfect tense

Section-D

- Use of imperfect tense in story telling
- Difference in use of Simple past tense and Imperfect tense
- Perifrasis

Reference Book: Aula internacional 1, Modern Spanish Grammar

Course Title/ Code	**French (FLS322)**
Course Type:	**Elective**
Course Nature:	Soft
L-T-P-O Structure	(1-1-0-0)
Objectives	At the end of the course, students will be able to 1. Exchange information about various sports activities. 2. Understand and use adjectives and place them correctly. 3. Learn Basic vocabulary that can be used to discuss objects of different quantities. 4. Discuss the weather by using expression of avoir and faire. 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. Ask questions by using different adverbs of interrogation. 7. Provide basic information about familiar situations and topics of interest by using savoir and connaitre verbs. 8. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture

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

Section-A

- Talking about sports activity
- Position de adjectifs

Section-B

- L'adverbe de quantite
- L'adjectif possessif

Section-C

- Les expressions avec Avoir et faire
- Les verbes savoir et connaitre

Section-D

- Les adverbs interrogatifs
- Les pronom sujets “ON”

ECU01- Semester-VII

SUBJECT CODES	SUBJECT NAME	**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
ECH434-T	WIRELESS COMMUNICATION	EC	HARD	ELECTIVE	3	1	0	0	4	4
ECH436-T	SPEECH SIGNAL PROCESSING									
ECH435-T	MEMS									
ECH434-P	WIRELESS COMMUNICATION LAB	EC	HARD	ELECTIVE	0	0	2	0	2	1
ECH436-P	SPEECH SIGNAL PROCESSING LAB									
ECH435-P	MEMS LAB									
ECH437-T	OPTICAL COMMUNICATION	EC	HARD	ELECTIVE	3	1	0	0	4	4
ECH438-T	ADVANCED CONTROL SYSTEMS									
ECH439-T	ADVANCED MICROPROCESSORS									
ECH437-P	OPTICAL COMMUNICATION LAB	EC	HARD	ELECTIVE	0	0	2	0	2	1
ECH438-P	ADVANCED CONTROL SYSTEMS LAB									
ECH439-P	ADVANCED MICROPROCESSORS LAB									
MAH412-T	OPERATION RESEARCH	MA	HARD	ELECTIVE	3	1	0	0	4	4
MAH411-T	NUMERICAL METHODS	MA								
	ELECTIVE FROM PHYSICS DEPTT	PH								
	ELECTIVE FROM CHEMISTRY DEPTT	CH								
MAH412-P	OPERATION RESEARCH LAB	MA	HARD	ELECTIVE	0	0	2	0	2	1
MAH411-P	NUMERICAL METHODS LAB	MA								
	ELECTIVE FROM PHYSICS DEPTT LAB	PH								
	ELECTIVE FROM CHEMISTRY	CH								

	DEPTT LAB									
	BASKET OF COURSES BY MANAGEMENT DEPTT.	MC	SOFT	ELECTIVE	1	0	2	0	3	2
ECN440	MINOR PROJECT	EC	NTCC	CORE	0	0	2	0	2	2
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**10**	**3**	**10**	**0**	**23**	**19**

DETAILED SYLLABUS
ECU01 –SEVENTH SEMESTER

Course Title/ Code	**WIRELESS COMMUNICATION (ECH434-T, ECH434-P)**
Course Type:	ELECTIVE (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	Having successfully completed this course, the student will be able to demonstrate: 1. An ability to participate in frequency spectrum designing for various wireless communication system in the country based on ITU-R spectrum allotment 2. An ability to understand the mechanism of different operating principles with examples. 3. Analyze cellular mobile communication system like GSM, CDMA and other wireless system

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

Section A

Introduction to Wireless Communication Systems: Evolution of mobile radio communications, Spectrum allocation, Types of wireless communication systems, Inter carrier interference. Small Scale Fading and Multipath **:** Small scale multipath propagation, Impulse response model of a multipath channel, Parameter of multipath channel (Coherence bandwidth, Coherence time, Doppler spread), Types of small scale fading, Rayleigh and Ricean distributions, Statistical models for multipath fading channels(Clark's model 2 – ray Rayleigh fading model)

Section B

Equalization & Diversity : Fundamentals of equalization, Equalizers in a communication receiver, Maximum likelihood sequence, Linear and nonlinear equalizer (DFE & MLSE), Adaptive equalization(Zero Forcing and Least Mean Square Algorithm), Interleaving, Maximal ratio combining improvement, RAKE receiver.

Section C

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

Section D

Cellular Concepts : Concept of cell, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems(cell splitting and sectoring), 2G, 2.5G, 3G. Advanced Wireless Standards**:** OFDMA (Principle, Cyclic prefix, Basics of channel estimation, Peak to Average Power Ratio, SCFDMA, Introduction to 4G Standard.

List of Experiments:

1. Generate all types of noise signal in MATLAB, their respective CDF, PDF, and comment on their behavior.
2. Develop a MATLAB program for designing a wireless channel, including all effects like, shadowing, fading, path loss with optimum method.
3. To study the effect of delay spread on frequency selectivity.
4. To study the outage probability, LCR & ADF in SISO for Selection Combining and MR.
5. Generation and Detection of Maximum likelihood Codes
6. Generation and Detection of Pseudo Random Codes.
7. To understand the cellular frequency reuse concept fulfilling the following objectives:
   i. Finding the co-channel cells for a particular cell.
   ii. Finding the cell clusters within certain geographic area. Verification of truth tables of logic gates.
8. To understand the impact of different parameters influencing the downlink C/I ratio.
9. To understand the concept of co-channel interference and hence Signal to Interference and Noise Ratio.
10. To calculate & plot SINR vs. distance at the MS for adaptation of shadowing effect.

Text Books:

1. Theodore S. Rappaport, Wireless Communications, Pearsons.
2. John G. Proakis and Massoud Salehi, Digital Communication, McGrawHill.

Reference Books:

1. Upena Dalal, Wireless Communication, Oxford University Press.
2. Jochen Schiller, Mobile Communication, Pearson Education Ltd.

Course Title/ Code	MEMS (ECH435-T, ECH435-P)
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	• Introduction of MEMS and their fabrication techniques. • To study the essential electrical and mechanical concepts used in MEMS. • To study the various MEMS systems, their working principles and applications. • To study the current scenario materials used in MEMS and optical MEMS.

	Sections	Weightage
Syllabus	A	25%
	B	25%
	C	30%
	D	20%
	TOTAL	100%

Section A

Introduction to MEMS and Micro Fabrication: History of MEMS development, Characteristics of MEMS, Miniaturization, Micro electronics integration, Mass fabrication with precision. Sensors and Actuators: Energy domain. Sensors, Actuators, Multidisciplinary nature of MEMS. Micro fabrication: microelectronics fabrication process, Silicon based MEMS processes, New material and fabrication processing, Points of consideration for processing. Anisotropic wet etching, Isotropic wet etching, Dry etching of silicon, Deep reactive ion etching (DRIE), and surface micromachining process, Structural and sacrificial material, The LIGA Process.

Section B

Electrical and Mechanical Concepts of MEMS: Conductivity of semiconductors, crystal plane and orientation, Stress and strain – definition, Relationship between tensile stress and strain, Mechanical properties of Silicon and thin films, Flexural beam bending analysis under single loading condition, Types of beam, Longitudinal strain under pure bending, Deflection of beam, Spring constant, Torsional deflection, Intrinsic stress, Resonance and quality factor.

Section C

Working Principle of Microsystems: Working Principle of Microsensors, Microactuators, Microaccelerometers, Microfluidics. Electrostatic sensing and actuation: Parallel plate capacitor, Pressure and tactile sensor, Parallel plate actuator- comb drive, Application of electrostatic sensing and actuators, Thermal sensing and Actuations:Thermal sensors, Actuators, Applications Inertial, flow and infrared sensors, Applications of thermal sensors and actuators. Piezoresistive sensors: Piezoresistive sensor material, Stress in flexural cantilever and membrane, Pressure, Piezoelectric sensing and actuation, Applications of piezoresistive sensors, Piezoelectric material properties, Quartz, PZT, PVDF, ZnO, Gyroscopes, Microfluidic Components and Devices, Microfluidics: Valves, Pumps and Mixers.

Section D

Polymer and Optical MEMS: Polymers in MEMS, Polymide, SU-8, Liquid crystal polymer(LCP), PDMS, PMMA, Parylene, Flurocarbon, Optical MEMS: passive MEMS optical components-lenses, mirrors, Actuation for active optical MEMS, New trends in Engineering and Science: Introduction to NEMS.

List of Experiments:

1. Introduction to Software and creating a 2D model.

   Case Study 1: Piezoresistive pressure sensor
2. Designing of different types of Diaphragm for different types materials used in MEMS.
3. Measurement of Stress and Strain on the Different types of Diaphragm.
4. Calculation of suitable pressure range for the appropriate diaphragm.
5. Placement of Piezoresistors on Diaphragm.
6. Calculation of pressure range for linear range of operation of pressure senor and temperature effects on the pressure sensor.

   Case Study 2: Thermal Actuator
7. Designing of Electothermal actuator of poysilicon material.
8. Designing of Electothermal actuator of poysilicon material.
9. Thermal analysis of electrothermal actuator for stability.
10. Measurement of temperature range for the linear operation of actuator.
11. Report and Presentations on case studies.

Text Books:

1. Chang Liu, Foundations of MEMS, Pearson Indian Print, 1st Edition, 2012.
2. Tai – Ran Hsu, MEMS & Microsystems Design and Manufacturing, Tata McGraw Hill Edition, 2006.
3. James D. Plummer, Michael D.Deal, Peter B. Griffin, Silicon VLSI Technology, Pearson Education.

Reference Books:

1. Gaberiel M. Rebiz, RF MEMS Theory,Design and Technology, John Wiley & Sons, 2003.
2. Charles P. Poole and Frank J. Owens, Introduction to Nanotechnology, John Wiley & Sons, 2003.
3. Julian W.Gardner and Vijay K Varadhan, Microsensors, MEMS and Smart Devices, John Wiley & sons, 2001.

Course Title/ Code	SPEECH SIGNAL PROCESSING (ECH436-T, ECH436-P)
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	• The student will learn the phenomenon of speech production and speech perception. • To develop the student's skills in analyzing and synthesizing speech through pole zero models. • To estimate and enhance speech by analyzing both in time and frequency.

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

Section A

Speech Production: Anatomy and physiology of speech production, Categorization of sound by sources, Prosody: Melody of speech, Uniform tube model, Concatenated tube model. Speech perception: Models of speech perception, Model of Source/Tract interaction.

Section B

Analysis and Synthesis of Pole Zero Speech Models: Introduction, Time dependent speech processing, Linear Prediction (LP) analysis: Basis and development, Levinson-Durbin's method, Normalized error, LP spectrum, LP cepstrum, LP residual, Criterion of "Goodness", Synthesis based all pole modeling, Pole zero estimation: Linearization, Use of two analysis windows.

Section C

Short Time Fourier Transform: Analysis and Synthesis : Need, approach, time, frequency and time-frequency analysis; Short-term fourier transform (STFT), Non-stationary signals, Development of STFT, Transform and filter-bank views of STFT, Signal estimation from the modified STFT, Enhancement of speech, Introduction to constant Q analysis.

Section D

Speech Coding: Need and parameters, Classification, Scalar and vector quantization, Frequency domain coding, Model based coding and LPC residual coding, Applications: GSM, CDMA and other mobile coders, Some applications like pitch extraction, spectral analysis and coding standard.

List of Experiments:

1. To identify the parameters of stationary and non-stationary signal
2. To identify Sampling Frequency and Bit Resolution for Speech Signal Processing.
3. Identification of Voice/Unvoiced/Silence regions of Speech
4. To identify different sound units in a language.
5. To study the effects of short term processing of speech signals.
6. To study the limitations of DTFT for the spectral analysis of speech.
7. To perform the Cepstral Analysis of Speech signals
8. To perform Linear Prediction Analysis on male and female voices.
9. Experiment no 8 continued
10. Estimation of formants from speech signals
11. Detection of Voice activity in speech.
12. Minor Project

Text Books:

1. L.R. Rabiner and R.W. Schafer, Digital Processing of Speech Signals, Pearson Education, Delhi, India,2004
2. T. F. Quatieri, Discrete Time Processing of Speech Signals, Pearson Education, 2005.
3. J. R. Deller, Jr., J. H. L. Hansen and J. G. Proakis, Discrete Time Processing of Speech Signals,Wiley-IEEE Press, NY, USA, 1999.

Reference Books:

1. D. O'Shaughnessy, Speech Communications: Human and Machine, Second Edition, University Press, 2005.
2. L. R. Rabiner, B. H. Jhuang and B. Yegnanarayana, Fundamentals of speech recognition, Pearson Education, 2009.

Course Title/ Code	**OPTICAL COMMUNICATION (ECH437-T, ECH437-P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard Course
L-T-P-O Structure	(3-1-2-0)
Objectives	Student will analyze fiber-optic communication systems and signal guiding characteristics of glass fibers, relate the application of optical fiber technology to modern telecommunication systems.

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

Section A

Introduction to Optical Fiber Communication: Electromagnetic spectrum used for optical communication, Block diagram of optical communication system, OFC System components and their working. Basic ray theory, advantages and disadvantages of OFC, Optical fiber structure. Optical Fibers And Cables: Fiber types, Step-index & Graded index fibers, Optical fiber modes, Single mode and multimode fibers, Fiber materials, Fiber optic cables. Transmission Characteristics: Attenuation, Material absorption, Scattering, Fiber bend loss, Dispersion –intermodal & intra-modal, Material and waveguide dispersions, Dispersion modified single mode fiber.

Section B

Light Sources: Absorption, spontaneous and stimulated emission, Semiconductor materials, Hetero-junctions. LED: LED structure (Planer, Dome, Surface, and Edge), Light output characteristics, Internal and external quantum efficiency, Lens coupling to fiber. LASER: Basic concepts of lasing, Semiconductor injection laser, Laser output characteristics, Laser Modulation, Laser to fiber coupling. Optical Detectors: Optical detection principles, Quantum efficiency and responsivity, Intrinsic absorption. PIN Photodiode**:** PIN photodiode structure, Impulse and frequency response of PIN photodiodes, Noise in PIN Photodiodes. Avalanche Photodiode**:** APD structure, APD bandwidth, APD noise, Multiplication process and excess noise, Comparison of Photo detectors.

Section C

Optical Fiber Connections: Fiber joints, Fiber splicing, Fiber couplers and connectors. Optical Fiber Communication System**:**. Optical transmitter and receiver circuits, Optical power budgets, Multiplexing and demultiplexing techniques – Optical TDM, WDM and DWDM. Optical Networks: Network concept and topologies, SONET/SDH, Optical switching.

Section D

Optical Amplifiers: Erbium doped fiber amplifier, Fiber Raman amplifier, and semiconductor laser amplifier. Fiber Optic Sensors: Introduction, Classification, Intensity-modulated sensors, Phase-modulated sensors, Spectrally modulated sensors, Distributed fiber-optic Sensors, Fiber-optic smart structures, Industrial applications of fiber-optic sensors.

List of Experiments:

1. a) Setting a fiber optic analog link and measure the bandwidth of the link
   b) Setting a fiber optic digital link and determine the maximum bit rate transmitted through the link.
2. Performance analysis of bi-directional broadband passive optical network
3. Measurement of numerical aperture and V-number of optical fiber.
4. Lab sheet for optical fiber components.
5. To determine Propagation loss & bending loss in optical fiber.
6. To determine and plot the characteristics of LED and LASER.
7. To analyze the RF spectrum of Laser Frequency Response
8. To determine and plot the characteristics of Photo-detector..
9. To measure the performance of optical communication system.
10. To study and analyze the Dispersion compensation.
11. To optimize the EDFA gain for WDM.

Text Books:

1. John M Senior, Optical Fiber Communications, Pearson.
2. R.P.Khare, Fiber Optics and Opto Electronics, Oxford Publication
3. Gerd Keiser; Optical Fiber Communications, TMH

Reference Books:

1. John Gowar, Optical Communication Systems, PHI.
2. Selvarajan, Kar, Srinivas, Optical fiber Communication, TMH.
3. Ghatak, K. Thyagarajan, An Introduction to Fiber Optics, Cambridge University Press
4. Donald J. Sterling, Technician's guide to fiber optics, Thomsons Learning Inc.

Course Title/ Code	**ADVANCED CONTROL SYSTEMS (ECH438-T, ECH438-P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	Students will be able to perform stability analysis of non linear control systems effectively.

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

Section A

Nonlinear Control Systems and Analysis: Definition of nonlinear systems**,** Difference between linear and nonlinear systems, Characteristics of nonlinear systems**,** Common physical nonlinearities. Analysis and Design of Nonlinear Control System**:** Phase plane analysis, Phase plane method - basic concept, Trajectories, Phase portrait, Singular points and their classification, Limit cycle and behavior of limit cycle, Phase plane analysis of nonlinear systems, Construction of phase trajectories using delta method

Section B

Describing Function Analysis (DF): Derivation of general DF, DF for different nonlinearities, and stability analysis of nonlinear system, Prediction of stability of nonlinear systems using DF method, Relay, Dead-zone, Backlash, and Saturation. State Variable Techniques: State space modeling, State transition matrix. State variables and linear discrete time systems, Diagonalisation, Solution of state equations, Conversion of state variable model to transfer function, Conversion of transfer function to canonical state variable model, Concept of Controllability and Observability, Test for Controllability and Observability, Linearization Techniques**:** Linearization by small signal analysis (Taylor series expansion), Linearization by nonlinear feedback.

Section C

Lyapunov Stability Analysis: Stability of equilibrium state, Asymptotic stability, Graphical representation, Lyapunov stability theorems, Stability analysis of linear systems, Nonlinear systems, Construction of Lyapunov functions using Krasovskii method, Variable gradient method. Digital Control Systems: Introduction, Spectrum analysis of sampling process, Signal reconstruction, Difference equations, z transform, Pulse transfer function, Inverse z transform response of linear discrete systems, z transform analysis of sampled data control systems, z and s domain relationship, Stability analysis.

Section D

Optimal Control and Adaptive Control: Problem formulation, Necessary conditions of optimality, State regulator problem, Parameter optimization problem, Optimization by Steepest Descent method, Optimization with constraint by Gradient method, Optimal control problem definition, Performance index and optimal control law, Basic optimal control design, Mathematical procedures for optimal control design, Pontryagin's minimum principles, time and optimal control problem. Definition of adaptive control system, functions of adaptive control, gain scheduling, model reference, series and parallel schemes and their industrial applications.

List of Experiments:

Nonlinear Control System and Analysis

1. Construct the trajectory for system represented by second order differential equation and for any initial condition by using Iso-cline and Delta Methods.
2. Draw the trajectory for the system with nonlinear element, relay, saturation, etc. for any initial condition and step input by using Iso-Cline and Delta Methods.
3. Study the behavior of Limit Cycle with the help of Van der Pol's equation.
4. Derivation of DF for nonlinearities, relay with saturation, relay with dead-zone, dead-zone and saturation, relay with Hysteresis etc.
5. Investigate the stability of system with nonlinearities, relay, saturation, deadzone, hysteresis and existence of limit cycle using DF technique.

Lyapunov Stability Analysis

6. Verify Sylvester theorem for the definiteness of the Liyapunov Function.
7. Determine the stability of the system and construct the Liyapunov function for Linear Time Invariant system.
8. By using Krasovskii method determine the stability of the system and construct the Liyapunov function.
9. By using Variable Gradient method determine the stability of nonlinear system.

Adaptive control

10. Study the different schemes of adaptive control and their applications.
11. Project

Text Books:

1. K. Ogata, Modern Control Engineering, 3 ed. Prentice Hall of India (P) Ltd., New Delhi.
2. Benjamin C. Kuo , Automatic Control Systems, Prentice-Hall Inc.
3. Norman S. Nise, Control Systems Engineering, Wiley Publications.

Reference Books:

1. M. Gopal, Modern Control System Theory, Wiley Eastern Ltd., New Delhi.
2. Gene F. Franklin, J David Powell, Abbas Emami-Naeini, Feedback Control of Dynamic Systems, 5ed Pearson Educations.
3. Shankar Sastry, Marc Bodson, Adaptive Control, Prentice Hall of India (P) Ltd.

Course Title/ Code	**ADVANCED MICROPROCESSORS (ECH439-T, ECH439-P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	Students will be able to build microprocessor based systems using Advanced Microprocessors.

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

Section A

Introduction to Microprocessor Family 80X86: Introduction to 80X86 and its higher processors, Advancements in microprocessors and introduction to latest advancements. Machine language instruction formats of 8086, Addressing modes of 8086, Instruction set of 8086/8088, Assembler directives and operators, Timing diagram of MIN and MAX mode of 8086. Numerical co-processor 8087:- Architecture, Pin diagram, Register set, Control word register, Exception handling, Interfacing with 8086, Instruction set of 8087, Programming using 8087.

Section B

80286 and its Co-Processor: 16 bit microprocessors: Internal architecture, Pin out, Real addressing modes, Protected virtual address mode, Privilege, Protection, Special operations, Bus interface, Fetch cycles, Interfacing I/0 and memory, Instruction set features, 80287 Co-processor.

Section C

80386 & 80486 Microprocessors: Introduction to 80386 microprocessor, Pin out, Register organization, Addressing modes, Data types, Real address mode, Protected mode, Virtual 8086 mode, Memory management unit (MMU), Memory paging mechanism, Memory segmentation, Enhanced instruction set, Introduction to 80486 and Pin out.

Section D

Pentium and Higher Processors: Pentium microprocessor architecture, Special Pentium registers, Pentium memory management, New Pentium instructions, Pentium Pro Microprocessor Architecture: Special features, Pentium IV Architecture, Comparison of Pentium processors, Motorola 680X0 microprocessor, Architecture, Register set, Pin diagram, Addressing mode, Instruction set.

List of Experiments:

1. Study and use of 8086 microprocessor trainer kit and execution of programs.
2. Write an ALP to generate square wave with period of 200μs, address of output device is 55H for 8086 microprocessor.
3. Array of LED Interfacing with 8086.
4. Program to Interface Seven Segment Display with 8086 microprocessor.

5. Generate Fibonacci series using 8086.
6. String Searching and Sorting.
7. Interfacing a Dot matrix display with 8086.
8. Interfacing of DC motor.
9. Project

Text Books:

1. A. K. Ray & K. M. Bhurchandi, Advanced microprocessors and peripherals, Tata McGraw Hill, New Delhi
2. Barry B Bray,& C. R. Sarma, The INTEL Microprocessors , Pearson Education Ltd, New Delhi

Reference Books:

1. Douglas V. Hall, Microprocessors and Interfacing Programming and Applications, Mc Graw Hill.
2. A. J Khambata, Microprocessors / Microcomputers Architecture, Software and Systems, John Wiley & Sons.

Course Title/ Code	**NUMERICAL METHODS (MAH411-T, MAH411-P)**
Course Type:	Elective (Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-1)
Objectives	The students would be able to apply the concepts of numerical techniques required for solving the mathematical problems and their applications.

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

Section A

Solution of nonlinear & tranequations bracketing methods for locating a root, initial approximations and convergence criteria, bisection method, regulafalsi, Newton- Raphson and secant method. Interpolation and curve fitting: introduction to interpolation, Lagrange approximation, Newton's formula for Equispaced & non Equispaced points (forward, backward and divided difference), hermite interpolation. Curve fitting by a straight line and a second degree curve and laws reducible to linear law.

Section B

Numerical differentiation and integration: approximating the derivatives, numerical differentiation formulas (forward, backward and central), introduction to numerical quadrature, Newton- cotes formula, Gaussian quadrature - Gauss Legendre & Gauss Chebyshev's.

Section C

Solution of linear systems: direct methods, Gaussian elimination, matrix inversion, iterative methods for linear systems (Gauss Seidel & Gauss Jacobi), LU decomposition. Eigen value problems: Jacobi, Given's and Householder's methods for symmetric matrices, power and inverse power methods.

Section D

Solution of differential equations: Introduction to differential equations, Initial value problems, Picard's method, Taylor series method , Euler's methods, classical method of Runge-Kutta method of order IV , Predictor-Corrector methods(Milne's & Adam's Bashforth).

Text Book:

1. M.K. Jain, S.R.K. Iyengar and R.K.Jain, "Numerical Methods for Scientific and Engineering Computation", New Age international Publishers.

Reference Book:

1. Laurene V, Fausett, "Applied Numerical Analysis using MATLAB", Pearson.
2. S.S. Sastry, "Introductory Methods of Numerical Analysis", Published by Prentice Hall of India.

List of Experiments:

1. To find roots of an equation using Bisection method.
2. To find roots of an equation using RegulaFalsi method.
3. To find roots of an equation using Newton Raphson method.
4. To find roots of an equation using Secant method.
5. To find the value of a dependent variable for a given value of an independent variable using Lagrange's interpolation method for a given set of data.
6. To find the value of a dependent variable for a given value of an independent variable using Newton divided difference interpolation for a given set of data.
7. To find the value of a definite integral using Trapezoidal rule of integration.
8. To find the value of a definite integral using Simpson's 1/3 rule of integration.
9. To find the value of a definite integral using Simpson's 3/8 rule of integration.
10. To find the solution of an ordinary differential equation of first order by Euler's modified method
11. To find the solution of an ordinary differential equation of first order by R-K method
12. To find the solution of a system of simultaneous algebraic equations using the Gauss-Jacobi iterative method.
13. To find the solution of a system of simultaneous algebraic equations using the Gauss-Seidel iterative method

Course Title/ Code	OPERATION RESEARCH (MAH412-T, MAH412-P)
Course Type:	Elective (Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	The students would be able to apply the concepts of operations research required for solving the mathematical problems and their applications.

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

Section – A

Introduction to Operations Research: Development – Definition– Characteristics and Phases – Types of models – operation Research models– applications.
Linear Programming Problems: Formulation – Graphical solution – Simplex method –Artificial variables techniques -Two–phase method, Big-M method – Duality Principle.

Section – B

Transportation problem– formulation, optimal solution, unbalanced transportation problem, Degeneracy. Assignment problem: formulation, optimal solution, variants of Assignment Problem- Traveling Salesman problem. Replacement problem: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely, group replacement. Staffing problem, equipment renewal problem.

Section – C

Project management-PERT & CPM: significance, phases of project management, PERT /CPM network components and precedence relationship, critical path analysis, forward and backward pass methods, slack of an activity and event, project scheduling with uncertain activity times, estimation of project completion time, project time –cost trade off, updating of the project progress.

Section – D

Waiting lines: Introduction – Single Channel – Poisson arrivals – exponential service times – within finite population and finite population models– Multichannel – Poisson arrivals – exponential service times with infinite population single channel Poisson arrivals. Sequencing problems: Introduction, assumptions, processing of n - jobs through 2 machines, processing of n - jobs through 3 machines processing of n - jobs through m- machines.

Text books:

1. Operations Research / S.D.Sharma-Kedarnath

2. Introduction to O.R/Taha/Pearsons

Reference Books:

Operation Research/A.P.VERMA/SK KATARIA AND SONS
Operations Research/P.K.GUPTA &D.S.HIRA
Software Reliability / John D.musa,Anthony Iannino and KajuzuhiraOkumoto/ Mac-Grawhill

List of Experiments

1. To solve the LPP involving the inequality constraints.
2. To solve the LPP involving the equality constraints.
3. Finding solution of LPP graphically.
4. To solve the LPP using the Simplex method.
5. To solve the LPP using Phase I method.
6. To solve the LPP using Phase II method.
7. To find the dual of given LPP..
8. Solution of dual by simplex method and interpretation
9. Formulating and solving transportation.
10. To find solution of assignment problems.

ECU01- Semester-VIII

SUBJECT CODES	SUBJECT NAME	**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
ECH441-T	WIRELESS SENSOR NETWORK	EC	HARD	ELECTIVE	3	1	0	0	4	4
ECH442-T	DATA COMMUNICATION									
ECH443-T	DIGITAL SIGNAL PROCESSORS									
ECH444-T	FUZZYLOGIC, NEURAL NETWORK & APPLICATIONS									
ECH441-P	WIRELESS SENSOR NETWORK LAB	EC	HARD	ELECTIVE	0	0	2	0	2	1
ECH442-P	DATA COMMUNICATION LAB									
ECH443-P	DIGITAL SIGNAL PROCESSORS LAB									
ECH444-P	FUZZYLOGIC, NEURAL NETWORK & APPLICATIONS LAB									
ECH445-T	SATELLITE COMMUNICATION	EC	HARD	ELECTIVE	3	1	0	0	4	4
ECH446-T	INDUSTRIAL AUTOMATION									
ECH447-T	EMBEDDED SYSTEM DESIGN									
ECH445-P	SATELLITE COMMUNICATION LAB	EC	HARD	ELECTIVE	0	0	2	0	2	1
ECH446-P	INDUSTRIAL AUTOMATION LAB									
ECH447-P	EMBEDDED SYSTEM DESIGN LAB									
ECN448	MAJOR PROJECT	EC	NTCC	CORE	0	0	8	0	8	8
	TOTAL (L-T-P-O/CONTACT HOURS/CREDITS)				**6**	**2**	**12**	**0**	**20**	**18**

DETAILED SYLLABUS
ECU01 –EIGTH SEMESTER

Course Title/ Code	**WIRELESS SENSOR NETWORK (ECH441-T, ECH441-P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	Students will be able to implement communication network using wireless sensors.

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

Section A

Introduction and Overview of WSN: Introduction, Brief historical survey of sensor networks, Challenges for wireless sensor networks, Enabling technologies for wireless sensor networks, Ad-Hoc networks, Applications of wireless sensor networks: Sensor and robots, Reconfigurable sensor networks, Highway monitoring, Military applications, Civil and environmental engineering applications, Wildfire instrumentation, Habitat monitoring, Nanoscopic sensor applications, Wireless Network Standards: IEEE 802.15.4.

Section B

Architecture: Basic sensor network architectural elements, Single node architecture, Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments, Network architecture, Sensor network scenarios, Optimization goals and figures of merit, Gateway concepts.

Section C

Medium Access Control for WSN: Physical layer and transceiver design Considerations, MAC protocols for wireless sensor, Networks, Low duty cycle protocols and wakeup concepts -Box-MAC, Bit-MAC, H-MAC, I-MAC, O-MAC, S-MAC , The mediation device protocol, Wakeup radio concepts, Address and name management, Assignment of MAC addresses, Routing protocols- Energy efficient routing, Geographic routing, Flooding and its variants.

Section D

Infrastructure Establishment: Topology control, Clustering, Time synchronization, Localization and positioning, Sensor tasking and control, Examples of operating systems: Tiny OS, Mate, Magnet OS.

List of Experiments:

1. Optimum Placements of sensors in wireless sensor network.
2. Sensor placement for effective diagnosis of multiple faults.
3. To generate a random matrix.
4. Generate a data matrix of the designated pattern vectors
5. Find the Fisher Information matrix associated to this matrix
6. Calculate the determinant for the Gram matrix for each sensor. This is done by deleting the rows and columns of matrix corresponding to the sensor reading with lowest interference, thus providing effective independence for the chosen sensor location
7. Remove the sensor which has least determinant from the data matrix by obtaining the matrix,
8. Add the next column from the matrix of data in order to update the Gram matrix with a new sensor. This procedure is repeated until an optimum matrix is obtained with all optimum sensor location sets.

Text Books:

1. Holger Karl & Andreas Willig, Protocols And Architectures for Wireless Sensor Networks, John Wiley.
2. Feng Zhao & Leonidas J. Guibas, Wireless Sensor Networks- An Information Processing Approach, Elsevier

Reference Books:

1. Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Network, John Wiley.
2. Ananthram Swami, Qing Zhao, Yao-Win Hong, Lang Tong, Wireless Sensor Networks Signal Processing and Communications, John Wiley.
3. Murthy, Adhoc Wireless Networks: Architectures And Protocols, Pearson Education .
4. C. S. Raghavendra, Wireless sensor networks, Springer.

Course Title/ Code	**DATA COMMUNICATION(ECH442-T, ECH442-P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	Students shall be able to explain the importance of data communication and internet in supporting business communications and daily activity.

	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	DIGITAL SIGNAL PROCESSORS (ECH443-T, ECH443-P)
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	● Understand the design tradeoffs and performance of Digital Signal Processors. ● Understand the hardware and software issues in Digital Signal Processor Design. ● Implement DSP algorithms and applications on Digital Signal Processors.

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

Section A

Digital Signal Processing Systems: Introduction to Digital signal processing systems and applications**,** DSP architectures, Software developments, hardware issues, system considerations.

Section B

Implementation Considerations: Data representations and arithmetic, Finite word length effects and solutions, programming issues, real time implementation considerations, hardware interfacing,

Section C

Fixed Point Digital Signal Processors: Source statement format, assembler directives, software development processes, TMS 320C2000, TMS320C54x, TMS320C62x, their architecture, programming issues, system issues and application

Section D

Floating Point Digital Signal Processors: TMS320C67X, TMS320C3x Architecture, central processing unit, memory organization and addressing modes, pipelining architecture, real time implementations, FIR filtering, IIR filtering

List of Experiments:

1. Creating, building and debugging a program on DSP starter kit.
2. Viewing and interpreting Memory graphics, breakpoints and profiler.
3. Implement and test an IIR filter on CCS and MatLab.
4. Perform overflow analysis, rounding and truncation analysis on the sum and product of two sine waves on SIMULINK and Fixed point blockset.
5. Expt no 4 contd..
6. Perform overflow analysis, rounding and truncation analysis on the sum and product of two sine waves on CCS.
7. Expt no.6 contd..
8. Represent a series of numbers in Q.15, Q.14 and Q2.13 formats and interpret the resulting data in a fixed point processor.
9. Expt no.8 contd.
10. Design a bandpass FIR and implement in MatLab and CCS.
11. Minor project
12. Minor project

Text Books:

1. B.Venkatramani, Digital signal processors, TMH
2. Sen M.Kuo, Woon-Seng S.Gen, Digital signal processors, Pearson.

Reference Books:

1. Jeff Bier, Amit Shoham, Edward A. Lee**,** DSP Processor Fundamentals: Architectures and Features, (IEEE Press Series on Signal Processing)

Course Title/ Code	**NEURAL NETWORKS, FUZZY LOGIC AND APPLICATIONS (ECH444-T, ECH444-P)**
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	To analyze the concepts and applications of machine learning using artificial neural networks and fuzzy logic.

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

SECTION A

Introduction to neural networks: Biological neural, Neural processing, Supervised and unsupervised learning, Neural network learning rules. Single layer perception, discrete and continuous perception, multi layer feed forward network, Back propagation networks, feedback networks, Training algorithms.

SECTION B

Unsupervised networks: Unsupervised learning, Competitive learning networks, Kohonen self organizing networks, Learning vector quantization, Hebbian learning, Hopfield network, Content addressable nature, Binary hopfield network, Continuous hopfield network.

SECTION C

Associative memories and SOM: Bidirectional associative memory, Principle component analysis. Auto associative memories, Bidirectional associative memory (BAM), Self organization maps (SOM) and ART1.

SECTION D

Fuzzy logic: Fuzzy sets, Fuzzy Rules: Extension Principle, Fuzzy measures, Fuzzy relations, Fuzzy functions, Fuzzy reasoning. Fuzzy systems and applications: Representation of fuzzy knowledge, Fuzzy inference systems, Mamdani model, Sugeno model, Tsukamoto model, Fuzzy decision making, Multi objective decision making, Fuzzy classification, Fuzzy control methods, Application.

List of Experiments:

1. Introduction to MATLAB and NN Toolbox.
2. Generation of few activation functions that are being used in neural networks.
3. Computing and plotting with perceptron and logic gates.
4. Computing and plotting with different neuron models.
5. Computing hebbian learning.
6. Computing and plotting with multilayer perceptron (MLP) for classification and regression problems.
7. Computing with RBF network as classifier (XOR Design)
8. Computing with kohonen's net (SOM) for clustering and visualization of data.
9. Computing with K-means algorithm for clustering data.

10. Hopfield net and designing associative memory.
11. Neural net techniques for object or image recognition and biometrics.
12. Introduction to fuzzy logic in MATLab.
13. Solving problems on fuzzy sets and operations on fuzzy sets

TEXT BOOK

1. S. Rajasekaran, G. A. Vijayalakshmi pai **,** Neural networks, fuzzy logic and genetic algorithm: synthesis and applications, Eastern Economy Edition,2011.
2. Jang J S R Sun C T and Mizutani E, Neuro Fuzzy and Soft computing, Pearson Education, (Singapore), 2004.

REFERENCES

1. S Rajasekaran and G A Vijayalakshmi Pai, “Neural networks Fuzzy logics and Genetic algorithms”, Prentice Hall of India, 2004
2. Derong Liu , “Advances in Neural Networks--ISNN 2007 “, Springer, 2007
3. Timothy J Ross, “Fuzzy Logic Engineering Applications”, John Wiley and Sons, 2004
4. James A. Anderson, “An Introduction to Neural Networks”, Prentice Hall, 2002

Course Title/ Code	SATELLITE COMMUNICATION (ECH445-T, ECH445-P)
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-0-2-0)
Objectives	To understand the basics of orbital mechanics, types of satellite orbits, location of ground stations, look angles from ground stations to the satellite and to examine the concepts of special satellite networking for voice and internet communication.

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

Section A

Overview of Satellite Communication: Evolution & growth of communication satellite, Satellite frequency allocation & Band spectrum, Current status and advantages of Satellite Communication, Active & Passive satellite, Applications of satellite communication. Satellite Orbits: Keplers laws of planetary motion, Describing orbit of satellite, Types of satellite orbit, Locating satellite in orbit, Locating satellite with respect to earth, Orbital elements, Look angles, Orbital perturbation, Orbit determination, Synchronous orbit, Launch vehicles, Placing Satellites into Geostationary Orbit, Telemetry, Tracking, Command and Monitoring (TTC&M).

Section B

Communication Satellite Link Design: Introduction, General link design equations, System noise temperature, C/N & G/T ratio, Link Budgets, Complete link design, Interference effects on complete link design, Earth station parameters, Free space loss, Atmospheric absorption, Rainfall Attenuation. Multiple Access Techniques: FDMA, Calculation of C/N with Intermodulation, TDMA, TDMA-Frame structure, TDMA-Burst structure, TDMA-Frame efficiency, TDMA- superframe, TDMA Frame acquisition & synchronization, Transmitter power in TDMA Networks, TDMA compared to FDMA, Multiple Beam (Satellite switched) TDMA satellite system, Beam Hopping(Transponder Hopping) TDMA, CDMA & hybrid access techniques**.**

Section C

Modulation and Multiplexing Techniques for Satellite Links: Analog satellite communication: Introduction, Baseband analog (Voice) signal, FDM techniques, S/N & C/N ratio in frequency modulation in satellite link, S/N ratio in FM with multiplexed telephone signal in satellite link, Single channel per carrier (SCPC) systems, Companded single

sideband (CSSB) systems, Analog FM/FDM TV satellite link, Intermodulation products & their effects in FM/FDM systems, Energy disposal in FM/FDM systems. Digital satellite communication: Elements of digital satellite communication systems, Satellite digital link design, Time Division Multiplexing.

Section D

Special Purpose Communication Satellites: Direct Broadcast Satellite, INMARSAT, INTELSAT , VSAT (data broadband satellite), MSAT (Mobile Satellite Communication technique), SARSAT (Search & Rescue satellite) & LEOs (Lower earth orbit satellite), MEO (Medium earth orbit), GEO (Geostationary orbit), Satellite communication with respect to Fiber Optic Communication, LANDSAT, Defense satellite, Satellite Navigation and the Global Positioning System, Introduction to ISRO (Indian Space Research Organization) satellites.

List of Experiments:

1. To set up satellite link and to estimate C/N Ratio and S/N ratio in satellite communication.
2. To send Tele-command and receive the Telemetry Data and Study the operation of Codec.
3. Plot of satellite azimuth & elevation angle using sky plot window.
4. To study the effect of a) path loss and calculate the distance between transmitter and receiver. b) Fading and measure the Fading margin of a received signal.
5. To set up a PC to PC Satellite Link using RS–232 port.
6. To measure the propagation delay of signal in a Satellite Communication Link.
7. Measurement of geographical location with GMT/IST using navigation window.
8. a)Analysis of Uplink and Downlink Link Budget Equation using MATLAB
   b) To obtain a plot of the relationship between the Heights of the satellite i.e. Orbital Altitude and the Satellite Antenna Diameter for the parameters achieved during Link budget Analysis.
9. To determine the free space loss and the power received in satellite communication using MATLAB program.
10. Rain Attenuation Modeling- ITU-R P.618-09 using MATLAB

Text Books:

1. Trimothy Pratt, Charles W. Bostian, Satellite Communications, John Wiley & Sons, 1986.
2. Dennis Roddy, Satellite Communications, McGraw Hill, 1996.

Reference Books:

1. Robert M Gagliardi, Satellite Communicatio', Van Nostrand Reinhold
2. A K Maini, Varsha Agrawal, Satellite Communication, Wiley
3. R. W. Jones, Handbook on Satellite Communication, International Telecommunication Union, edition Wiley, 2002

Course Title/ Code	INDUSTRIAL AUTOMATION (ECH446-T, ECH446-P)
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	• Controlling complicated systems in an optimized way by reducing human error at the same time. • Redesigning of systems in a much simpler way for better performance. • To control and analyze systems in real time.

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

Section A

Introduction to Industrial Automation and Control: Architecture of Industrial Automation Systems. Introduction to Programmable Logic Controller: PLC evolution, Hardwire control system compared with PLC system , Advantages of PLCs – criteria for selection of suitable PLC, Block diagram of PLC and principle of operation, Power supplies to PLC, list of various PLCs available, IEC 61131 standard, Various Direction Controlled Valves, Pressure control valves, Flow control valves. Input Modules**:** Discrete input module, Analog input module, Sinking and sourcing, Sensors (Limit switch, Reed switch, Photo electric sensor, Inductive proximity sensor, Temperature sensor, Ultrasonic), Input Addressing scheme in important commercial PLCs. Output modules:-Discrete output module, TTL output module, Relay output, Isolated output module, surge suppression in output, Analog outputs, open collector output, Output addressing scheme in important commercial PLCs.

Section B

PLC Programming: Symbols used, Relays and logic functions – OR, AND, Comparator, Programming Devices, Simple instructions, Programming NC and NO contacts, EXAMINE ON and EXAMINE OFF instructions, online, offline methods, Latch and Unlatch outputs, Pulse edge evaluation, Timer instructions, on-delay and off-delay timer, Counter instructions, UP / DOWN counters, Timer and Counter applications, Program control instructions, Data manipulating instructions, Math instructions, Converting simple relay ladder diagram into PLC relay ladder diagram, PID and PWM functions.

Section C

Networking: Levels of industrial control, Types of networking, Transmission media, Network architecture, Network communications protocols, Field Bus – introduction, Concepts, International field bus standards, TCP / IP Protocol, Ethernet, Modbus, Hart Protocol, DNP3, IEC 60870-5, IEC 61850, IEC 62351.

Section D

Data Acquisition Systems: Computers in Process control, Data Loggers, Data acquisition systems (DAS), Alarms, Direct Digital Control (DDC), Computer Process interface for Data Acquisition and control, Supervisory Control and Data Acquisition (SCADA), Introduction and brief history of SCADA – SCADA Hardware and software, Applications.

List of Experiments:

1. To study hardware and software used in PLC
2. To develop Ladder program for Gates.
3. To develop an application using On-Delay and OFF- Delay timer.
4. To Develop an application using UP/DOWN counter
5. To develop a ladder program for DOL and Star Delta starter
6. To study PID controller instruction for a pilot plant
7. To develop and implement for traffic Control Application.
8. To develop implement logic for Bottle Filling Application
9. Project

Text Books:

1. Gary Dunning, Introduction Programmable Logic Controllers, CENGAGE Learning, 3rd Ed., 2006.
2. John R. Hackworth, Frederick D. Hackworth Jr , Programmable Logic Controllers, Pearson, 2004.
3. Bolton, Programmable Logic Controllers, Elsevier, 4th Ed., 2006.
4. Various IEC standards.

Reference Books:

1. Frank.D. Petruzella, Programmable Logic Controllers, Tata McGraw Hill, 3rd Edition.2010.
2. Douglas M. Considine, Glenn D. Considine, Standard Handbook of Industrial Automation, Springer.

Course Title/ Code	EMBEDDED SYSTEM DESIGN (ECH447-T, ECH447-P)
Course Type:	Elective (Departmental)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	To introduce the concepts of Microcontroller and to design real time systems using it.

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

Section A

Introduction to Embedded Systems: Embedded systems, Components of embedded systems- Processor Embedded into a system, Embedded software in a system, Classification of Embedded systems, Design Process-Requirements, Specifications, Designing of components, System Integration. Basic Embedded Microcontroller Architecture: 8051architecture, Addressing modes, Instruction set, Timers, Interrupts, Serial Communication.

Section B

Interfacing I/O Devices with 8051: DAC,ADC, LCD,IR,LDR, KEYPAD. Overview of Atmega 32 Microcontroller**:** Introduction to Atmel AVR microcontroller, Architecture, Instruction set, Status registers, General purpose registers, Interrupt vectors, Serial ports, Timers and counters, Operational features and programming.

Section C

Embedded System Co-Design: Distributed embedded architecture- Hardware and software architectures, Networks for embedded systems -I2C, CAN Bus, SHARC link ports, Ethernet, Myrinet, Internet, Network based design, Communication analysis, System performance analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.

Section D

Real Time Operating Systems: Semaphores and shared data operating system services, Memory management, Interrupt routines in an RTOS environment, Basic design using RTOS, Services I/O sub systems, Network operating system, Interrupt routines in RTOS environment, RTOS task scheduling models, Interrupt–IEEE standard POSIX functions for standardization of RTOS and inter-task communication functions.

List of Experiments:

1. Introduction to KEILC and Program to toggle all the bits of Port P1 continuously with and without delay
2. ADC (0808) interfacing with 8051
3. LCD interfacing with 8051
4. Keyboard Interfacing with 8051
5. Reading LM35 and plotting in LCD.
6. Introduction to Arduino and interfacing LED & Switch to it.
7. Design of Simple Embedded Systems:

   i. Alarm clock using 8051
   ii. Voting Machine using 8051
   iii. Station display using 8051
   iv. Keypad controlled Lock using Arduino
   v. IR Remote Controlled Home Appliances using Arduino
   vi. Blink an LED using Bluetooth using Arduino
   vii. Vending machine using Arduino

Text Books:

1. Raj Kamal, Embedded Systems Architecture Programming and Design, Tata McGraw Hill, NewDelhi, 2003
2. Muhammad Ali Mazidi, Sarmad Naimi, Sepehr Naimi, The AVR Microcontroller and Embedded Systems Using Assembly and C, Prentice Hall, 2011
3. Wayne Wolf, Computers as Components Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001
4. David E. Simon, An Embedded Software Primer, Pearson Education, 2009

Reference Books:

1. Shibu K.V, Introduction to Embedded Systems, Tata McGraw-Hill, NewDelhi, 2003
2. Muhammad Ali Mazidi, 8051 Microcontroller and Embedded systems, Pearson Education, 2009
3. Steven Frank Barrett, Daniel J. Pack**,** Atmel AVR Microcontroller Primer: Programming and Interfacing, Morgan and Claypoll publishers
4. Lyla, Embedded Systems, Pearson, 2013
5. Steve Heath, Embedded System Design, Elsevier, 2005.
6. Jean J. Labrosse**,** Embedded Software**,** Elsevier, 2008

DEPARTMENT OF ELECTRONICS & COMMUNICATION
SYLLABUS & SCHEME (ECU01)
TOTAL CREDITS FOR SEMESTER I – VIII

S.No.	Semester	Credits
1	I	24
2	II	24
3	SUMMER TRAINING (POST 2nd SEM)	3
4	III	24
5	IV	24
6	SUMMER TRAINING (POST 4th SEM)	6
7	V	24
8	VI	22
9	SUMMER TRAINING (POST 6th SEM)	6
10	VII	19
11	VIII	18
TOTAL CREDITS FOR B.TECH PROGRAMME		194

COURSES OFFERED TO OTHER DEPARTMENTS

SEMESTER	COURSE CODE	COURSE NAME	OFFERED TO (DEPARTMENT)	Course Type	Course Nature	PERIODS				CREDITS
				Core/Elective/ University Compulsory	Hard/Soft/ Workshop/ NTCC	L	T	P	O	
1st	ECH101	ELECTRICAL ENGINEERING	CSE,IT	Core	Hard	3	1	2	0	5
2nd	ECH103	FUNDAMENTALS OF ELECTRONICS	ME	Core	Hard	3	1	2	0	5
2nd	ECW104	ELECTRONICS WORKSHOP	CSE,IT	Elective	Workshop	0	0	3	0	2
3rd	ECH207	PRINCIPLES OF DIGITAL ELECTRONICS & CIRCUIT DESIGN	CSE,IT	Core	Hard	3	1	2	0	5
4th	ECH434	WIRELESS COMMUNICATION	CSE	Core	Hard	3	1	2	0	5
5th	ECH207	PRINCIPLES OF DIGITAL ELECTRONICS & CIRCUIT DESIGN	ME	Elective	Hard	3	1	2	0	5
6th	ECH326	MICROPROCESSORS & INTERFACING	CSE,IT,ME	Elective	Hard	3	1	2	0	5
6th	ECH327	CONTROL SYSTEMS	ME	Elective	Hard	3	1	2	0	5
6th	ECH318	DIGITAL SYSTEM DESIGN	CSE,IT	Elective	Hard	3	1	2	0	5
6th	ECH435	MEMS	ME	Elective	Hard	3	1	2	0	5

DETAILED SYLLABUS

Course Title/ Code	**FUNDAMENTALS OF ELECTRICAL & ELECTRONICS ENGINEERING (ECH103)**
Course Type:	Core (Allied)
Course Nature:	Hard
L-T-P-O Structure	(3-1-2-0)
Objectives	Meanwhile and after the completion of this subject, student will be able to design and construct simple analog and digital electronic circuits, take measurement of circuit behavior, compare with predicted circuit models and explain discrepancies and analyze their performance using electronic instruments.

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

Section A

ELECTRIC CIRCUITS AND MEASUREMENTS: Ohm's Law, Kirchoff's Laws, Steady State Solution of DC Circuits, Introduction to AC Circuits, Waveforms and RMS Value, Power and Power factor, Single Phase and Three Phase Balanced Circuits. Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters

SECTION B

ELECTRIC MACHINES : Single phase Transformer -Construction, Principle of Operation, EMF equation, DC generator-EMF equation, types, DC Motors- need of starter, types, construction, working principle of single phase and three phase induction Motor, synchronous motors.

SECTION C

SEMICONDUCTOR DEVICES : Characteristics of PN junction diode, Zener effect, Zener diode and its characteristics, Half wave and full wave rectifiers, Voltage regulation, Bipolar junction transistor– CE configurations and characteristics, Operational amplifier: introduction and its ideal characteristics.

SECTION D

Introduction to Microprocessor & Embedded System: Binary Number System, Logic Gates, Boolean Algebra, Half and Full Adders. Bus Organization, Types of Memory

List of Experiments:

1. Familiarization with the components, breadboard, resistor coding's and various types of meters and implementation of a circuit on breadboard
2. Verification of Kirchhoff's law: (a) Kirchhoff's voltage law (b) Kirchhoff's current law
3. Measurement of power in single phase AC circuits
4. Calculation of efficiency and regulation of a single phase transformer
5. OC and SC test on single phase transformer
6. To plot OCC for a DC separately excited shunt generator
7. To perform direct load Test on a DC separately excited Shunt generator and plot load voltage Vs load current
8. Armature voltage control and field current control of speed of DC shunt motor
9. Familiarization with the working knowledge of the CRO & Function generator, calculation of form factor, peak factor
10. To plot V-I characteristics of PN junction diode , Zener diode and calculate cut-in voltage and break down voltage
11. Frequency response of CE configuration
12. Integrator and differentiator using op-amp

Text Books:

1. Mittle N, Basic Electrical and Electronics Engineering, Tata McGraw Hill Edition, New Delhi
2. Nagsarkar T K and Sukhija M S, Basics of Electrical Engineering, Oxford press

Reference Books:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, Basic Electrical, Electronics and Computer Engineering, TMH, Second Edition
2. Sedha R S, Applied Electronics, S. Chand & Co
3. Rappaport, Wireless Communication, PHI

Course Title/ Code	**ELECTRONICS WORKSHOP (ECW104)**
Course Type:	Elective
Course Nature:	Workshop
L-T-P-O Structure	(0-0-3-0)
Objectives	• To provide a platform for students for practical implementation of Electronic Circuits and Projects. • To develop engineering skills in students as per industrial standards.

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. Study of Avalanche and Zener breakdown mechanisms in PN junction diodes.
3. Implementation of half-wave and full-wave rectifier circuits and measurement of average and rms values of the rectifier output.
4. Plot the forward and 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.
5. Implementation and analysis of diode circuits as clipper, clamper and voltage multiplier.
6. Plot the input/output characteristics of a transistor in common base configuration and calculation of its current amplification factor (α).
7. Plot the input/output characteristics of a transistor in common emitter configuration and calculation of its current amplification factor (β).
8. Plot the input/output characteristics of a transistor in common collector configuration and calculation of its current amplification factor (γ).
9. Study of transistor as a switch and as an amplifier.
10. To find the frequency response of single stage RC coupled amplifier and calculation of f_L, f_H and its bandwidth.
11. Study of operational amplifier as inverting and non-inverting amplifiers.
12. Application of OP-AMP as an integrator and differentiator.
13. Implementation of various logic gates using universal gates.
14. Project.

Text Books:

1. Jacob Millman, Christos C. Halkias, Satyabrata Jit, Electronics Devices and Circuits, 3rd Edition, TMH
2. R P Jain, Modern Digital Electronics (Edition III), TMH

Reference Books:

1. Robert L. Boylestad & Louis Nashelsky, Electronic Devices and Circuit Theory, Tenth Edition, Pearson Education, 2013.
2. Morris Mano, Digital Design, PHI.