MANAV RACHNA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRONICS & COMMUNICATION

PROGRAM STRUCTURE

&

DETAILED SYLLABUS

B.Tech. Electronics & Computer Engineering

BATCH: 2020-2024

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

B.TECH IN ELECTRONICS AND COMPUTER ENGINEERING

150-160 CREDITS FOR DEGREE COURSE

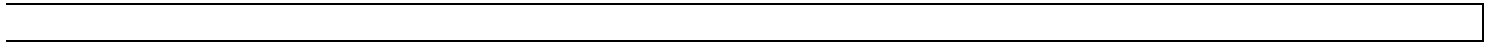
SESSION 2020-2021

SEMESTER - 1

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

SEMESTER - 2

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



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

SEMESTER - 4											
SUBJECT CODES	**SUBJECT NAME**	**PRE-REQUISITE**	****OFFERING DEPARTMENT**	***COURSE NATURE (HARD/SOFT/ WORKSHOP/ NTCC)**	**COURSE TYPE (CORE/ELECTIVE / UNIVERSITY COMPULSORY)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
ECH206B	ELECTROMAGNETIC FIELD AND WAVES	PHYSICS FOR ENGINEERS	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH216B-T	ANALOG COMMUNICATION	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH216B-P	ANALOG COMMUNICATION LAB	NA	ELECTRONICS & COMMUNICATION	HARD	CORE	0	0	2	0	2	1
ECH208B-T	DIGITAL ELECTRONICS	BASIC ELECTRONICS	ELECTRONICS & COMMUNICATION	HARD	CORE	3	1	0	0	4	4
ECH208B-P	DIGITAL ELECTRONICS LAB	BASIC ELECTRONICS	ELECTRONICS & COMMUNICATION	HARD	CORE	0	0	2	0	2	1
ECH209B	VLSI DESIGN	ANALOG ELECTRONICS	ELECTRONICS & COMMUNICATION	HARD	CORE	3	0	0	0	3	3
CSH201B-T	OOPS USING JAVA	PROGRAMMING FOR PROBLEM SOLVING USING C	COMPUTER SCIENCE	HARD	CORE	3	0	0	0	3	3
CSH201B-P	OOPS USING JAVA LAB	PROGRAMMING FOR PROBLEM SOLVING USING C	COMPUTER SCIENCE	HARD	CORE	0	0	2	0	2	1

ECW210B	ALTAIR WORKSHOP	NA	ELECTRONICS & COMMUNICATION	WORKSHOP	CORE	0	0	2	0	2	1
CDO202	PROFESSIONAL COMPETANCY ENHANCEMENT-II	NA	CDC	SOFT	CORE	0	0	1	0	1	0.5
RDO502	RESEARCH & INNOVATION-I	NA	ELECTRONICS & COMMUNICATION	SOFT	CORE	0	0	1	0	1	0.5
FLS105	SPANISH-II	NA	FOREIGN LANGUAGE	AUDIT	ELECTIVE	1	1	0	0	2	0
FLS106	GERMAN-II										
FLS107	FRENCH-II										
						1	0	0	0	1	0
						17	4	10	0	31	23

SEMESTER - 5

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

SEMESTER - 6

SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	**OFFERING DEPARTMENT	*COURSE NATURE (HARD/SOFT/ WORKSHOP/ NTCC)	COURSE TYPE (CORE/ELECTIVE / UNIVERSITY COMPULSORY)	L	T	P	O	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
ECH307B-T	ANTENNA AND WAVE PROPOGATION	ELECTROMAGNETIC FIELD AND WAVE	ELECTRONICS & COMMUNICATION								

CSH211B-T	OPERATING SYSTEMS	NA	COMPUTER SCIENCE	HARD	ELECTIVE	3	1	0	0	4	4
ECH309B-T	DIGITAL SYSTEM DESIGN	DIGITAL ELECTRONICS	ELECTRONICS & COMMUNICATION								
ECH310B-T	INTRODUCTION TO NEURAL NETWORK	NA	ELECTRONICS & COMMUNICATION								
CSH202B-T	DATABASE MANAGEMENT SYSTEM	PROGRAMMING FOR PROBLEM SOLVING USING C	COMPUTER SCIENCE								
ECH307B-P	ANTENNA AND WAVE PROPOGATION LAB	ELECTROMAGNETIC FIELD AND WAVE	ELECTRONICS & COMMUNICATION	HARD	ELECTIVE	0	0	2	0	2	1
CSH211B-P	OPERATING SYSTEMS LAB	NA	COMPUTER SCIENCE								
ECH309B-P	DIGITAL SYSTEM DESIGN LAB	DIGITAL ELECTRONICS	ELECTRONICS & COMMUNICATION								
ECH310B-P	INTRODUCTION TO NEURAL NETWORK LAB	NA	ELECTRONICS & COMMUNICATION								
CSH202B-P	DATABASE MANAGEMENT SYSTEM LAB	PROGRAMMING FOR PROBLEM SOLVING USING C	COMPUTER SCIENCE								
MCS232	FUNDAMENTALS OF FINANCE	NA	MANAGEMENT	SOFT	ELECTIVE	1	0	2	0	3	2
MCS231	BASICS OF ECONOMICS	NA									
ECH311B-T	MICROWAVE AND RADAR ENGINEERING	ELECTROMAGNETIC FIELD AND WAVES	ELECTRONICS & COMMUNICATION	HARD	ELECTIVE	3	1	0	0	4	4
ECH312B-T	WIRELESS COMMUNICATION	ANALOG & DIGITAL COMMUNICATION, ANTENNA AND WAVE	ELECTRONICS & COMMUNICATION								
CSH404B-T	CLOUD COMPUTING	NA	COMPUTER SCIENCE								
ECH313B-T	DIGITAL IMAGE PROCESSING AND COMPUTER VISION	NA	ELECTRONICS & COMMUNICATION								
ECH314B-T	CMOS VLSI DESIGN	VLSI DESIGN	ELECTRONICS & COMMUNICATION								
ECH311B-P	MICROWAVE AND RADAR ENGINEERING LAB	EMFW	ELECTRONICS & COMMUNICATION	HARD	ELECTIVE	0	0	2	0	2	1
ECH312B-P	WIRELESS COMMUNICATION LAB	ANALOG & DIGITAL COMMUNICATION, ANTENNA AND WAVE	ELECTRONICS & COMMUNICATION								
CSH404B-P	CLOUD COMPUTING LAB	NA	COMPUTER SCIENCE								
ECH313B-P	DIGITAL IMAGE PROCESSING AND COMPUTER VISION LAB	NA	ELECTRONICS & COMMUNICATION								
ECH314B-P	CMOS VLSI DESIGN LAB	VLSI DESIGN	ELECTRONICS & COMMUNICATION								
ECH315B	DATA COMMUNICATION	NA	ELECTRONICS & COMMUNICATION	HARD	ELECTIVE	3	1	0	0	4	4
CSH301B	COMPUTER NETWORKS	NA	COMPUTER SCIENCE								
ECH316B	WAVELETS AND MULTIRATE SYSTEMS	NA	ELECTRONICS & COMMUNICATION								
ECH317B	EMBEDDED AND REAL TIME SYSTEMS	MICROPROCESSOR & MICROCONTROLLER	ELECTRONICS & COMMUNICATION								
LWS323	CYBER LAW	NA	LAW	SOFT	ELECTIVE	2	0	0	0	2	2
LWS325	LAW RELATING TO INTELLECTUAL PROPERTY RIGHTS	NA									
ECW318B	VERILOG	NA	ELECTRONICS & COMMUNICATION	WORKSHOP	ELECTIVE	0	0	2	0	2	1
ECW319B	EDA FOR RF	AWP	ELECTRONICS & COMMUNICATION								
ECW320B	TANNER	VLSI DESIGN	ELECTRONICS & COMMUNICATION								
CSW213B	UNIX	NA	COMPUTER SCIENCE								
CDO302	PROFESSIONAL COMPETANCY RNHANCEMENT-IV	NA	CDC	SOFT	CORE	4	0	0	0	4	1

						1	0	0	0	1	0
						17	3	8	0	28	20

SEMESTER - 7											
SUBJECT CODES	**SUBJECT NAME**	**PRE-REQUISITE**	****OFFERING DEPARTMENT**	***COURSE NATURE (HARD/SOFT/ WORKSHOP/ NTCC)**	**COURSE TYPE (CORE/ELECTIVE / UNIVERSITY COMPULSORY)**	**L**	**T**	**P**	**O**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
ECH401B	INFORMATION THEORY AND CODING	NA	ELECTRONICS AND COMMUNICATION	HARD	ELECTIVE	3	1	0	0	4	4
ECH402B	MIXED SIGNAL IC DESIGN	ANALOG ELECTRONICS, DIGITAL ELECTRONICS	ELECTRONICS AND COMMUNICATION								
ECH403B	WIRELESS SENSOR NETWORKS	NA	ELECTRONICS AND COMMUNICATION								
ECH404B	SECURITY IN WIRELESS AND MOBILE COMMUNICATION	EMFW	ELECTRONICS AND COMMUNICATION								
CSH423B	ARTIFICIAL INTELLIGENCE	NN AND FL	COMPUTER SCIENCE								
ECH405B	SPEECH PROCESSING AND RECOGNITION	NA	ELECTRONICS AND COMMUNICATION								
CSH424B	MOBILE COMPUTING WITH ANDROID	NA	COMPUTER SCIENCE								
ECH406B	ASIC DESIGN AND FPGA	VLSI DESIGN	ELECTRONICS AND COMMUNICATION								
ECH408B	SATELLITE COMMUNICATION	ADC	ELECTRONICS AND COMMUNICATION								
ECH407B	RF SYSTEM DESIGN	ANALOG ELECTRONICS	ELECTRONICS AND COMMUNICATION	HARD	ELECTIVE	3	1	0	0	4	4
ECH409B	ROBOTICS DESIGN	NA	ELECTRONICS AND COMMUNICATION								
ECH410B	STATISTICAL SIGNAL PROCESSING	DSP	ELECTRONICS AND COMMUNICATION								
CSH425B	THEORY OF AUTOMATA AND COMPILER DESIGN	NA	COMPUTER SCIENCE								
ECH411B	VLSI TESTING	VLSI DESIGN	ELECTRONICS AND COMMUNICATION								
MCS368B	BASICS OF ENTRENEURSHIP	NA	MANAGEMENT	SOFT	ELECTIVE	1	0	2	0	3	2
	Digital Marketing	NA	MANAGEMENT								
MOOC-23E-ECS-304	Human Behaviour	NPTEL COURSE/MOOC COURSE								8 WEEKS	2
ECH412B	MEMS	NA	ELECTRONICS AND COMMUNICATION	HARD	ELECTIVE	3	1	0	0	4	4
ECH413B	NANOTECHNOLOGY	NA	ELECTRONICS AND COMMUNICATION								
ECH414B	MOBILE COMMUNICATION	NA	ELECTRONICS AND COMMUNICATION								
ECH415B	FIBRE OPTIC COMMUNICATION	NA	ELECTRONICS AND COMMUNICATION								
ECH416B	BIOMEDICAL SIGNAL PROCESSING	NA	ELECTRONICS AND COMMUNICATION								
ECH417B	MODERN DIGITAL COMMUNICATION TECHNIQUES	NA	ELECTRONICS AND COMMUNICATION								
CSH426B	BIG DATA	NA	COMPUTER SCIENCE								
CSH427B	MACHINE LEARNING	NA	COMPUTER SCIENCE								

ECN423	PROJECT PHASE-I	NA	ELECTRONICS AND COMMUNICATION	HARD	CORE	0	0	4	0	4	2
						2	0	0	0	2	0
						12	3	6	0	21	18

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

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

PROGRAMME BOOKLET

B.Tech Electronics and Communication Engineering (ECU02)

(Academic Session: 2021-2022)

(Syllabus: Scheme)

Department of ECE

School of Engineering

Manav Rachna University

MANAV RACHNA UNIVERSITY

VISION

To educate students in frontier areas of knowledge enabling them to take up challenges as ethical and responsible global citizens

MISSION

- To impart outcome based holistic education
- To disseminate education in frontier areas
- To produce globally competitive, ethical and socially responsible human resources
- To produce human resources sensitive to issues of Environment and Sustainable Development
- To develop Environment and Sustainable development as a thrust area of research and development.

QUALITY POLICY

To continuously learn from the best practices, study role models and develop transparent procedures for empowerment of stakeholders.

STRATEGIC OBJECTIVES

- To facilitate, enhance & promote innovation in curriculum design and delivery and have Outcome-oriented Learning Culture.
- To promote Research Environment and Management Practices.
- To enhance the quality of the student learning experience.
- To provide Resources and Infrastructure for Academic Excellence.

DEPARTMENT OF ECE

VISION

To be a leading Centre of Excellence for Education, Research and Development in the Field of Electronics with an aim to develop talent and technology through Innovation, meet the needs of Industry and contribute in development and betterment of Mankind.

MISSION

- Build capacity for applying cutting edge technologies in the development of new E & C products and services.
- Collaboratively develop programs/courses for industry/society at large.

- Nurture the national and international competitiveness of the students by facilitating international internships and industrial project opportunities.
- Foster an ecosystem conducive to innovations
- Strengthen and provide support in sustaining a healthy society by improving the quality of life through application of technology.

B.Tech.ECE

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

- Right aptitude for Industry Research and Academics as per the professional career choice.
- Learning skills for developing competencies in research and development and understanding the applications for product design and innovation.
- Technical mindset for engineering and scientific approach for solving and impending technical challenges.
- Professional ethics and positive attitude to work in a Team.
- Continuous improvement, growth and lifelong learning.
- Program Outcomes (POs) / Program Specific Outcomes (PSOs)
- Program Outcomes / Program Specific Outcomes describe graduate attributes i.e.what students are expected to know or will be able to do when they graduate from a program. The POs / PSOs of B. Tech. in Electronics & Computer Engineering

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2.Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design / development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6.The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8.Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11.Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12.Life- long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO1: Ensure integration of Electronics and Computer technology thereby enabling in designing and developing integrated solutions.

PSO2: Develop skills and tools for bridging the gap between research and Industrial needs by increasing industry interface

COURSE STRUCTURE

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING									
B.TECH IN ELECTRONICS AND COMMUNICATION ENGINEERING									
150-160 CREDITS FOR DEGREE COURSE									
B.TECH (ECU01) SESSION -2021-2022									
SEMESTER - 1									
SUBJECT CODES	**SUBJECT NAME**	**PRE- REQUISITE**	**OFFERING DEPARTMENT**	**COURSE TYPE (CORE/ELECTIVE/ UNIVERSITY COMPULSORY)**	**L**	**T**	**P**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
CHH144-T	CHEMISTRY-I	NA	CHEMISTRY	CORE	3	1	0	4	4
CHH144-P	CHEMISTRY-I LAB	NA	CHEMISTRY	CORE	0	0	2	2	1
MAH103B	MATHEMATICS – I (CALCULUS AND LINEAR ALGEBRA)	NA	MATHEMATICS	CORE	3	1	0	4	4
ECH101B-T/ ECH103B-T	BASICS OF ELECTRICAL ENGINEERING/ BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	NA	ECE	CORE	3	1	0	4	4
ECH101B-P/ ECH103B-P	BASISC OF ELECTRICAL ENGINEERING LAB/ BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	NA	ECE	CORE	0	0	2	2	1
CSH101B-T	PROGRAMMING FOR PROBLEM SOLVING USING C	NA	CSE	CORE	3	1	0	4	4
CSH101B-P	PROGRAMMING FOR PROBLEM SOLVING USING C LAB	NA	CSE	CORE	0	0	2	2	1
MEW102B	ENGINEERING GRAPHICS & DRAWING	NA	ME	CORE	0	0	2	2	1
LWS324	INDIAN CONSTITUTION	NA	LAW	CORE	1	0	0	1	0

CDS101B	PROFESSIONAL COMMUNICATION-I	NA	CDC		2	0	0	2	0.5
TOTAL					15	4	8	27	20.5
SEMESTER - 2									
SUBJECT CODES	**SUBJECT NAME**	**PRE-REQUISITE**	**OFFERING DEPARTMENT**	**COURSE TYPE (CORE/ELECTIVE / UNIVERSITY COMPULSORY)**	**L**	**T**	**P**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
PHH102B-T	PHYSICS FOR ENGINEERS	NA	PHYSICS	CORE	3	1	0	4	4
PHH102B-P	PHYSICS FOR ENGINEERS LAB	NA	PHYSICS	CORE	0	0	2	2	1
MAH106B	MATHEMATICS – II (DIFFERENTIAL EQUATIONS)	MATHE MATICS-I	MATHEMATICS	CORE	3	1	0	4	4
ECH106B-T	ELECTRONIC DEVICES & CIRCUITS	NA	ECE	CORE	3	1	0	4	4
ECH106B-P	ELECTRONIC DEVICES & CIRCUITS LAB	NA	ECE	CORE	0	0	2	2	1
CSW208B	PROGRAMMIG FOR PROBLEM SOLVING USING PYTHON	NA	CSE	CORE					
CSH112B	INTRODUCTION TO DATA STRUCTURES	NA	CSE	CORE	3	1	0	4	4
EDS288	APPLIED PHILOSOPHY	NA	EDUCATION	ELECTIVE	1	1	0	2	2
EDS289	APPLIED PSYCHOLOGY								
EDS290	APPLIED SOCIOLOGY								
HLS103B/ HLS104B	PROFESSIONAL ENGLISH ADVANCE/PROFESSIONAL ENGLISH BASIC	NA	HUMANITIES	CORE	2	0	2	4	3
CHH137	ENVIRONMENTAL SCIENCES	NA	CHEMISTRY	AUDIT	2	0	0	2	0
TOTAL					17	5	6	28	23
POST 2ND SEM SUMMER TRAINING									
SEMESTER - 3									

SUBJECT CODES	SUBJECT NAME	PRE-REQUISITE	OFFERING DEPARTMENT	COURSE TYPE (CORE/ELECTIVE / UNIVERSITY COMPULSORY)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
ECH202B-T	NETWORK THEORY	NA	ECE	CORE	3	1	0	4	4
ECH202B-P	NETWORK THEORY LAB	NA	ECE	CORE	0	0	2	2	1
ECH203B-T	ANALOG ELECTRONICS	NA	ECE	CORE	3	1	0	4	4
ECH203B-P	ANALOG ELECTRONICS LAB	NA	ECE	CORE	0	0	2	2	1
ECH204B	SIGNALS AND SYSTEMS	NA	ECE	CORE	3	1	0	4	4
ECH208B-T	DIGITAL ELECTRONICS	NA	ECE	CORE	3	1	0	4	4
	ELECTRONIC DESIGN WORKSHOP								
ECH208B-P	DIGITAL ELECTRONICS	NA	ECE	CORE	0	0	2	2	1
CDO201	PROFESSIONAL COMPETANCY ENHANCEMENT-I	NA	CDC	CORE	0	0	1	1	0.5
RDO501	INTRODUCTION TO RESEARCH	NA	ECE	CORE	0	0	1	1	0.5
FLS101	SPANISH-I								
FLS102	GERMAN-I								
FLS103	FRENCH-I	NA	FOREIGN LANGUAGE	ELECTIVE	1	0	0	1	0
				TOTAL	13	4	8	25	20
ECW108B	*PROGRAMMIG FUNDAMENTALS USING LINUX	NA	ECE	CORE (VLSI)	0	0	2	3	1

SEMESTER - 4

SUBJECT CODES	SUBJECT NAME	PRE- REQUISITE	OFFERING DEPARTMENT	COURSE TYPE (CORE/ELECTIVE / UNIVERSITY COMPULSORY)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
ECH206B	ELECTROMAGNETIC FIELD AND WAVES	NA	ECE	CORE	3	1	0	4	4
ECH207B-T	ANALOG AND DIGITAL COMMUNICATION	NA	ECE	CORE	3	1	0	4	4

ECH207B-P	ANALOG AND DIGITAL COMMUNICATION LAB	NA	ECE	CORE	0	0	2	2	1
ECH220B-T	MICROPROCESSORS & INTERFACING	NA	ECE	CORE	3	1	0	4	4
ECH220B-P	MICROPROCESSORS & INTERFACING LAB	NA	ECE	CORE	0	0	2	2	1
ECH209B	VLSI DESIGN	ANALOG ELECTRONICS	ECE	CORE	3	0	0	3	3
ECW205B	ELECTRONIC DESIGN WORKSHOP	NA	ECE	CORE	0	0	2	2	1
CDO202	PROFESSIONAL COMPETANCY ENHANCEMENT-II	NA	CDC	CORE	4	0	0	4	1
CSW208B	PROGRAMMING FOR PROBLEM SOLVING USING PYTHON	PROGRAMMING FOR PROBLEM SOLVING USING C	CSE	CORE	0	0	2	2	1
FLS105	SPANISH-II	NA	FOREIGN LANGUAGE	ELECTIVE	1	0	0	1	0
FLS106	GERMAN-II								
FLS107	FRENCH-II								
				TOTAL	17	3	8	28	20
ECH214B-T	DIGTAL HARDWARE MODELLING USING VHDL	DIGITAL ELECTRONICS	ECE	CORE (VLSI)	3	1	0	4	4
ECH214B-P	*DIGTAL HARDWARE MODELLING USING VHDL LAB	DIGITAL ELECTRONICS	ECE	CORE (VLSI)	0	0	2	2	1
POST 4TH SEM SUMMER TRAINING									
SEMESTER - 5									
SUBJECT CODES	**SUBJECT NAME**	**PRE-REQUISITE**	**OFFERING DEPARTMENT**	**UNIVERSITY COMPULSORY)**	**L**	**T**	**P**	**CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
ECH326B-T	MICROCONTROLLERS & INTERFACING	NA	ECE	CORE	3	1	0	4	4

ECH326B-P	MICROCONTROLLERS & INTERFACING LAB				0	0	2	2	1
ECH314B-T	CMOS VLSI DESIGN	VLSI DESIGN	ECE	ELECTIVE	3	0	0	3	3
ECH309B-T	DIGITAL SYSTEM DESIGN	DIGITAL ELECTRONICS							
ECH401B-T	INFORMATION THEORY AND CODING	NA							
ECH403B-T	WIRELESS SENSOR NETWORKS	NA							
ECH327B-T	PROTOTYPING IOT BASED AFFORDABLE HEALTHCARE SYSTEM	NA							
CSH310B-T	ARTIFICIAL INTELLIGENCE	NA	CSE						
CSH201B-T	OOPS USING JAVA	NA							
ECH314B-P	CMOS VLSI DESIGN LAB	VLSI DESIGN	ECE	ELECTIVE	0	0	2	2	1
ECH309B-P	DIGITAL SYSTEM DESIGN LAB	DIGITAL ELECTRONICS							
ECH401B-P	INFORMATION THEORY AND CODING LAB	NA							
ECH403B-P	WIRELESS SENSOR NETWORKS LAB	NA							
ECH327B-P	PROTOTYPING IOT BASED AFFORDABLE HEALTHCARE SYSTEM LAB	NA							
CSH310B-P	ARTIFICIAL INTELLIGENCE LAB	NA	CSE						
CSH201B-P	OOPS USING JAVA LAB	NA							
ECH305B-T	INTERNET OF THINGS	NA	ECE	CORE	2	0	0	2	2
ECH305B-P	INTERNET OF THINGS LAB	NA	ECE	CORE	0	0	2	2	1
MCS232	FUND OF FINANCE	NA	MGMT	ELECTIVE	1	1	0	2	2
MCS231	BASICS OF ECONOMICS								
CDO301	PROFESSIONAL COMPETANCY RNHANCEMENT-III	NA	CDC	CORE	4	0	0	4	1
ECW210B	ALTAIR WORKSHOP	NA	ECE	CORE	0	0	4	4	2
				TOTAL	13	2	10	25	17
ECH323B-T	*SYSTEM DESIGN USING VERILOG	DIGTAL HARDWARE MODELLING USING VHDL	ECE	CORE (VLSI)	3	0	0	3	3

ECH323B-P	*SYSTEM DESIGN USING VERILOG LAB	DIGTAL HARDWARE MODELLING USING VHDL	ECE	CORE (VLSI)	0	0	2	2	1
SEMESTER - 6									
SUBJECT CODES	**SUBJECT NAME**	**PRE-REQUISITES**	**OFFERING DEPARTMENT**	**UNIVERSITY COMPULSORY)**	**L**	**T**	**P**	**CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
ECH302B-T	DIGITAL SIGNAL AND IMAGE PROCESSING	SIGNALS AND SYSTEMS	ECE	CORE	3	1	0	4	4
ECH302B-P	DIGITAL SIGNAL AND IMAGE PROCESSING LAB				0	0	2	2	1
ECH304B-T	CONTROL SYSTEMS	NA	ECE	CORE	3	1	0	4	4
ECH426B-T	WIRELESS & MOBILE COMMUNICATION	ANALOG AND DIGITAL COMMUNICATION	ECE	CORE	3	1	0	4	4
ECH426B-P	WIRELESS & MOBILE COMMUNICATION LAB				0	0	2	2	1
ECH316B-T	WAVELETS AND MULTIRATE SYSTEMS	NA	ECE	ELECTIVE	2	1	0	3	3
ECH310B-T	NEURAL NETWORK AND FUZZY LOGIC								
ECH419B-T	PLC PROGRAMMING AND APPLICATIONS								
ECH321B-T	HEALTHCARE SYSTEMS (DESIGN & ANALYSIS)								
ECH322B-T	BIOMEDICAL SIGNAL AND IMAGE PROCESSING								
ECH316B-P	WAVELETS AND MULTIRATE SYSTEMS LAB	NA	ECE	ELECTIVE	0	0	2	2	1
ECH310B-P	NEURAL NETWORK AND FUZZY LOGIC LAB								
ECH419B-P	PLC PROGRAMMING AND APPLICATIONS LAB								
ECH321B-P	HEALTHCARE SYSTEMS (DESIGN & ANALYSIS) LAB								
ECH322B-P	BIOMEDICAL SIGNAL AND IMAGE PROCESSING LAB								
LWS323	CYBER LAW	NA	LAW	ELECTIVE	2	0	0	2	2

LWS325	LAW RELATING TO INTELLECTUALPROPERTY RIGHTS								
CHH137	ENVIRONMENTAL SCIENCE	NA	CHEMISTRY	AUDIT	2	0	0	2	0
CDO302	PROFESSIONAL COMPETANCY ENHANCEMENT-IV	NA	CDC	CORE	4	0	0	4	1
				TOTAL	19	4	6	29	21
ECH324B-T	*HARDWARE VERIFICATION USING SYSTEM VERILOG	DIGTAL HARDWARE MODELLING USING VERILOG	ECE	CORE (VLSI)	3	1	0	4	4
ECH324B-P	*HARDWARE VERIFICATION USING SYSTEM VERILOG LAB	DIGTAL HARDWARE MODELLING USING VERILOG	ECE	CORE (VLSI)	0	0	2	2	1
POST 6TH SEM SUMMER TRAINING									
SEMESTER - 7									
SUBJECT CODES	**SUBJECT NAME**	**PRE-REQUISITE**	**OFFERING DEPARTMENT**	**COURSE TYPE (CORE/ELECTIVE / UNIVERSITY COMPULSORY)**	**L**	**T**	**P**	**NO. OF CONTACT HOURS PER WEEK**	**NO. OF CREDITS**
ECH315B-T	DATA COMMUNICATION	NA	ECE	CORE	3	1	0	4	4
ECH317B	EMBEDDED SYSTEM DESIGN	NA	ECE	CORE	3	1	0	4	4
ECH311B-T	MICROWAVE AND RADAR ENGG	NA	ECE	ELECTIVE	3	0	0	3	3
ECH411B-T	VLSI TESTING	VLSI DESIGN							
ECH412B-T	MEMS	NA							
ECH313B-T	DIGITAL IMAGE PROCESSING AND COMPUTER VISION	DIGITAL SIGNAL PROCESSING							
ECH404B-T	SECURITY IN WIRELESS AND MOBILE	NA							

	COMMUNICATION								
ECH418B-T	MECHATRONICS	NA							
CSH311B-T	THEORY OF AUTOMATA AND COMPILER DESIGN	NA	CSE						
CSH402B-T	BIG DATA	NA							
CSH303B-T	MOBILE COMPUTING WITH ANDROID	NA							
ECH311B-P	MICROWAVE AND RADAR ENGG LAB	NA	ECE	ELECTIVE	0	0	2	2	1
ECH411B-P	VLSI TESTING LAB	VLSI DESIGN							
ECH412B-P	MEMS LAB	NA							
ECH313B-P	DIGITAL IMAGE PROCESSING AND COMPUTER VISION LAB	DIGITAL SIGNAL PROCESSING							
ECH404B-P	SECURITY IN WIRELESS AND MOBILE COMMUNICATION LAB	NA							
ECH418B-P	MECHATRONICS LAB	NA							
CSH311B-P	THEORY OF AUTOMATA AND COMPILER DESIGN LAB	NA	CSE						
CSH402B-P	BIG DATA LAB	NA							
CSH303B-P	MOBILE COMPUTING WITH ANDROID LAB	NA							
ECH406B	ASIC DESIGN AND FPGA	NA	ECE	ELECTIVE	3	0	0	3	3
ECH407B	RF SYSTEM DESIGN	NA							
ECH405B	SPEECH PROCESSING AND RECOGNITION	NA							
ECH427B	RANDOM PROCESSES FOR WIRELESS COMMUNICATION	NA							
ECH413B	NANOTECHNOLOGY	NA							
ECH424B	BLOCK CHAIN DEVELOPMENT	NA							
CSH404B-T	CLOUD COMPUTING	NA	CSE						
MCS368B	BASICS OF ENTRENEURSHIP	NA	MANAGEMENT	ELECTIVE	1	0	0	1	1
MEW203B	3D PRINTING(CAD)		ME	ELECTIVE	0	0	2	2	1
ECN423	PROJECT PHASE-I	NA	ECE	CORE	0	0	6	6	3
				TOTAL	13	2	10	25	20
ECH421B-T	HARDWARE VERIFICATION USING UVM	DIGTAL HARDWARE MODELLING USING SYSTEM VERILO	ECE	CORE (VLSI)	3	1	0	4	4

		G							
ECH421B-P	HARDWARE VERIFICATION USING UVM LAB	DIGTAL HARDWARE MODELLING USING SYSTEM VERILOG	ECE	CORE (VLSI)	0	0	2	2	1

SEMESTER - 8

SUBJECT CODES	SUBJECT NAME	PRE- REQUISITE	OFFERING DEPARTMENT	COURSE TYPE (CORE/ELECTIVE / UNIVERSITY COMPULSORY)	L	T	P	NO. OF CONTACT HOURS PER WEEK	NO. OF CREDITS
ECN420	PROJECT PHASE-II/INDUSTRIAL TRAINING	NA	ECE	CORE	320 TO 360 HOURS				12
				TOTAL					12
	CREDITS ASSIGNED ECE		**CREDITS ASSIGNED ECE-VLSI**						
	SEMESTER	**CREDITS ASSIGNED**	**SEMESTER**	**CREDITS ASSIGNED**					
	I	20.5	I	20.5					
	II	23	II	23					
	III	20	III	23					
	IV	20	IV	26					
	V	17	V	22					
	VI	21	VI	27					
	VII	20	VII	26					
	VIII	12	VIII	12					
ECO105B	SUMMER TRAINING POST II SEM	2	SUMMER TRAINING POST II SEM	2					
ECO213B	SUMMER TRAINING POST IV SEM	2	SUMMER TRAINING POST IV SEM	2					
ECO320B	SUMMER TRAINING POST VI SEM	3	SUMMER TRAINING POST VI SEM	3					
	TOTAL CREDITS	**160.5**	**TOTAL CREDITS**	**186.5**					

SEMESTER I

Course Title/Code	**CHEMISTRY-I (CHH144-T)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisites	NA	
Course Objective	Students would be able to learn the basics of atomic structure, intermolecular forces, and importance of pH, stereochemistry, learn the basics of spectroscopic techniques and apply the basics of these topics to industrial and domestic purpose.	
Course Outcomes (COs)		Mapping
CO1	Apprehend the importance of thermodynamic properties of Gibbs free energy and entropy functions	Employability
CO2	Describe the water chemistry, theories of corrosion and concepts of metallurgy through Ellingham diagram	Employability
CO3	Analyze the basics of stereochemistry and the importance of green synthesis with emphasis on its twelve principles	Employability
CO4	Analyze the importance of spectroscopic techniques and its applications in various fields to deduce structures	Employability

SECTION-A

Atomic Structure: Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of s, p, d and f orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Periodic properties: Electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital, energies of atoms in the periodic table, polarizability and Polarization, Fajan's Rule, oxidation states and their stabilities.

SECTION-B

Intermolecular forces and potential energy surfaces: Ionic, dipolar and van der waals interaction, equations of state of real and gases and critical phenomenon. Use of free energy in chemical equilibria: Thermodynamic functions: entropy and gibbs free energy; estimations of entropy and free energies. Relationship between Free energy and emf Cell potentials. Nernst equation and application. Acid base, oxidation reduction and solubility equilibria, Water chemistry: Introduction - Use of water for Industrial and domestic purposes, sources of water supply, Hardness of water, degree of hardness and its estimation by EDTA methods). PH-value of water, disinfection of water Softening of hard water (Lime-Soda method, calgon methods. corrosion: introduction, cause and theories: Dry and wet theory and prevention methods, use of free energy consideration in metallurgy through Ellingham Diagram.

SECTION-C

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

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

SECTION-D

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

Suggested Text /Reference Books

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CHH144-T	CHEMISTRY -I	CO1	3	-	-	-	-	-	-	-	-	-	2	-	-	-
		CO2	3	-	2	-	-	-	2	-	-	-	2	-	-	-
		CO3	3	-	-	-	-	-	-	-	-	-	2	-	-	-
		CO4	3	-	2	-	-	-	3	-	-	-	2	-	-	-

Course Title/Code	**CHEMISTRY-I LAB (CHH144-P)**	
Course Type	Core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisites	NA	
Course Objective	Student would be able to learn basic of atomic structure, intermolecular forces, and importance of pH, stereochemistry, learn basic of spectroscopic techniques and apply basic of these topics to industrial and domestic purpose.	
Course Outcomes (COs)		Mapping
CO1	Develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.	Employability
CO2	Substitute metals with conducting polymers and also produce cheaper biodegradable polymers to reduce environmental pollution.	Employability
CO3	Design economically and new methods of synthesis nano materials.	Employability
CO4	Apply their knowledge for protection of different metals from corrosion	Employability
CO5	Have the knowledge of converting solar energy into most needy electrical energy efficiently and economically to reduce the environmental pollution.	Employability

List of Experiments

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CHH144-P	CHEMISTRY-I LAB	CO1	3	-	-	-	-	-	-	-	-	-	2	-	-	-
		CO2	3	-	-	-	-	-	-	-	-	-	2	-	-	-
		CO3	3	-	2	-	-	-	2	-	-	-	2	-	-	-
		CO4	3	-	-	-	-	-	-	-	-	-	2	-	-	-
		CO5	3	-	2	-	-	-	3	-	-	-	2	-	-	-

Course Title/Code	**MATHEMATICS-1 (Calculus and Linear Algebra) (MAH103B)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisites	NA	
Course Objective	The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines	
Course Outcomes (COs)		Mapping
CO1	Calculate radius of curvature and Evolutes. Write the Taylor series & Maclaurin series expansion of function of single variable and apply in solving other mathematical problems. Find the maximum/minimum values of a function.	Employability
CO2	Apply the tool Fourier series for learning advanced Engineering Mathematics.	Employability
CO3	Determine gradient vector fields and find potential functions and evaluate line integrals directly and by the fundamental theorem.	Employability
CO4	Calculate rank and inverse of a matrix and solve system of linear equations using Cramer's Rule, Gauss elimination and Gauss Jordan method.	Employability

SECTION –A

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

SECTION –B

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

SECTION –C

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

SECTION –D

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

Suggested Text/Reference Books

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MAH103B	MATHEMATICS (CALCULUS AND LINEAR ALGEBRA)	CO1	3	3	-	-	-	-	-	-	1	1	-	-	-	-
		CO2	3	3	-	-	-	-	-	-	1	1	-	-	-	-
		CO3	3	3	-	-	-	-	-	-	1	1	-	-	-	-
		CO4	3	3	-	-	-	-	-	-	1	1	-	-	-	-

Course Title/Code	**BASIC ELECTRICAL ENGINEERING (ECH101B-T)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	To Analyze DC and AC circuits with different circuit elements and study the use of different modules of a back-up system and electric machines.	
Course Outcomes (COs)		Mapping
CO1	Analyze DC and AC circuits with different circuit elements.	Employability
CO2	Analyze and represent various parameters of alternating quantities and determine the power in these circuits	Employability
CO3	Transform and regulate the input power for various loads	Employability
CO4	Inspect various Electrical machines and different modules of a back-up system.	Employability

SECTION A

DC Circuits Electrical circuit elements (R, L and C), voltage and current sources, Network reduction: voltage and current division, source transformation –Kirchhoff current and voltage laws, Kirchhoff's laws – Mesh current and node voltage-methods analysis of simple circuits with dc excitation. Superposition, Thevenin Norton and maximum power transfer Theorems. star delta conversion

SECTION B

AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections. Transformers: ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer.

SECTION C

Electrical Machines: Construction and components of DC Machine – Principle of operation - Lap and wave windings- EMF equations -Principle of operation of three-phase induction motors – Construction –Types – Equivalent circuit, Single phase Induction motors -Construction– Types–starting and speed control methods. Alternator- working principle–Equation of induced EMF – Voltage regulation, Synchronous motors- working principle-starting methods -– Torque equation – Stepper Motors – Brushless DC Motors

SECTION D

Power Converters: DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation. Electrical Installations. Components of LT Switchgear: Switch Fuse Module(SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text / Reference Books

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill.
2. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press.
3. E. Hughes, “Electrical and Electronics Technology”, Pearson.
4. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH101B-T	BASIC ELECTRICAL ENGINEERING	CO1	3	3	2	-	-	-	-	-	1	1	-	2	2	1
		CO2	3	3	2	-	-	-	-	-	1	-	-	2	2	1
		CO3	2	2	2	-	-	-	-	-	1	-	-	2	2	1
		CO4	3	2	2	-	-	-	-	-	1	-	-	2	2	1

Course Title/Code	**BASIC ELECTRICAL ENGINEERING LAB (ECH101B-P)**	
Course Type	Core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To Analyze DC and AC circuits with different circuit elements and study the use of different modules of a back-up system and electric machines.	
Course Outcomes (COs)		Mapping
CO1	Experimentally verify the basic circuit theorems	Skill Development
CO2	Apply the knowledge gained to explain the behavior of the circuit at series & parallel resonance of circuit & the effect of resonance.	Skill Development
CO3	Apply the knowledge of theorems/laws to analyze the simple circuits	Skill Development
CO4	Measure the operation and characteristics of AC machines and DC machines	Skill Development

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Verification of theorems
- Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics4.Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
- Demonstration of cut-out SECTIONs of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections.
- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.
- Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.
- Mini Project

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH10 B-P	BASIC ELECTRICAL	CO1	3	3	2	-	-	-	-	-	1	1	-	2	2	1
		CO2	3	3	2	-	-	-	-	-	1	-	-	2	2	1

	ENGINEERING LAB	CO3	2	2	2	-	-	-	-	-	1	-	-	2	2	1
		CO4	3	2	2	-	-	-	-	-	1	-	-	2	2	1

Course Title/Code	**PROGRAMMING FOR PROBLEM SOLVING USING C (CSH101B-T)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisites	NA	
Course Objective	Students will be able to construct a program of moderate complexity from a specification	
Course Outcomes (COs)		Mapping
CO1	Analyze and apply Test Driven Development approach to design programs.	Employability
CO2	Apply the programming language constructs as per given problems	Employability
CO3	Apply C programming language constructs on open source platform	Employability
CO4	Learn to work in a team using different online platform for program development	Employability

SECTION-A

Programming and UNIX-Students will learn the basics of programming using Scratch, they will learn to use statements, expressions, conditions, selection, iteration, variables, functions, arrays, threads and events. In addition, they will be introduced to basic UNIX commands under Bash. Introduction to Programming, test driven development, Scratch: Introduction, statements, expressions, conditions, selection, iteration, variables, functions, arrays. UNIX: Basic commands- pwd, ls, cd, rm, cat, less, mkdir, rmdir; permissions, root. C language: statements, expressions, conditions, selection iteration, variables, functions, arrays.

SECTION-B

Applying programming constructs-Students will learn how to write programs that satisfy unit tests. The instructor will build the unit tests, demonstrating how to break a problem down into smaller components. In the labs and homework, students will construct programs that satisfy the unit tests. Students become familiar with the constructs of the C programming language. Moving to C: Data Types, constants, and variables, Statements, Expressions, Conditions, Selection, iteration, Functions and recursion Decision making within a program, Conditions, Relational Operators, Logical Connectives, if statement, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement, structured Programming Arrays; One dimensional arrays: Array manipulation; Searching, Insertion, Deletion of an element from an array; Finding the largest/smallest element in an array; Null terminated strings as array of characters, Standard library string functions-Introduction to Top-down approach of problem solving, Modular programming and functions, Standard Library of C functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, Pasing arguments to a Function: call by reference, call by value, Recursive Functions, arrays as function arguments .

SECTION-C

Practical programming-During the third quarter of the class, students will begin building their own programs by decomposing problems into smaller tasks and writing unit tests that will check to see that the program accurately accomplishes the task using Test Driven Development. They will then write the program that satisfies their own unit tests. Students will learn to apply the constructs of the C programming language to create programs. Students will learn to apply these programming techniques: Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions, Break,

Continue and Goto, Type Conversion; Enumerations; Macros. Students will be able to use these techniques to develop programs

SECTION-D

Memory Management and Abstraction-During the final quarter, students will be introduced to dynamic memory allocation and dynamic data structures including: dynamic arrays. They will consolidate their ability to use the C programming techniques they have learned in the earlier Sections. Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays, pointers and structures, dynamic memory allocation, Software Configuration Management, Modules, CUnit, GIT, SCRUM, MAKE. Dynamic Memory Allocation.

Suggested Text / Reference Books

1. The C Programming Language, Brian Kernighan and Dennis Ritchie
2. The Unix Programming Environment
3. Pro Git
4. Help Pages
5. Eclipse C/C++ Development Guide
6. Wikipedia Pages
7. Test-driven development, http://en.wikipedia.org/wiki/Test-driven_development
8. Unit testing, http://en.wikipedia.org/wiki/Unit_testing

Tool Web Sites

1. Eclipse, https://eclipse.org/users/
2. Git, http://git-scm.com/
3. GCC, https://gcc.gnu.org/onlinedocs/gcc-4.9.3/gcc/
4. Make
5. Unix
6. Web tutorials
7. Harvard's CS50, https://courses.edx.org/courses/HarvardX/CS50x3/2015/info

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSH 101B-T	PROGRAMMING FOR PROBLEM SOLVING USING C	CO1	1	1	1	-	-	-	-	-	-	-	-	-	2	2
		CO2	2	2	2	2	2	-	-	-	-	-	2	-	1	2
		CO3	2	2	2	2	2	-	-	-	2	-	-	2	1	2
		CO4	3	2	2	2	2	-	-	-	2	-	-	2	3	2

Course Title/Code	**PROGRAMMING FOR PROBLEM SOLVING USING C LAB (CSH101B-P)**	
Course Type	Core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisites	NA	
Course Objective	Students are able to construct a program of moderate complexity from a specification	
Course Outcomes (COs)		Mapping
CO1	Analyze and apply Test Driven Development approach to design programs.	Skill Development
CO2	Apply programming language constructs as per given problems	Skill Development
CO3	Apply C programming language constructs on open source platform	Skill Development
CO4	Learn to work in a team using different online platform for program development	Skill Development

List of experiments

- Sequential Statements Variables, Blocks
- Unix Commands: pwd, mkdir, cd, ls, less, touch, cp,move, cat, rm, rmdir –r etc.
- Moving to C Using nano and gcc.
- Project on Calculator Using Agile Methodology, Nano, Cunit, Git, Scrum, Agile Methodology,
- Nano, Gcc, Make. Covering Concepts:
- Statements, Functions, Arrays, Structures
- Pointers
- File Handling.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSH 101B-P	PROGRAMMING FOR PROBLEM SOLVING USING C LAB	CO1	1	1	1	-	-	-	-	-	-	-	-	-	2	-
		CO2	2	2	2	2	2	-	-	-	-	-	2	-	1	-
		CO3	2	3	2	2	2	-	-	-	-	-	-	2	1	2
		CO4	2	2	2	2	2	-	-	-	-	-	-	2	1	2

Course Title/Code	**ENGINEERING GRAPHICS & DRAWING (MEW102B)**	
Course Type	Core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisitions	NA	
Course Objective	Comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views (principal, auxiliary, SECTIONs).Dimension and annotate two-dimensional engineering drawings	
Course Outcomes (COs)		Mapping
1	Use the drawing instruments effectively and able to dimension the given figures	Employability/Skill Development
2	Appreciate the usage of engineering curves in tracing the paths of simple machine components	Employability/Skill Development
3	Analyse the concept of projection and acquire visualization skills, projection of points	Employability/Skill Development

SECTION A

Introduction to Engineering Drawing :Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic Sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales; Orthographic Projections: Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

SECTION B

Projections of Regular Solids: Inclined to both the Planes- Auxiliary Views; Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. SECTIONs and Sectional Views of Right Angular Solids : Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the Sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

SECTION C

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

SECTION D

Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models.Part editing and two-dimensional documentation of models. Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; introduction to Building Information Modeling (BIM).

Suggested Text / Reference Books

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House

2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers Corresponding set of) CAD Software Theory and User Manuals

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MEW 102B	ENGINEERING GRAPHICS AND DRAWING	CO1	3	-	-	2	-	-	3	-	-	3	-	-	-	3
		CO2	3	-	3	-	-	2	-	-	-	3	-	3	-	-
		CO3	3	-	-	3	-	-	3	-	-	3	-	-	2	-

Course Title/Code	**INDIAN CONSTITUTION (LWS324)**	
Course Type	Audit	
L-T-P Structure	1-0-0	
Credits	0	
Pre-requisities	NA	
Course Objective	The objective of this paper is to orient the students about the Basic features and fundamental principles on the Constitution of India.	
Course Outcomes (COs)		Mapping
CO1	Demonstrate the knowledge and ability to analyze the basic principles of the Constitution of India.	Employability/Entrepreneurship/Skill Development

SECTION-A

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

SECTION-B

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

SECTION-C

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

SECTION-D

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
LWS 324	INDIAN CONSTITUTION	CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Course Title/Code	**BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING (ECH103B-T)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	Understand the working principles of basic electrical circuits and electronic devices (diode, Transistors, OP-Amp etc.), analyze their behavior and implement the knowledge to design their various applications.	
Course Outcomes (COs)		Mapping
CO1	Apply the fundamental concepts of Basic Electrical circuits.	Employability
CO2	Apply the concepts and working principles of Diodes for its various applications	Employability
CO3	Demonstrate familiarity with electronic devices viz., Transistors, Feedback Amplifiers and Oscillators and design implementation.	Employability/ Skill Development
CO4	Analyze and Design Operational Amplifiers and real-life applications using 555 Timer.	Employability/ Skill Development

SECTION A

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

SECTION B

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

SECTION C

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

SECTION D

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

Text Books:

(i) D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.

(ii) Debashis De, “Basic Electronics’, Pearson, Education India, 2010.

Reference Books:

(i) D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.

(ii)L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.

(iii) David. A. Bell (2003), Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India.

(iv) Santiram Kal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India 3. Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals by Pearson Education.

(v) Paul B. Zbar, A.P. Malvino and M.A. Miller (2009), Basic Electronics – A Text-Lab. Manual, TMH 5

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH103B- T	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING	CO1	3	3	2	2	1	1	-	-	-	-	-	-	3	2
		CO2	3	3	2	2	1	1	-	-	-	-	-	-	3	2
		CO3	3	3	2	2	1	1	-	-	-	-	-	-	3	2
		CO4	3	3	2	2	1	1	-	-	-	-	-	-	3	2

Course Title/Code	**BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LAB (ECH103B-P)**	
Course Type	Core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	Understand the working principles of basic electrical circuits and electronic devices (diode, Transistors, OP-Amp etc.), analyze their behavior and implement the knowledge to design their various applications.	
Course Outcomes (COs)		Mapping
CO1	Describe the electrical properties and characteristics of various materials, used in the electrical appliances , devices , instruments	Skill Development
CO2	Design circuits using diodes and transistors	Skill Development
CO3	Realize circuits using opamps	Skill Development

LIST OF EXPERIMENTS

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH103B-T	BASICS OF ELECTRICAL AND ELECTRONICS LAB	CO1	3	3	2	2	1	1	-	-	-	-	-	-	3	2
		CO2	3	3	2	2	1	1	-	-	-	-	-	-	3	2
		CO3	3	3	2	2	1	1	-	-	-	-	-	-	3	2

Course Title/Code	**PROFESSIONAL COMMUNICATION-I(CDS101B)**	
Course Type	Core	
L-T-P Structure	1-0-0	
Credits	1	
Pre-requisities	NA	
Course Objective	To teach students effective listening and speaking skills in real life scenarios..	
Course Outcomes (COs)		Mapping
CO1	Students will be able to develop all-round personality by mastering inter-personal skills to function effectively in different circumstances.	Skill Development
CO2	Students will be able to demonstrate effective communication through grammatically correct	Skill Development
CO3	Students will be able to apply effective listening and speaking skills in real life scenarios.	Skill Development

Unit 1: Attitudinal Communication

1.1 Attitude and its Impact on Communication- 1.2 Courtesy & Politeness in Communication- 1.3 Diversity & Inclusion – Bullying, Cultural Sensitivity, Stereotypes, Sexual Harassment, LGBTQ, Respect, Chivalry, Racial & Gender Discrimination, Disability Harassment, Inclusion.1.4 Power Dressing

Unit 2: Syntactical Communication - I

2.1 Common errors in communication-2.2 Identification of word class-2.3 Errors & rectifications-2.3.1 Article usage-2.3.2.Tenses usage - Present Perfect vs. Past Simple vs. Past Perfect-2.3.2 Subject Verb Agreement

Unit 3: Phonetics

3.1 Impact of First Language Influence

3.2 Tone- 3.3 Intonation-3.4 Rate of Speech-3.5 Pronunciation: Vowels & Consonant sounds

Unit 4: Developing Communication Skills -I (Listening & Speaking)

4.1 Concept of LSRW: Importance of LSRW in communication.-4.2 Listening Skills : Real Life challenges, Barriers to Listening-4.3 Speaking : Self Introduction, Interview, GD, Resume CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CDS101B	PROFESSIONAL COMMUNICATION-I	CO1	3	3	2	2	1	1	-	-	-	-	-	-	3	2
		CO2	3	3	2	2	1	1	-	-	-	-	-	-	3	2
		CO3	3	3	2	2	1	1	-	-	-	-	-	-	3	2

SEMESTER II

Course Title/Code	**PHYSICS FOR ENGINEERS (PHH102B- T)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisites	NA	
Course Objective	To provide the student with a broad understanding of the physical principles of the universe, to help them develop critical thinking and quantitative reasoning skills, to empower them to think creatively and critically about scientific problems and experiments	
Course Outcomes (COs)		Mapping
CO1	Students would be able to describe semiconductors, fermi level, various types of diodes and demonstrate its applications in electronics.	Employability
CO2	Measure various parameters using CRO	Employability
CO3	Calculate electrical parameters using various measurement techniques	Employability
CO4	Analyze the Electromagnetic Wave equation and its applications	Employability

SECTION-A

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

SECTION-B

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

SECTION-C

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

SECTION-D

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

Suggested Text Books

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PHH102B-T	PHYSICS FOR ENGINEERS	CO1	3	3	2	2	3	-	-	-	3	2	-	1	3	3
		CO2	3	3	2	2	3	-	-	-	3	2	-	1	3	2
		CO3	3	3	2	2	3	-	-	-	3	2	-	3	3	2
		CO4	3	3	2	2	3	-	-	-	3	2	-	1	3	2

Course Title/Code	**PHYSICS FOR ENGINEERS LAB (PHH102B-P)**
Course Type	Core
L-T-P Structure	0-0-2
Credits	1
Pre-requisities	NA
Course Objective	To provide the student with a broad understanding of the physical principles of the universe, to help them develop critical thinking and quantitative reasoning skills, to empower them to think creatively and critically about scientific problems and experiments

Course Outcomes (COs)		Mapping
CO1	Students will be able to analyze various characteristics of the semiconductor devices and circuits.	Skill development
CO2	Demonstrate the working of electronic components and devices.	Skill development
CO3	Students will be able to measure component values and parameters of the circuits using different measuring devices	Skill development
CO4	Apply the knowledge in designing the application based projects.	Skill development

List OF Experiments

- Study the IV characteristics of a PN junction diode.
- Error analysis in measurement on simple electrical circuits.
- Study and use of digital CRO.
- Measurement of frequency and voltage using CRO
- Mini Project
- Measurement of Phase difference using CRO.
- Study of DC / AC analog voltmeters and their comparison
- Use of digital multimeter and sensitivity measurement.
- Measurement of Q-factor L, R using LCRQ meter.
- To measure a displacement using Linear Variable differential transformer (LVDT)

CO-Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PHH102B- P	PHYSICS FOR ENGINEERS LAB	CO1	3	3	-	-	3	-	-	-	3	-	-	3	2	3
		CO2	3	2	-	3	3	2	-	2	3	-	-	3	3	3
		CO3	3	2	2	3	3	2	-	2	3	-	-	3	3	3
		CO4	3	3	3	3	3	3	2	2	3	3	3	3	3	3

Course Title/Code	**MATHEMATICS – II (DIFFERENTIAL EQUATIONS) (MAH106B)**
Course Type	Core
L-T-P Structure	3-1-0
Credits	4
PRE-REQUISITES	MATHEMATICS-1 (Calculus and Linear Algebra)
Course Objective	The objective of this course is to familiarize the prospective engineers with techniques in ordinary and partial differential equations and Numerical Methods. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes (COs)		Mapping
CO1	Solve ordinary differential equations(ODE)	Skill development
CO2	Apply the tool of power series for learning advanced Engineering Mathematics.	Skill development
CO3	Find roots of polynomial and transcendental equations by using numerical techniques.	Skill development
CO4	Identify and impute the interpolating polynomial for equispaced and unequispaced intervals	Skill development

SECTION – A

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

SECTION – B

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

SECTION – C

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

SECTION – D

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

Textbooks/References:

1. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.

2. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.

3. Manish Goyal and N.P. Bali Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.

4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.

5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

6. G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.

7. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.

8. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.

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

10. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MAH106B	MATHEMATICS – II (DIFFERENTIAL EQUATIONS)	CO1	3	3	3	-	-	-	-	-	-	-	-	2	-	-
		CO2	3	3	3	-	-	-	-	-	-	-	-	2	-	-
		CO3	3	3	2	2	-	-	-	-	-	-	-	1	-	-
		CO4	3	3	2	2	-	-	-	-	-	-	-	1	-	-

Course Title/Code	**BASIC ELECTRONICS (ECH102B-T)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	To provide the students with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the devices, instruments and sensors used in various applications	
Course Outcomes (COs)		Mapping
CO1	Demonstrate the working principle, operation and applications of various types of diodes and special diodes.	Skill development/ Employability
CO2	Differentiate and analyze the working of various transistors	Skill development/ Employability
CO3	List, analyze and design various feedback amplifiers.	Skill development/ Employability

SECTION-A

Diodes and Applications covering, Semiconductor Diode - Ideal versus Practical, Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; PN Diode Switching time, Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Concept of Heterojunction Silicon Controlled Rectifier (SCR), UJT, Applications.

SECTION-B

Special diodes: Schottky diode, Varactor Diode, PIN diode. Applications of diode: Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Wave shaping circuits: Clipping circuits; Series, Shunt, Combinational, Clamping circuits; Series and Shunt; Applications; Voltage multiplier

SECTION-C

Transistor Characteristics covering, Bipolar Junction Transistor (BJT) – Construction, Operation, Common Base, Common Emitter and Common Collector Configurations, Amplifying Action, Transistor Biasing: Selection of Operating Point, Stability factor Voltage Divider Bias Configuration; Bias compensation :Diode Compensation, Thermistor Compensation and sensistor Compensation; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Depletion and Enhancement Type Metal Oxide Semiconductor (MOS) FETs

SECTION-D

Feedback in Amplifiers – Principle, Advantages of Negative Feedback, Effect of Negative feedback on input impedance, output impedance and bandwidth, Topologies, Current Series, Current Shunt, Voltage Shunt and Voltage Series Feedback; Effect of Negative feedback on Amplifier characteristics; Operation of Oscillators, Essentials of Transistor Oscillator, Classification: RC Phase Shift, Wien Bridge, High Frequency LC

Text/Reference Books

1. David. A. Bell, Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India

2. SantiramKal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India

3. Thomas L. Floyd and R. P. Jain, Digital Fundamentals by Pearson Education

4. Paul B. Zbar, A.P. Malvino and M.A. Miller, Basic Electronics – A Text-Lab. Manual, TMH

5. R. T. Paynter, Introductory Electronic Devices & Circuits, Conventional Flow Version, Pearson

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH102 B-T	BASIC ELECTRONICS	CO1	3	3	3	3	2	2	2	-	-	-	-	3	3	3
		CO2	3	-	3	3	3	2	-	-	3	3	2	2	2	2
		CO3	3	3	2	2	2	3	2	2	2	2	2	3	3	3

Course Title/Code	**BASIC ELECTRONICS LAB (ECH102B-P)**	
Course Type	Core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To provide the students with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the devices, instruments and sensors used in various applications	
Course Outcomes (COs)		Mapping
CO1	Demonstrate the working of electronic components and various measuring instruments.	Skill development/ Employability
CO2	Analyze the characteristics of diode and implement its various applications	Skill development/ Employability
CO3	Analyze the characteristics of a Transistor in various configurations and their applications	Skill development/ Employability
CO4	Design the oscillator circuits to produce oscillations of desired frequencies and implementation of logic gates.	Skill development/ Employability

List of Experiments:

- Familiarization with electronic components and measuring instruments.
- Plot the forward and reverse V-I characteristics of a PN junction diode and calculation of cut-in voltage, static and dynamic resistances.
- Plot the Reverse V-I characteristics of a Zener diode and calculation of cut-in and Zener breakdown voltages. Implementation of half-wave and full-wave rectifier circuits and measurement of average and rms values of the rectifier output.
- To study the working of a diode as a clipper, clamper
- Plot the input/output characteristics of a transistor in common emitter configuration and calculation of its current amplification factor (β)
- Calculate the gain of Transistor in Common Collector configuration
- To design Wien Bridge Oscillator and calculate the frequency of oscillations
- To design RC phase shift Oscillator and calculate the frequency of oscillations
- Implementation of various logic gates using universal gates.

CO-MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH102B-P	BASIC ELECTRONICS LAB	CO1	3	3	-	3	3	-	-	-	3	-	-	3	3	3
		CO2	3	3	3	3	3	-	3	-	3	-	-	3	2	3
		CO3	3	3	3	3	3	-	3	-	3	-	-	3	2	3
		CO4	3	3	3	3	3	-	3	-	3	-	-	3	2	3

Course Title/Code	**APPLIED PHILOSOPHY (EDS288)**	
Course Type	Soft Elective	
L-T-P Structure	1-1-0	
Credits	2	
Pre-requisities	NA	
Course Objective	To enable students to - confront the philosophical problems implicit in the experience of self, others and the society. - read critically the philosophy of influential philosophers with respect to society, Science and success in life - understand and apply concepts and theories of moral philosophy. - reflect philosophically and ethically on their own personal, professional and civic lives. -formulate for himself or herself a philosophy of life or world-view consistent with the objectives of liberal society.	
Course Outcomes (COs)		Mapping
CO1	Examine the philosophical problems implicit in the experience of self, others and the society	Entrepreneurship
CO2	Explore the philosophy of influential philosophers with respect to society, Science and success in life	Entrepreneurship
CO3	Demonstrate the understanding of the concepts and theories of moral philosophy.	Entrepreneurship
CO4	Reflect philosophically and ethically on one's own personal, professional and civic lives.	Entrepreneurship

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.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EDS288	APPLIED PHILOSOPHY	CO1	-	-	-	-	-	-	-	2	2	2	2	2	-	-
		CO2	-	-	-	-	-	-	-	2	2	2	2	2	-	-
		CO3	-	-	-	-	-	-	-	2	2	2	2	2	-	-
		CO4	-	-	-	-	-	-	-	2	2	2	2	2	-	-

Course Title/Code	APPLIED PSYCHOLOGY (EDS289)	
Course Type	Soft Elective	
L-T-P Structure	1-1-0	
Credits	2	
Pre-requisities	NA	
Course Objective	To define psychology and its application across various fields. -To understand the conceptual framework of attitude and personality along with cherishing out their attitude and personality development. -To conceptualize psychology in social and organizational settings. -To maintain and reform group dynamics.	
Course Outcomes (COs)		Mapping
CO1	Develop critical thinking to understand the application of psychology	Entrepreneurship
CO2	Identify the impact of Stereotyping, prejudice and discrimination in formation of attitude	Entrepreneurship
CO3	Identify major attributes of Personality.	Entrepreneurship
CO4	Understand social psychology and able to solve the inflicts among the group	Entrepreneurship

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 teamwork

References Books and Readings:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EDS289	APPLIED PSYCHOLOGY	CO1	-	-	-	-	-	-	-	2	2	2	2	2	-	-
		CO2	-	-	-	-	-	-	-	2	2	2	2	2	-	-
		CO3	-	-	-	-	-	-	-	2	2	2	2	2	-	-
		CO4	-	-	-	-	-	-	-	2	2	2	2	2	-	-

Course Title/Code	APPLIED SOCIOLOGY (EDS290)	
Course Type	Soft Elective	
L-T-P Structure	1-1-0	
Credits	2	
Pre-requisities	NA	
Course Objective	To know and understand about the fundamental concepts of sociology and its applications. To develop the analytical skills of students about ways in which social processes affect our everyday lives. To understand the impact of various processes of social change and assess their impact on society. To understand and analyze the social cultural dynamics that contribute to transformation of Indian reality To study the various contemporary issues of society. To develop basic research skills in area of sociology.	
Course Outcomes (COs)		Mapping
CO1	analyze the social cultural dynamics that contribute to transformation of Indian Society	Entrepreneurship
CO2	Develop the necessary skills of social processes which affect our everyday lives.	Entrepreneurship
CO3	study and analyze various temporary issues of society and able to provide solutions of social barrier and benefiting the masses.	Entrepreneurship
CO4	develop basic research skills in the area of sociology and help to find possible solution of specific social barriers of the society	Entrepreneurship

SECTION A

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

SECTION B

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

SECTION C

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

SECTION D

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

References: Books and Readings

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EDS290	APPLIED SOCIOLOGY	CO1	-	-	-	-	-	-	-	2	2	2	2	2	-	-
		CO2	-	-	-	-	-	-	-	2	2	2	2	2	-	-
		CO3	-	-	-	-	-	-	-	2	2	2	2	2	-	-
		CO4	-	-	-	-	-	-	-	2	2	2	2	2	-	-

Course Title/Code	**PROFESSIONAL ENGLISH-ADVANCE (HLS104B)**	
Course Type	Soft Core	
L-T-P Structure	2-0-2	
Credits	3	
Pre-requisities	NA	
Course Objective	The students (A) will be able to articulate (B) communication skills and develop talent (C) for increased understanding of corporate requirement (D).	
Course Outcomes (COs)		Mapping
CO1	To communicate articulately.	Employability, Skill development
CO2	To show the basics of presentation skills.	Employability, Skill development
CO3	To exhibit substantive writing skills.	Employability, Skill development
CO4	To demonstrate the procedure of debating skills.	Employability, Skill development
CO5	To display the developed critical aptitude.	Employability, Skill development

SECTION – A

Lexis: Vocabulary Building: The Concept of Word Formation, Root Words from Foreign Languages and their use in English, Acquaintance with Prefixes & Suffixes from Foreign Languages in English to form derivatives, Synonyms, Antonyms, and Standard abbreviations.

Semantics: Basic Writing Skills: Sentence Structures, Use of Phrase & Clauses in Sentences, Importance of Proper Punctuation, Creating Coherence, Organizing Principles of Paragraphs in Documents, Techniques of Writing Precisely.

SECTION – B

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

SECTION – C

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

SECTION – D

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

Lab Activities

- Exercises based on Grammar
- Exercises based on Semantics
- Telephonic and Face-to-Face Communication
- Listening to Understand (Hearing vs. Listening)
- Business Letters
- Reading/Listening Comprehension
- Essay Writing Session
- Precis Writing Session
- Role Plays

- Business QUIZ based on Lexis and Semantics
- Presentation
- Developing Outlines

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
HLS104B	PROFESSIONAL ENGLISH-ADVANCE	CO1	-	-	-	-	-	2	-	2	2	3	2	-	-	3
		CO2	-	-	-	-	-	2	-	2	2	3	3	-	-	3
		CO3	-	-	-	-	-	2	-	2	2	3	3	-	-	3
		CO4	-	-	-	-	-	2	-	2	2	3	2	-	-	3
		CO5	-	-	-	-	-	1	-	1	1	3	1	-	-	3

Course Title/Code	**PROFESSIONAL ENGLISH-BASIC (HLS103B)**	
Course Type	Soft Core	
L-T-P Structure	2-0-2	
Credits	3	
Pre-requisities	NA	
Course Objective	The students (A) will be able to imbibe (B) the basics of communication skills & English Language and literature (C) by understanding the need of industry (D).	
Course Outcomes (COs)		Mapping
CO1	To demonstrate the basic skills of effective communication	Employability, Skill development
CO2	To build an elementary understanding of form, meaning and use of words in varied dis urses.	Employability, Skill development
CO3	To equip them with fundamental writing skills.	Employability, Skill development
CO4	To show the essentials of debating skills.	Employability, Skill development
CO5	To exhibit creative thinking.	Employability, Skill development

SECTION – A

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

SECTION – B

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

SECTION – C

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

SECTION – D

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

Lab Exercises/Activities

- Exercises based on Communication
- Exercises based on Grammar
- Exercise on Sentence
- Spotting the Errors
- Reading/Listening Comprehension
- Essay Writing Session

- Report Writing and Email Writing
- Direct & Indirect Narration
- Active & Passive Voices
- Tense
- Paraphrasing
- Presentation

Suggested Text Book Reading:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
HLS103B	PROFESSIONAL ENGLISH-BASIC	CO1	-	-	-	-	-	2	-	2	2	3	2	-	-	3
		CO2	-	-	-	-	-	2	-	2	2	3	3	-	-	3
		CO3	-	-	-	-	-	2	-	2	2	3	3	-	-	3
		CO4	-	-	-	-	-	2	-	2	2	3	2	-	-	3
		CO5	-	-	-	-	-	1	-	1	1	3	1	-	-	3

Course Title/Code	**ENVIRONMENTAL SCIENCE (CHH137)**	
Course Type	Soft Audit	
L-T-P Structure	1-0-0	
Credits	0	
Pre-requisities	NA	
Course Objective	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. .	
Course Outcomes (COs)		Mapping
CO1	Explain the multidisciplinary dimensions of environmental issues and suggest potential solutions	Employability, Skill development, Entrepreneurship
CO2	Discuss about the various types of organisms and draw inferences about their interactions in different e systems	Employability, Skill development, Entrepreneurship

SECTION-A

Unit 1: Multidisciplinary nature of environmental studies

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

Unit 2: Renewable and Non-Renewable Resources

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies (OC). Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. (OC)Equitable use of resources for sustainable lifestyles

SECTION-B

Unit 3: Ecosystems

Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the Following ecosystem:-Forest ecosystem, Grassland ecosystem Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (OC),Unit 4: Biodiversity and its conservation• Introduction – Definition: genetic, species and ecosystem diversity.• Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic And option values (OC)Biodiversity at global, National and local levels. India as a mega-diversity nation Hot-sports of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity (OC)

SECTION-C

Unit 5: Environmental Pollution

Definition

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

Unit 6: Social Issues and the Environment

From Unsustainable to Sustainable development• Urban problems related to energy• Water conservation, rain water harvesting, watershed management • Resettlement and rehabilitation of people; its problems and concerns. CaseStudies• Environmental ethics: Issues and possible solutions.• Climate change, global warming, acid rain, ozone layer depletion, nuclear Accidents and holocaust. Case Studies (OC). • Wasteland reclamation.• Consumerism and waste products.• Environment Protection Act.• Air (Prevention and Control of Pollution) Act (OC)• Water (Prevention and control of Pollution) Act (OC)• Wildlife Protection Act• Forest Conservation Act• Issues involved in enforcement of environmental legislation (OC).• Public awareness (OC).

SECTION-D

Unit 7: Human Population and the Environment• Population growth, variation among nations - Population explosion – Family Welfare Programme • Environment and human health.• Human Rights (OC).• Value Education (OC).• HIV/AIDS (OC).• Women and Child Welfare (OC).• Role of Information Technology in Environment and human health.• Case Studies (OC).*OC = Outcome component Field work • Visit to a local area to document environmental assets river/ forest/grassland/hill/mountain • Visit to a local polluted site-Urban/Rural/Industrial/Agricultural• Study of common plants, insects, birds. • Study of simple ecosystems-pond, river, hill slopes, etc. Any socially relevant problem identification and proposing its possible solution

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CHH137	ENVIRONMENTAL SCIENCE	CO1	3	3	3	3	-	3	-	-	-	-	-	-	-	-
		CO2	-	-	3	3	3	-	3	-	-	-	-	-	-	-

Course Title/Code	**ELECTRONIC DEVICES & CIRCUITS (ECH106B-T)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisites	NA	
Course Objective	To provide the students with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the devices, instruments and sensors used in various applications.	
Course Outcomes (COs)		Mapping
CO1	To apply the fundamental concepts of Basic Electronics circuits.	Employability
CO2	Characterize & apply the concepts and working principles of various diodes for real time applications	Employability
CO3	Demonstrate the implementation of transistors and FETs in various circuits	Employability
CO4	To demonstrate the circuit of power supplies and voltage regulators	Employability

SECTION-A

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

SECTION-B

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

SECTION-C

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

SECTION-D

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

Text Books:

1. Millman &Halkias, “Integrated Electronics”, McGraw Hill Publications, 1992.

2. Boylestad &Nashlesky, “Electronic Devices & Circuit Theory”, PHI, 10th Edition.

3. Albert Malvino & David J. Bates, “Electronic Principles”, Tata McGraw Hill, 7th Edition 2007

4. Floyd, “Electronic Devices”, PHI, 7th Edition.

Reference Books:

1. Sedra, Smith, ‘Microelectronic Circuits’, Oxford University Press, fifth edition, 2004.

2. Paul Horowitz and Winfield Hill, ‘The art of electronics’, Cambridge university press, third edition, 2011.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH106B-T	ELECTRONIC DEVICES & CIRCUITS	CO1	3	3	-	-	3	-	-	-	3	3	3	3	3	3
		CO2	3	3	-	3	-	-	-	3	3	-	3	3	3	3
		CO3	3	3	3	3	-	3	3	-	-	-	3	3	3	3
		CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3

Course Title/Code	**ELECTRONIC DEVICES & CIRCUITS LAB (ECH106B-P)**	
Course Type	Core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To provide the students with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the devices, instruments and sensors used in various applications.	
Course Outcomes (COs)		Mapping
CO1	Demonstrate the working of electronic components and various measuring instruments.	Employability, Entrepreneurship
CO2	Analyze the characteristics of diode and implement its various applications	Employability, Entrepreneurship
CO3	Analyze the characteristics of Transistors and their applications	Employability, Entrepreneurship
CO4	To demonstrate the circuit of power supplies and voltage regulators and apply the knowledge in designing an Application based Project	Employability, Entrepreneurship

List of Experiments:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH106B- P	ELECTRONIC DEVICES & CIRCUITS	CO1	3	3	-	3	3	-	-	-	3	-	-	3	3	3
		CO2	3	3	3	3	3	-	3	-	3	-	-	3	2	3
		CO3	3	3	3	3	3	-	3	-	3	-	-	3	2	3
		CO4	3	3	3	3	3	-	-	3	3	3	3	3	3	3

Course Title/Code	**INTRODUCTION TO DATA STRUCTURES (CSH112B)**
Course Type	Core
L-T-P Structure	3-1-0
Credits	4
Pre-requisites	NA
Course Objective	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.

Course Outcomes (COs)		Mapping
CO1	TO understand the concept of Dynamic memory management, algorithms and their complexity ; demonstrate the abstract properties and operations of Linear data structures (using Static Memory Allocation) : Array ; To apply different Searching and Sorting algorithms.	Employability, Entrepreneurship
CO2	Demonstrate the abstract properties and operations of Linear data structures (using Dynamic Memory Allocation) : Link List and variations of Linked List.	Employability
CO3	Demonstrate the abstract properties and operations of Linear data structures (using Static & Dynamic Memory Allocation) : Stacks, Queues	Employability, Entrepreneurship
CO4	Demonstrate the abstract properties and operations of Non Linear data structures (using Static & Dynamic Memory Allocation) : Trees, Graphs	Employability, Entrepreneurship

SECTION-A

Data structures and Algorithms: Introduction to Data structure: Concept of data structure, choice of right data structures, types of data structures, Abstract Data types, Introduction to algorithms, how to design and develop an algorithm: stepwise refinement, algorithm analysis, complexity of algorithms Arrays: Introduction, One Dimensional Arrays, two dimensional array, Multidimensional arrays, address calculation of a location in arrays operations defined: traversal, selection, searching, insertion, deletion, and sorting. Searching: linear search, binary search, Sorting: selection sort, bubble sort, insertion sort, merge sort, quick sort.

SECTION-B

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

SECTION-C

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

SECTION-D

Non-Linear Structures: Trees definition, characteristics concept of child, sibling, parent child relationship etc, binary tree: different types of binary trees based on distribution of nodes: complete binary tree, binary tree (threaded and unthreaded),operation on binary tree: insertion, deletion, searching and traversal of binary trees, traversing: Preorder, Postorder and Inorder, Introduction to binary search tree, operations and Time complexity on BST: insertion, deletion, searching, Introduction to AVL tree: Concept of balanced trees, balance factor in AVL trees, insertion into and deletion from AVL tree, balancing AVL tree after insertion and deletion, in B trees, Application of trees. Graphs: Definition, Relation between tree & graph, directed and undirected graph, connected and disconnected graph, Euler graph, Hamiltonian graphs, Representation of graphs using adjacency matrix and list, Depth first and breadth first traversal of graphs, Applications of Graph.

Text Books:

1. Data Structures with C by Seymour Lipschutz ,McGraw Hill Education(India) Private Limited.

2. Data Structures using C by A. K. Sharma, Pearson Publication. Data Structures using C-Yashwant Kanetkar Publication.

Reference Books:

1. Data Structures using C by A. M. Tenenbaum, Langsam, Moshe J. Augentem, PHI Pub.

2. Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman Publisher.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSH112B	INTRODUCTION TO DATA STRUCTURES	CO1	3	3	-	-	3	-	-	-	3	3	3	3	3	3
		CO2	3	3	-	3	-	-	-	3	3	-	3	3	3	3
		CO3	3	3	3	3	-	3	3	-	-	-	3	3	3	3
		CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3

Course Title/Code	**PROGRAMMING FOR PROBLEM SOLVING USING PYTHON (CSW208B)**	
Course Type	Domain Core	
L-T-P Structure	0-0-2	
Credits	2	
Prerequisites	PROGRAMMING FOR PROBLEM SOLVING USING C	
Course Objective	The course is designed to provide Basic knowledge of Python. Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language.	
Course Outcomes (COs)		Mapping
CO1	Analyze the concept of Dynamic memory management, algorithms and their complexity ; demonstrate the abstract properties and operations of Linear data structures (using Static Memory Allocation) : Array ; To apply different Searching and Sorting algorithms.	Employability, Entrepreneurship
CO2	Demonstrate the abstract properties and operations of Linear data structures (using Dynamic Memory Allocation) : Link List and variations of Linked List.	Employability
CO3	Demonstrate the abstract properties and operations of Linear data structures (using Static & Dynamic Memory Allocation) : Stacks, Queues	Employability, Entrepreneurship
CO4	Demonstrate the abstract properties and operations of Non Linear data structures (using Static & Dynamic Memory Allocation) : Trees, Graphs	Employability, Entrepreneurship

SECTION-A

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

SECTION-B

Implementing custom functions, Variable scope – Global vs. Local, Dealing with various function arguments – default, named and variable length arguments, Understanding the concept of pass by value and pass by reference, Returning multiple values from a function, Anonymous & Recursive function, Understanding Strings in Python & different type of its delimiter, Working with special string operators & formatted strings, Exploring some useful built string methods, Working with Date & Time.

SECTION-C

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

SECTION-D

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

LIST OF EXPERIMENTS: Tool Used: - Eclipse Java Oxygen

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

Text Books:

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

Reference Books:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSW208B	PROGRAMMING FOR PROBLEM SOLVING USING PYTHON	CO1	3	3	-	-	3	-	-	-	3	3	3	3	3	3
		CO2	3	3	-	3	-	-	-	3	3	-	3	3	3	3
		CO3	3	3	3	3	-	3	3	-	-	-	3	3	3	3
		CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3

SEMESTER III

Course Title/Code	**NETWORK THEORY (ECH202B-T)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisites	NA	
Course Objective	To synthesize an electrical network from a given impedance/admittance function.	
Course Outcomes (COs)		Mapping
CO1	A thorough understanding of the fundamental concepts and techniques used in the two-port network terminology.	Employability
CO2	Analyze the transient behavior of electrical networks for various excitations.	Employability
CO3	Analyze different types of filter configuration and Synthesize any filter configuration within a reasonable percentage error.	Employability
CO4	Design the synthesized circuit with practical parts	Entrepreneurship

SECTION –A

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

SECTION-B

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

SECTION -C

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

SECTION-D

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

Text Books:

1. A Sudhakar and Shyammohan S Palli, “Circuits and Networks- Analysis and Synthesis”, McGraw Hill Education.

2. D Roy Choudary, “Network and Systems” New Age International.

Reference Book:

1. M. E. Van Valkenberg, “Network Analysis” 2nd Edition, Prentice Hall of India

2. S P Ghosh, A K Chakraborty, “Network Analysis and Synthesis

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH202B- T	NETWORK THEORY	CO1	3	2	-	-	-	-	2	2	2	2	-	2	2	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	-	2	2	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2

Course Title/Code	**NETWORK THEORY LAB (ECH202B-P)**	
Course Type	Core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To synthesize an electrical network from a given impedance/admittance function.	
Course Outcomes (COs)		Mapping
CO1	To describe and demonstrate the fundamental concepts and techniques used in the two-port network terminology.	Employability, Skill Development
CO2	To analyze the electrical networks using transient analysis for various excitations.	Employability, Skill Development
CO3	To design and analyze different types of filter configuration and Synthesize any filter configuration within a reasonable percentage error.	Employability, Skill Development

LIST OF EXPERIMENTS:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH202B-P	NETWORK THEORY LAB	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1

Course Title/Code	**ANALOG ELECTRONICS (ECH203B-T)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	To provide the basic knowledge on the working and operation of various transistors and linear integrated circuits their design and applications	
Course Outcomes (COs)		Mapping
CO1	Understand the working of transistor as an amplifier at low and high frequency and do the analysis of single and multistage amplifiers	Employability, Entrepreneurship
CO2	Comprehend the applications of Field effect transistor amplifier.	Employability
CO3	Appreciate the working of power amplifier circuits and Oscillators and implement various designs	Employability, Entrepreneurship
CO4	Visualize the working of operational amplifiers and will be able to demonstrate the same on various applications	Employability, Entrepreneurship

SECTION A

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

SECTION B

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

SECTION C

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

SECTION D

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

Text/References:

1. A. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.

2. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, McGraw Hill U. S., 1992.

3. J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 1988.

4. P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.

5. P. R. Gray, R. G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons, 2001.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4		PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH203B- T	ANALOG ELECTRONICS	CO1	3	3	2	1	1	1	1	-	1	1	-	-	3	2	3
		CO2	3	3	2	1	1	1	1	-	1	1	-	-	3	1	3
		CO3	3	3	2	2	1	1	1	-	1	1	-	-	3	2	3
		CO4	3	2	3	2	1	1	1	-	1	1	-	-	2	2	3

Course Title/Code	**ANALOG ELECTRONICS LAB (ECH203B-P)**	
Course Type	Core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To provide the basic knowledge on the working and operation of various transistors and linear integrated circuits, their design and applications	
Course Outcomes (COs)		Mapping
CO1	To describe the operation of the transistor as an amplifier at low and high frequencies and to analyze single-stage and multistage amplifiers.	Employability, Skill Development
CO2	To comprehend the working of FETs and apply it for FET amplifier applications.	Employability, Skill Development
CO3	Analyze the operation of power amplifier circuits and oscillators to design circuits for various applications	Employability, Skill Development
CO4	Visualize the operation of operational amplifiers and be able to show it in a variety of applications	Employability, Skill Development

LIST OF EXPERIMENTS:

- Design & measure the frequency response of an RC coupled amplifier using discrete components.
- Design a two stage RC coupled amplifier and determine the effect of cascading on gain and bandwidth
- Study the effect of voltage series, current series, voltage shunt, and current shunt feed-back on amplifier using discrete components.
- Design & realize inverting amplifier, non-inverting and buffer amplifier using 741 Op Amp.
- Verify the operation of a differentiator circuit using 741 op amp and show that it acts as a high pass filter.
- Verify the operation of a integrator circuit using 741 op amp and show that it acts as a low pass filter.
- Design and verify the operations of op amp adder and Subtractor circuits.
- Plot frequency response of AC coupled amplifier using op amp 741 and study the effect of negative feedback on the bandwidth and gain of the amplifier.
- Design & realize using op amp 741, Wein -bridge oscillator.
- To design & realize using op amp 741, square wave generator.
- To design & realize using op amp 741, logarithmic amplifier

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH203B- P	ANALOG ELECTRONICS LAB	CO1	3	3	2	1	1	1	-	1	1	-	-	3	2	3
		CO2	3	3	2	1	1	1	-	1	1	-	-	3	1	3
		CO3	3	3	2	2	1	1	-	1	1	-	-	3	2	3
		CO4	3	2	3	2	1	1	-	1	1	-	-	2	2	3

Course Title/Code	**SIGNALS AND SYSTEMS (ECH204B)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	Understand signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives and develop mathematical skills to solve problems involving convolution, filtering, modulation and sampling.	
Course Outcomes (COs)		Mapping
CO1	Differentiate between signal types and determine various properties of practical systems	Employability
CO2	Determine the behavior and shape of a signal in frequency domain	Employability
CO3	Characterize and analyze the response of the LTI system to test signals	Employability, Skill Development
CO4	Classify continuous and discrete time signals and illustrate the convergence of discrete time signals	Employability
CO5	Transform signals (both in continuous and discrete time) into more recognizable form of frequency domain for analysis of communication.	Employability, Skill Development

SECTION A

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

SECTION B

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

SECTION C

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

SECTION D

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

Text/References:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India.

2. Tarun Kumar Rawat, Signals and Systems, Oxford University Press, 1st edition, 2010.

Reference Books:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH204B	SIGNALS AND SYSTEMS	CO1	3	3	2	2	2	2	2	2	2	3	3	3	3	3
		CO2	3	3	3	3	2	2	2	2	2	3	3	3	3	3
		CO3	3	3	3	3	2	2	2	2	2	3	3	3	3	3
		CO4	3	3	3	3	2	2	2	2	2	3	3	3	3	3
		CO5	3	3	2	2	2	2	2	2	2	3	3	3	3	3

Course Title/Code	**DIGITAL ELECTRONICS (ECH208B-T)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	To understand the logic of various digital circuits which will further help in their designing.	
Course Outcomes (COs)		Mapping
CO1	Apply the fundamental concepts, techniques and applications of Number Systems and Codes used in digital electronics.	Employability
CO2	Analyze and design various Combinational circuits.	Employability
CO3	Analyze and design various Sequential circuits	Employability
CO4	Describe how analog signals are used to represent digital values in different logic families.	Employability

SECTION-A

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

SECTION-B

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

SECTION-C

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

SECTION-D

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

Text Books:

1. Anil K. Maini, Digital Electronics, Principles, Devices and Applications, John Wiley & Sons

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

3. Anand Kumar, Fundamentals of Digital Circuit, PHI Publication

Reference Books:

1. Thomas L. Flyod, Digital Fundamentals, Pearson Education India

2. R.P. Jain, Modern digital electronics, 3rd edition, TMH Publication.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH208B-T	DIGITAL ELECTRONICS	CO1	3	3	3	1	1	1	1	1	1	2	2	1	1	3
		CO2	3	3	2	2	1	1	1	1	1	2	2	3	2	3
		CO3	2	2	2	3	1	1	1	1	1	2	2	1	3	2
		CO4	3	3	2	2	1	1	1	1	1	2	2	2	3	3

Course Title/Code	**DIGITAL ELECTRONICS LAB (ECH208B-P)**	
Course Type	Core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To understand the logic of various digital circuits which will further help in their designing.	
Course Outcomes (COs)		Mapping
CO1	To comprehend and implement the essential principles, techniques, and applications of Number Systems and Codes as they pertain to digital electronics.	Employability, Skill Development
CO2	To design and analyze various Combinational circuits.	Employability, Skill Development
CO3	To design and analyze various Sequential circuits.	Employability, Skill Development
CO4	To demonstrate and interpret the digital signals from analog signals in various logic families.	Employability

Experiment List:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH208B-P	DIGITAL ELECTRONICS LAB	CO1	3	3	3	1	1	1	1	1	1	2	2	1	1	3
		CO2	3	3	2	3	1	1	1	1	1	2	2	3	2	3
		CO3	2	2	2	3	1	1	1	1	1	2	2	1	3	2
		CO4	3	3	3	2	1	1	1	1	1	2	2	2	3	3

Course Title/Code	**INTRODUCTION TO RESEARCH (RDO501)**	
Course Type	Soft Core	
L-T-P Structure	1-0-0	
Credits	0.5	
Pre-requisities	NA	
Course Objective	To apply the contextual knowledge of designing in research and to understand and adopt the ethical practice that are to be followed in the research activities. The student is able choose specific area of research.	
Course Outcomes (COs)		Mapping
CO1	The student shall be able to describe research and its impact.	Employability, Skill Development
CO2	The student shall be able to identify broad area of research, analyze, the processes and procedures to Carryout research	Employability
CO3	The student shall be able to use different tools for literature survey	Employability, Skill Development
CO4	The student is able choose specific area of research and supervisor/mentor is finalized	Employability

SECTION-A

Unit 1: What is Research and its impact?-1.1 Capturing the current research trends-1.2 Insight about scientific research performed by renowned experts in the related field(case studies)-1.3 Do's and Don'ts pertaining to research

SECTION-B

Unit 2: Identification of Broad Area of research- 2.1 Identification of thrust area of research for deciding broad area 2.2 Framing the research questions and hypothesis- 2.3 Identification of the research gap based on feasibility of problem- 2.4 Exploration of in-house and commercially available facilities related to broad area

SECTION-C

Unit 3: Understanding the tools for Literature Survey- 3.1 Finding research papers related to a topic-3.2 Understanding the different aspects of Literature search- 3.3 Usage of different sources like Google scholar, WoS, SCI/ SCIE, PubMed, Scopus, ABDC, EBSCO etc.- 3.4 Search for online journals relevant to research area- 3.5 Indexing of Journals- 3.5 Usage of scholarly networking sites like Research Gate, Mendeley, and Academia.edu etc- 3.6 Demo sessions on the usage of above mentioned sources

SECTION-D

Unit 4: Review of research papers pertaining to broad area and specific area of research- 4.1 Selection of relevant papers- 4.2 Finding specific research problem from broad area of research- 4.3 Literature survey and justification of specific research problem- 4.4 Experimentation and data cleaning and-verification- 4.5 Understanding and selection of the research domain- 4.6 Seeking information through published work w.r.t the problem- 4.7 Reading & categorizing the downloaded/referred papers and structuring of the idea-Model design about framing the research questions-Unit 5: Report Writing and Presentation skill Development-5.1 Report making on the surveyed literature to cater the basic idea of the research papers-5.2 Compiling and analyzing the published results to justify and understand the proposed ideas-5.3 Usage of MS-PowerPoint and other technical resources for the presentation-5.4 Development of presentation skills and group addressing-5.5 Scientific/technical writing and ethical practice, project report

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
RDO 501	INTRODUCTION TO RESEARCH	CO1	3	3	3	3	2	2	2	2	2	3	3	3	3	3
		CO2	3	3	3	3	2	2	2	2	2	3	3	3	3	3
		CO3	3	3	3	3	2	2	2	2	2	3	3	3	3	3
		CO4	3	3	3	3	2	2	2	2	2	3	3	3	3	3

Course Title/Code	**SPANISH-I (FLS101)**	
Course Type	Audit Elective	
L-T-P Structure	2-0-0	
Credits	0	
Pre-requisities	NA	
Course Objective	Exchange greetings and do introductions using formal and informal expressions Understand and use interrogative and answer simple questions Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary Provide basic information about familiar situations and topics of interest Express or/and justify opinions using equivalents of different verbs Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture	
Course Outcomes (COs)		Mapping
CO1	Students will be able to greet each other.	Employability, Skill Development
CO2	Students will be able to make sentences with the verb ser. They will be able to use verb ser with nationality and professions.	Employability
CO3	Students will be able to learn cardinal and ordinal numbers.	Employability, Skill Development
CO4	Students will be able to recognize masculine and feminine words in Spanish. They will be learning the articles and its usages with nouns.	Employability

SECTION-A

Unit 1: Introduction to Spanish and SER1.1 Presentation on Spanish language-1.2 Greetings and goodbyes-1.3 Spanish letters-1.4 Introduction of verbo SER-Unit 2: Verb Ser, Nationality, Profession and Counting-2.1 Uses of verbo SER-2.2 Adjectives related to verbo SER.-2.3 Introduction of Nationality-2.4 Professions and vocabulary related to professions-2.5 Counting till number 20.

SECTION-B

Unit 3: Articles, Interrogative and Estar-3.1 Introduction of Articles and Indefinite articles-3.2 Interrogatives-3.3 Introduction of Verbo Estar

SECTION-C

Unit 4:Estar, Preposition, Tener and Self Introduction-4.1 Uses of Verbo ESTAR and adjectives related to it-4.2 Introducton of 'my house' vocabulary-4.3 Prepositions related to the positioning of an object-4.4 Self – introduction

SECTION-D

Unit 5 : Day, Month and Regular AR verb-5.1 Days-5.2 Month-5.3 Introduction to regular –AR verbs

Text Books/Reference Books:

1. ¡Ole!-Langers
2. ¡Uno, dos, tress

Weblinks:

http://studyspanish.com/

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
FLS101	SPANISH-I	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2

Course Title/Code	**FRENCH-I (FLS103)**
Course Type	Audit Elective
L-T-P Structure	2-0-0
Credits	0
Pre-requisities	NA
Course Objective	• Exchange greetings and do introductions using formal and informal expressions • Understand and use interrogative and answer simple questions • Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary • Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed • Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. • Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary • Provide basic information about familiar situations and topics of interest • Express or/and justify opinions using equivalents of different verbs • Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture

Course Outcomes (COs)		Mapping
CO1	Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.	Employability, Skill Development
CO2	Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary.	Employability
CO3	Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.	Employability, Skill Development
CO4	Students will be able to understand audio text and comprehend to the same. They will be able to form paragraph using auxilary verb and basic verbs.	Employability, Skill Development

SECTION-A

Unit - Saluer et épeler l'alphabet

1.1 Les Salutations & forms of politeness-1.2 Alphabets-Unit 2- Usage de Vous et de Tu -2.1 Taking leave expressions-2.2 Les pronoms sujets-2.3 Basic Questions

SECTION-B

Unit 3- Présentez-vous-3.1 Les verbes ER-3.2 Self introduction-3.3 Décrivez votre ami(e)

SECTION-C

Unit 4- Identifier un nombre, compter-4.1 Les nomS.2 Verbes Avoir, Etre, Aller y Faire-4.3 Les nombres-Unit 5- Demander/ donner les explications-5.1 Les articles define et indéfini-5.2 Les mois de l'année-5.3 Les jours de la semaine

SECTION-D

Unit 6- Parler des saisons et demander l'heure-6.1 Time-6.2 Weather-6.3 Unseen Passage

Text Books/Reference Books/ Suggested Readings:

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

Weblinks:

1. www.bonjourfrance.com
2. www.allabout.com

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
FLS103	FRENCH-I	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2

Course Title/Code	**GERMAN-I (FLS102)**
Course Type	Audit Elective
L-T-P Structure	2-0-0
Credits	0
Pre-requisities	NA
Course Objective	• Exchange greetings and do introductions using formal and informal expressions • Understand and use interrogative and answer simple questions • Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary • Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed • Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. • Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary • Provide basic information about familiar situations and topics of interest • Express or/and justify opinions using equivalents of different verbs • Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture

Course Outcomes (COs)		Mapping
CO1	Students will be able to exchange greetings and introductions using formal and informal expressions. They will be able to ask and answer simple questions.	Employability, Skill Development
CO2	Students will be able to discuss restaurant vocabulary, using simple sentences.	Employability
CO3	Students will be able to discuss likes and dislikes, understand simple conversations (e.g., greetings, and daily activities).	Employability, Skill Development
CO4	Students will be able to differentiate certain patterns of behavior in the cultures of the German- speaking world and the student's native culture.	Employability
CO5	Students will be able to exchange greetings and introductions using formal and informal expressions. They will be able to ask and answer simple questions.	Employability, Skill Development

SECTION-A

Unit-1: Begrüßungen-1.1 Salutations/Greetings-1.2 Introduction-Unit-2: sich vorstellen und Zahlen-2.1-Introduction 2.2 Alphabets-2.3 Numbers 1-20

SECTION-B

Unit-3: Berufe/ Pronomen-3.1 Personal pronouns-3.2 Hobbies and professions

SECTION-C

Unit-4:Café-4.1 Café related vocabulary and dialogues-4.2 Revision personal pronouns-Unit-5: Café dialog-5.1 Café related vocabulary and dialogues-5.2 Common verbs and their conjugations

SECTION-D

Unit-6: Zeit und Monate-6.1 Time-6.2 Days-6.3 Months

Text Books/Reference Books:

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

Weblinks:http://www.nthuleen.com/

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
FLS102	GERMAN-I	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2
		CO5	2	3	3	2	-	-	2	-	-	2	-	2	2	2

Course Title/Code	**PROFESSIONAL COMPETENCY ENHANCEMENT-I(CDO201)**	
Course Type	Soft	
L-T-P Structure	1-0-0	
Credits	0.5	
Pre-requisities	NA	
Course Objective	To acquire basic knowledge about aptitude	
Course Outcomes (COs)		Mapping
CO1	Students will become better at analytics and problem solving	Employability, Skill Development
CO2	Students will be able to solve aptitude problems quickly utilizing the short cuts	Employability
CO3	Students will have enhanced level of reasoning, numerical skills and speed	Employability, Skill Development
CO4	Students will have the ability to 'quickly think on their feet'	Employability
CO5	Students will have enhanced concentration & thinking ability.	Employability, Skill Development

SECTION-A – Reasoning Ability

Unit 1: Mental Ability

1.1 Mental Ability Test-1.2 Direction Sense Test-1.3 Blood Relations Test-1.4 Cubes-1.5 Cuboids-1.6 Dice-1.7 Word Problems-1.8 Puzzles- Unit 2: Verbal & Non Verbal Reasoning-2.1 Letter Series-2.2 Set Theory-2.3 Venn Diagram-2.4 Syllogism-2.5 Missing Value in figure-2.6 Practice Test

SECTION-B

Unit 3: Logical Reasoning & Word Puzzles

3.1 Logical Reasoning I-3.1.1. Row Arrangement-3.1.2. Circular Arrangement-3.2 Logical Reasoning II-3.2.1. Arrangement-3.2.2. Puzzles-3.3 Logical Reasoning III-3.4 Practice Test-Unit 4: Personality Development- 4.1 Concept of personality-Concept of personality-Bringing out the best in one's personality

4.2 Self awareness

Different learning styles-Areas of Self awareness-Developing self-awareness-4.3 Goal Setting- Five principles of goal setting-Setting "SMART" goals-6P's of goal setting- SWOT analysis-Short term& Long term goals

SECTION-C

Unit 5: Resume Writing-What, why and how of Resume-Building different SECTIONs of the Resume through projects and activities during the course-Unit 6 : Presentation Skills-Designing the presentation- Audience and content analysis- Delivering the presentation- Preparation, Practice, Performance

SECTION-D

Unit 7: Professional Communication-Email writing-Diction and Speech Clarity-LSRW & Introduction to verbal ability as an assessment tool for employability-Unit 8: Professional Grooming and Professional Etiquette - etiquette - Professional-grooming-Personal Grooming-Courtesy and communication discipline

Text Books/Reference Books:

1. A Modern Approach to Logical Reasoning: R S Aggarwal, S Chand & Company Pvt Ltd

2. A Modern Approach to Non Verbal Reasoning: R S Aggarwal, S Chand & Company Pvt Ltd

3. Developing Management Skills by David A Whetten, Kim S Cameron

4. Personality and Soft Skills Development by Rajeev Kumar

5. English for business, 100 tips foe effective communication,By: Dignen, Bob; McMaster, Ian. Planegg: Spotlight Verlag GmbH. 2016. eBook.

6. Presentation Skills for technical professionals: Achieving Excellence,By: Karten, Naomi; Gottesdiener, Ellen. Series: Soft Skills for IT Professionals. Ely, Cambridgeshire, United Kingdom :IT Governance Publishing. 2010. eBook., Database: eBook Collection (EBSCOhost)

Weblinks:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CDO201	PROFESSIONAL COMPETENCY ENHANCEMENT-I	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2
		CO5	3	3	2	2	-	-	-	2	-	3	2	2	-	1

Course Title/Code	**PROGRAMMING FUNDAMENTALS USING LINUX (ECW107B)**	
Course Type	CORE WORKSHOP (Departmental)	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To enable the student to articulate given program scenario and apply different programming constructs.	
Course Outcomes (COs)		Mapping
CO1	To analyze the semantics of the given problem statement and illustrate the programming techniques to solve them	Employability, Skill Development
CO2	To integrate the learned and applied concepts into given LINUX projects to produce real life solutions	Employability

LAB EXPERIMENT:

1. General Purpose Commands: date, who, who am I, uname, cal, tty, stty, echo, printf, bc, script, passwd ,finger.File Handling utilities: directory related commands : pwd,mkdir,cd,rmdir,ls -le related commands: cat, cp, mv, rm, chmod, chown, chgrp, file, find, ln, ulink, ulimit,umask,touch -Process Related Commands: ps, kill, nohup, at, batch, crontab, fg, bg, jobs -Filters: cat, head, tail, cut, paste, cmp, comm, diff, sort, more, less, pg, tr, uniq etc….Network Related commands: telnet, ftp, rlogin, arp -Disk and backup utilities- disk utilities -df, du- backup utilities: cpio ,tar-Advanced filters (grep,sed,awk)
2. Write a grep command that selects the lines from the file1 that have exactly three characters
3. Write a grep command that selects the lines from the file1 that have at least three characters.
4. Write a grep command that selects the lines from the file1 that have three or fewer characters
5. Write a grep command that count the number blank lines in the file1
6. Write a grep command that count the number nonblank lines in the file1
7. Write a grep command that selects the lines from the file1 that have the string UNIX.
8. Write a grep command that selects the lines from the file1 that have only the string UNIX.
9. Write a grep command that copy the file to the monitor, but delete the blank lines.
10. Write a grep command that selects the lines from the file1 that have at least two digits without any other characters in between
11. Write a grep command that selects the lines from the file 1 that do not start with A to G.
12. Write a sed command that print lines numbersof lines beginning with “O”
13. Write a sed command that delete digits in the given input file.
14. Write a sed command that delete lines that contain both BEGIN and END
15. Write a sed command that delete lines that contain BEGIN but not END
16. Write a sed command that deletes the first character in each line in a file
17. Write a sed command that deletes the last character in each line in a file
18. Write an awk command to print the lines and line number in the given input file
19. Write an awk command to print first field and second field only if third field value is >=50 in the given input file. (input field separator is “:” and output field separator is “,”)
20. Consider the marks.txt is a file that contains one record per line(comma separate fields) of the student data in the form of studentid, student name, Telugu marks, English marks, Maths Marks, Science marks, Social Marks. Write an awk script to generate result for every students in the form of studentid, studentname, Total Marks and result. Result is PASS if marks is >=30 in TELUGU and English, and if marks>=40 in other subjects.
21. Write an awk program to print the fields 1 and 4 of a file that is passed as command line argument. The file contains lines of information that is separated by “,” as delimeter. The awk program must print at the end the average of all 4th field data.
22. Write an awk program to demonstrate user defined functions and system command.

23. Write an awk script to count the number of lines in a file that do not contain vowels.
24. Write an awk script to find the number of characters, words and lines in a file.

Text Books:

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

Reference Books:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECW 107B	PROGRAMMING FUNDAMENTALS USING LINUX	CO1	3	3	3	3	2	2	2	2	2	3	3	3	3	3
		CO2	3	3	3	3	2	2	2	2	2	3	3	3	3	3

SEMESTER IV

Course Title/Code	**ELECTROMAGNETIC FIELD AND WAVES (ECH206B)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	To introduce the concepts and mathematical methods to understand and analyze the Electromagnetic field and waves	
Course Outcomes (COs)		Mapping
CO1	Analyze the transmission lines and their parameters using the Smith Chart	Employability
CO2	Describe the depth of static and time-varying electromagnetic field as governed by Maxwell's equations.	Employability
CO3	Formulate and analyze problems involving lossy media with planar boundaries using uniform plane waves.	skill development
CO4	Apply concepts of this subject in Antenna Engineering and its applications.	skill development

SECTION-A

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

SECTION-B

Maxwell's Equations- Basics of Vectors, Vector calculus, Basic quantities of Electromagnetics, Basic laws of Electromagnetics: Gauss's law, Ampere's Circuital law, Faraday's law of Electromagnetic induction. Maxwell's Equations, Surface charge and surface current, Boundary conditions at Media Interface. Uniform Plane Wave- Homogeneous unbound medium, Wave equation for time harmonic fields, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity and group velocity of a wave, Power flow and Poynting vector.

SECTION-C

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

SECTION-D

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide. Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna.

Text/Reference Books:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005

2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India

3. NarayanaRao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.

4. David Chen g, Electromagnetics, Prentice Hall

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH206B	ELECTROMAGNETIC FIELD AND WAVES	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2

Course Title/Code	**ANALOG & DIGITAL COMMUNICATION (ECH207B-T)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	Students will be able to analyze and design various analog and digital communication systems by applying the concepts of modulation, noise analysis and multiplexing techniques.	
Course Outcomes (COs)		Mapping
CO1	Apply the knowledge of signals and transformation to study different modulation techniques.	Employability
CO2	Identify and implement the modulation techniques required for analog and digital communication.	Employability
CO3	Implement analog to digital conversion and examine the techniques for reducing the error produced in this process.	Employability
CO4	Analyze the effect of distortion and noise on a communication system .	Entrepreneurship

SECTION-A

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

SECTION B

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

SECTION C

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

SECTION D

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH207 B-T	ANALOG & DIGITAL COMMUNICATION	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2

Course Title/Code	**ANALOG & DIGITAL COMMUNICATION LAB (ECH207B-P)**	
Course Type	Core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	Students will be able to analyze and design various analog and digital communication systems by applying the concepts of modulation, noise analysis and multiplexing techniques.	
Course Outcomes (COs)		Mapping
CO1	Demonstration of generation and detection of analog modulation techniques using MATLAB..	Skill Development
CO2	Compare the different analog modulation techniques.	Skill Development
CO3	Analyze digital modulation techniques by using MATLAB tools.	Skill Development
CO4	Analyze different techniques in modern digital communications, in particular in source coding using MATLAB tools.	Skill Development

List of Experiments:

- Introduction to communication toolbox and observe the waveforms of various signals in Simulink
- (a) Develop a Amplitude modulator (DSB –FC) and demodulator using MATLAB. Plot the graph for modulated and demodulated output.
- (b) Generation of Amplitude modulated (DSB –FC) signal and its demodulation using trainer kit. Hence calculation of modulation index.
- Generation of Double side band-suppressed carrier (DSB-SC) signal using MATLAB and plot the graph for modulated and demodulated output.
- Generation of Single side band-suppressed carrier (SSB-SC) signal using MATLAB and plot the graph for modulated and demodulated output.
- (a) Develop a Frequency modulator and demodulator using MATLAB. Plot the graph for modulated and demodulated output.
- (b) Generation of Frequency Modulated signal and calculate Modulation Index of Frequency Modulated Waveform.
- To generate the PAM/PWM/PPM signals on trainer kit and observe the waveforms on CRO.
- To generate pulse code modulation signal on trainer kit observe the waveform on CRO.
- To generate ASK, FSK and PSK signals using trainer kit and observe the waveform on CRO.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH207 B-P	ANALOG & DIGITAL COMMUNICATION LAB	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2

Course Title/Code	**MICROPROCESSOR AND INTERFACING (ECH220B-T)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	To understand basic of processor and microprocessor and interfacing with real world	
Course Outcomes (COs)		Mapping
CO1	To develop assembly language program for microprocessors and microcontrollers.	Employability
CO2	To comprehend the architectural and pipelining concepts for Microprocessors.	Employability
CO3	To interface peripherals, sensors and actuators and in embedded systems.	Employability
CO4	To design microprocessor based system.	Entrepreneurship

SECTION –A

An over view of 8085-An over view of 8085, Architecture of 8086 Microprocessor. Special functions of General purpose registers. 8086 flag register and function of 8086 Flags. Addressing modes of 8086. Instruction set of 8086. in diagram of 8086-Minimum mode and maximum mode of operation. Timing diagram Assembler directives, simple programs, procedures, and macros.

SECTION –B

Assembly language programs-Assembly language programs involving logical, Branch & Call instructions, sorting, evaluation of arithmetic expressions, string manipulation.

SECTION-C

Memory interfacing to 8086 (Static RAM & EPROM). Need for DMA. DMA data transfer Method. Interfacing with 8237/8257. 8255 PPI – various modes of operation and interfacing to 8086. Interfacing Keyboard, Displays, 8279 Stepper Motor and actuators. D/A and A/D converter interfacing

SECTION-D

Interrupt structure of 8086: Interrupt structure of 8086. Vector interrupt table. Interrupt service routines. Introduction to DOS and BIOS interrupts. 8259 PIC Architecture and interfacing cascading of interrupt controller and its importance

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH220B-T	MICROPROCESSOR AND INTERFACING	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2

Course Title/Code	**MICROPROCESSOR AND INTERFACING LAB (ECH220B-P)**	
Course Type	Core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To understand basic of processor and microprocessor and interfacing with real world	
Course Outcomes (COs)		Mapping
CO1	Design and implement programs on 8085 microprocessors.	Employability
CO2	Design interfacing circuits with 8085 microprocessors.	Employability
CO3	Design and implement programs on 8086 microprocessors.	Employability
CO4	Design and implement programs on 8086 microprocessors.	Entrepreneurship

LIST OF EXPERIMENTS

- Write and execute an Assembly language Program (ALP) to 8086 processors to sort the given array of numbers.
- Write and execute an Assembly language Program (ALP) to 8086 processors to reverse the given string
- Write and execute an Assembly language Program (ALP) to 8086 processor to verify the password.
- Write and execute an Assembly language Program (ALP) to 8086 processor to insert or delete a character
- Write and execute an Assembly language Program (ALP) to 8086 processor to call a delay subroutine and display the character on the LED display.
- Interface a keypad to 8086 microprocessors and display the key number pressed on the 7- segment display which is also interfaced to 8086.
- Write an interrupt service routine to 8086 whenever there is an interrupt request on interrupt pin, which displays "hello" on a LCD.
- Interface an 8086 microprocessor trainer kit to PC and establish a communication between them through RS 232.
- Interface DMA controller to 8086 and transfer bulk data from memory to I/O device.
- Interface a stepper motor to 8086 and operate it in clockwise and anti-clock wise by choosing variable step-size.
- Interface an 8 bit ADC to 8086 and generate digital output and store it in memory for the given square/ ramp/ triangle wave form inputs.
- Interface an ADC to 8086 and generate step, ramp, triangle and square waveforms with different periods.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH220B-P	MICROPROCESSOR AND INTERFACING LAB	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2

Course Title/Code	**VLSI DESIGN (ECH209B)**	
Course Type	Core	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisities	ANALOG ELECTRONICS	
Course Objective	To understand the foundation of fabrication and designing of integrated circuits	
Course Outcomes (COs)		Mapping
CO1	Understand different steps involved in the fabrication of ICs using MOS transistor, CMOS/BiCMOS transistors and passive components.	Employability
CO2	Analyse and formulate the circuit characterization and performance estimation for an integrated circuit.	Employability
CO3	Formulate and analyse the performance of various inverter structure through pull-up to pull-down ratios.	Employability
CO4	Apply the concept of this subject for designing combinational logic circuits using CMOS.	Employability

SECTION A

REVIEW OF MOS TECHNOLOGY: Introduction to IC technology, MOS Transistor enhancement mode and depletion mode operations, fabrication of NMOS, CMOS and Bi-CMOS devices. Equivalent circuit for MOSFET and CMOS.

SECTION B

MOS TRANSISTOR THEORY: MOS device design equations, MOS transistor, Evaluation aspects of MOS transistor, threshold voltage, MOS transistor transconductance& output conductance, figure of merit, determination of pull-up to pull-down ratio for an n-MOS inverter driven by another n-MOS inverter & by one or more pass transistor, alternative forms of pull-up, CMOS and Bi-CMOS-inverters. Latch up in CMOS circuitry and Bi-CMOS Latch up susceptibility .MOS CIRCUITS AND LOGIC DESIGN- Basic physical design of simple logic gates using n-MOS, p-MOS and CMOS, CMOS logic gate design- Considerations, CMOS logic structures, clocking strategies.

SECTION C

CIRCUIT CHARACTERIZATION AND PERFORMANCE ESTIMATION: Resistance estimation, capacitance estimation, inductance, switching characteristics, CMOS gate transistor sizing, power dissipation. VLSI FABRICATION: Crystal growth, wafer preparation, epitaxy, oxidation, lithography, etching, diffusion, dielectric and poly-silicon film deposition, ion implantation, yield and reliability, centralization.

SECTION D

DESIGN EXAMPLE USING CMOS: Incrementer / decrementer, left/right shift serial/parallel register, comparator for two n-bit number, a two-phase non-overlapping clock generator with buffered output on both phases, design of an event driven element for EDL system

TEXT BOOKS:

1. Introduction to Digital Integrated Circuits: Rabaey,Chandrakasan & Nikolic.

2. Principles of CMOS VLSI Design: Neil H.E. Weste and Kamran Eshraghian; Pearson.

REFERENCE BOOKS:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH209B-T	VLSI DESIGN	CO1	3	3	3	1	1	1	1	1	1	2	2	1	1	3
		CO2	3	3	2	3	1	1	1	1	1	2	2	3	2	3
		CO3	2	2	2	3	1	1	1	1	1	2	2	1	3	2
		CO4	3	3	3	2	1	1	1	1	1	2	2	2	3	3

Course Title/Code	**SPANISH-II (FLS105)**	
Course Type	Elective	
L-T-P Structure	1-1-0	
Credits	0	
Pre-requisities	NA	
Course Objective	Exchange greetings and do introductions using formal and informal expressions Understand and use interrogative and answer simple questions Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe colours, clothing, profession, family and marital status in short discourse using simple sentences and basic vocabulary Provide basic information about familiar situations and topics of interest Express or/and justify opinions using equivalents of different verbs Differentiate certain patterns of behavior in the cultures of the Spanish-speaking world and the student's native culture	
Course Outcomes (COs)		Mapping
CO1	Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.	Employability, Skill Development
CO2	Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed.	Employability, Skill Development
CO3	Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.	Employability, Skill Development
CO4	Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary. Provide basic information about familiar situations and topics of interest.	Employability, Skill Development
CO5	Express or/and justify opinions using equivalents of different verbs. Differentiate certain patterns of behavior in the cultures of the Spanish-speaking world and the student's native culture.	Employability, Skill Development
CO6	Describe various places, location, themselves using simple sentences and vocabulary.	Employability, Skill Development

SECTION-A

Unit 1- Mi famila

1.1 Describe your family-1.2 Adjectives to describe a person-1.3 Short essay on family & friend-Unit 2- Gustar-2.1 Likes and dislikes-2.2 Conjugation-2.3 Comprehension

SECTION-B

Unit 3- Verbos Irregulares y reflexivos-3.1 Conjugation-3.2 Routina diaria-3.3 Sentence formation

SECTION-C

Unit 4- El horario

4.1 Timings-4.2 Colours-Unit 5- Estar+gerundio-5.1 Conjugation-5.2 Prepositions-5.3Picture description

SECTION-D

Unit 6- Ser y estar-6.1 Direction-6.2 Comprehension

Text Books/Reference Books:

1. ¡Ole!-Langers
2. ¡Uno, dos, tres

Weblinks:

http://studyspanish.com/

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
FLS105	SPANISH-II	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2
		CO5	2	3	3	2	-	-	2	-	-	2	-	2	2	2
		CO6	2	3	3	2	-	-	2	-	-	2	-	2	2	2

Course Title/Code	**GERMAN-II (FLS106)**	
Course Type	Elective	
L-T-P Structure	1-1-0	
Credits	0	
Pre-requisities	NA	
Course Objective	Exchange greetings and do introductions using formal and informal expressions Understand and use interrogative and answer simple questions Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary Provide basic information about familiar situations and topics of interest Express or/and justify opinions using equivalents of different verbs Differentiate certain patterns of behavior in the cultures of the German-speaking world and the student's native culture.	
Course Outcomes (COs)		Mapping
CO1	Students will be able to write short essays on family and friends.	Employability, Skill Development
CO2	They will have knowledge of tenses.	Employability, Skill Development
CO3	Students will be able to identify classroom vocabulary in the German language	Employability, Skill Development
CO4	Students will be able to speak ordinal and cardinal numbers and they will also learn months, days in German	Employability, Skill Development
CO5	They will be able to express or/and justify opinions using equivalents of different verbs	Employability, Skill Development
CO6	They will be able to express or/and justify opinions using equivalents of different verbs.	Employability, Skill Development

SECTION-A

Unit 1- Mi famila

1.1 Describe your family-1.2 Adjectives to describe a person-1.3 Short essay on family & friend-Unit 2- Gustar-2.1 Likes and dislikes-2.2 Conjugation-2.3 Comprehension

SECTION-B

Unit 3- Verbos Irregulares y reflexivos -3.1 Conjugation-3.2 Routina diaria-3.3 Sentence formation

SECTION-C

Unit 4- El horario-4.1 Timings-4.2 Colours-Unit 5- Estar+gerundio-5.1 Conjugation-5.2 Prepositions-5.3Picture description-

SECTION-D

Unit 6- Ser y estar-6.1 Direction-6.2 Comprehension

Text Books/Reference Books:

1. ¡Ole!-Langers
2. ¡Uno, dos, tres……
3. Weblinks:http://studyspanish.com/

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
FLS106	GERMAN-II	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2
		CO5	2	3	3	2	-	-	2	-	-	2	-	2	2	2
		CO6	2	3	3	2	-	-	2	-	-	2	-	2	2	2

Course Title/Code	**FRENCH-II (FLS107)**	
Course Type	Elective	
L-T-P Structure	1-1-0	
Credits	0	
Prerequisites	NA	
Course Objective	Recognize numbers and tell their age using numbers. Tell and ask time in 12 hour and 24 hour format Learn Basic vocabulary that can be used to discuss the weather and seasons Identify colors, professions and adjectives in French and describing different people and objects using these three. Describe orally and in writing themselves, their family and their friends. Use reflexive verbs to describe daily routine. Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Provide basic information about familiar situations and topics of interest Express or/and justify opinions using equivalents of different verbs Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture	
Course Outcomes (COs)		Mapping
CO1	.Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.	Employability, Skill Development
CO2	Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed.	Employability, Skill Development
CO3	Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.	Employability, Skill Development
CO4	Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary. Provide basic information about familiar situations and topics of interest.	Employability, Skill Development
CO5	Express Gorand justify opinions using equivalents of different verbs. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture.	Employability, Skill Development
CO6	Describe various places, location, themselves using simple sentences and vocabulary.	Employability, Skill Development

SECTION-A

Unit 1- Se présenter (1)-1.1 Les pluriels-1.2 Adjectives to describe a person-Unit 2- Se présenter (2)-2.1 Professions

2.2 Short essay on family & friend -2.3 Comprehension

SECTION-B

Unit 3- Parler de ses habitudes quotidiennes-3.1 Les verbes pronominaux-3.2 Décrivez votre journée-

SECTION-C

Unit 4- Nommez et localiser des lieux dans la ville-4.1 Prepositions-4.2 Asking & telling the way-Unit 5- Informations -simples sur le climat, la météo-5.1 Les saisons-5.2 Les expressions de la saison-5.3 Compréhension

SECTION-D

Unit 6- Demander/ indiquer les horaires et les couleurs

6.1 Timings-6.2 Colours

Text Books/Reference Books/ Suggested Readings:

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

Weblinks:

www.bonjourfrance.com

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
FLS107	FRENCH-II	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2
		CO5	2	3	3	2	-	-	2	-	-	2	-	2	2	2
		CO6	2	3	3	2	-	-	2	-	-	2	-	2	2	2

Course Title/Code	**DIGITAL HARDWARE MODELLING USING VHDL (ECH214B-T)**	
Course Type	Core	
L-T-P Structure	3-1-0	
Credits	4	
Prerequisites	Digital Electronics	
Course Objective	To understand the logic of various digital circuits this will further help in their designing.	
Course Outcomes (COs)		Mapping
CO1	Understand the design units of VHDL and implementation of circuits using different modelling styles.	Employability, Entrepreneurship
CO2	Understand the implementation of circuits using Behavioral Modelling , concept of Delays, Dataflow Modelling and the concept of Resolution Function.	Employability
CO3	Implementation of combinational and sequential circuits using VHDL.	Employability, Entrepreneurship
CO4	Analysis of FSM and Testbench and Logic of several PLDs.	Employability, Entrepreneurship

SECTION A

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

SECTION B

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

SECTION C

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

SECTION D

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

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH214B-T	DIGITAL HARDWARE MODELLING USING VHDL	CO1	3	2	2	2	1	1	1	1	1	2	3	3	3	3
		CO2	3	3	2	3	1	2	1	1	1	2	3	3	3	3
		CO3	3	2	3	2	2	1	1	1	1	2	3	3	3	3
		CO4	3	2	3	2	2	1	1	1	1	2	3	3	3	3

ourse Title/Code	**DIGITAL HARDWARE MODELLING USING VHDL LAB (ECH214B-P)**	
Course Type	Core	
L-T-P Structure	0-0-2	
Credits	1	
Prerequisites	Digital Electronics lab	
Course Objective	To understand the logic of various digital circuits this will further help in their designing.	
Course Outcomes (COs)		Mapping
CO1	Designing digital circuits, behavioral and RTL modeling of digital circuits using Verilog HDL	Employability, Entrepreneurship
CO2	Verifying these models and synthesizing RTL models to standard cell libraries and FPGAs	Employability
CO3	Designing, modeling, implementing and verifying combinational and sequential circuits using VHDL.	Employability, Entrepreneurship
CO4	Analysis of FSM and Test bench and Logic of several PLDs.	Employability, Entrepreneurship

List of Experiments:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH214B-P	DIGITAL HARDWARE MODELLING USING VHDL LAB	CO1	3	2	2	2	1	1	1	1	1	2	3	3	3	3
		CO2	3	3	2	3	1	2	1	1	1	2	3	3	3	3
		CO3	3	2	3	2	2	1	1	1	1	2	3	3	3	3
		CO4	3	2	3	2	2	1	1	1	1	2	3	3	3	3

Course Title/Code	**PROFESSIONAL COMPETENCY ENHANCEMENT-II(CDO202)**	
Course Type	Soft	
L-T-P Structure	1-0-0	
Credits	0.5	
Prerequisites	NA	
Course Objective	To acquire basic knowledge about aptitude	
Course Outcomes (COs)		Mapping
CO1	To improve students basic knowledge about Arithmetic Aptitude	Employability, Skill Development
CO2	To make students solve aptitude problems quickly utilizing the short cuts	Employability
CO3	To make students have the ability to 'quickly think on their feet'	Employability, Skill Development
CO4	To strengthen students communication skills	Employability

SECTION A – Quantitative Aptitude

Unit 1: Arithmetic I

Simplification-1.1.1 Use of BODMAS rule and Formulas for solving equations.-1.1.2 Simple Fractions and Decimal Fractions.-1.1.3 Surds and Indices.-1.2 Ratio and Proportion-1.2.1 Changes in Ratios, Combined Ratio and Continued Proportion.-1.2.2 Application in different questions.-1.2.3 Variations and Partnership.-1.3 Percentage-1.3.1 Basic Conversion, Consumption & Expenditure, Successive changes and Errors.-.3.2 Application in Areas and Volumes.-1.4 Profit and Loss-1.4.1 Sales and Purchase Transactions. -1.4.2 MRP and Discount, Equivalent discounts.-1.4.3 Errors in weight (Dishonest Dealer).-1.5 Average-1.5.1 Combined and Mistaken Averages.-1.5.2 Changes in Average.-1.5.3 Application in Cricket and others.-1.5.4 Practice Exercise.-1.6 Interest-1.6.1 Simple and Compound Interest Formulae.-1.6.2 Relations and their Applications.-1.6.3 Practice Exercise.-Unit

2: Arithmetic II

2.1 Time and work-2.1.1 Combined work, Work & Wages, Work & Efficiency.-2.1.2 Working Alternatively, Work and Equations.-2.1.3 Pipes and Cisterns, Inlet and Outlet pipes, Capacity of Tank and Leakage-2.2 Alligations & Mixtures-2.2.1 Formula Based-2.2.2 Successive Displacement-2.2.3 Mixtures-2.2.4 Error in Measurement-2.2.5 Profit on False Weight2.3 Revision & Practice-2.3.1 Problems on Ages & Numbers-2.3.2 Calendar-2.3.3 Coding & decoding-2.3.4 Data Sufficiency-

SECTION B

Verbal Ability Test-Unit 3. Communication Skills in English--1.1 Relevance of Verbal Ability AND PREPARATORY GUIDELINES-1.2 Functional Grammar – Subject Verb Agreement-1.3 Tenses – Perfect, Simple , Continuous 1.4 Common Errors and rectification-Unit 4: Word Power Building Skills-2.1 Words: Antonyms, Synonyms, Analogies-2.2 Compound words: Homophones, Homonyms, Word Families-2.3 Root Word Technique for Prefixes & Suffixes-2.4: Word Power: 7 Tips for Learning New Words-2.5 Practice Vocabulary Exercises

SECTION C

Unit 5: Writing Skills-3.1 Writing: Introduction of Writing Skills, Objectives of enhancing Writing Skills & Types of Writing-3.2 Sentences, Phrases, Types of Sentences, Parts of Sentences-3.3 Paragraph Writing: Construction, Linkage & Cohesion-3.4 Practice Exercises: Writing Skills

SECTION D

Unit 6: Reading Skills-4.1 Objectives of Reading, Definition & Types of Reading & Importance of Reading-4.2 Reading Techniques: SW3R, Active Reading, Detailed, Speed-4.2 Practice Exercises: Short & Medium Passages

Text Books/Reference Books:

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

Web links:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CDO202	PROFESSIONAL COMPETENCY ENHANCEMENT-II	CO1	3	2	-	-	-	-	2	2	2	2	-	2	-	2
		CO2	3	2	3	2	-	-	-	2	2	3	-	2	3	1
		CO3	3	3	2	2	-	-	-	2	-	3	2	2	-	1
		CO4	2	3	3	2	-	-	2	-	-	2	-	2	2	2

Course Title/Code	**ELECTRONIC DESIGN WORKSHOP (ECW205B)**	
Course Type	Core	
L-T-P Structure	0-0-3	
Credits	1.5	
Pre-requisites	**NA**	
Course Objective	To provide hands-on experience on the state-of-the-art Cadence EDA tools for VLSI Design. The participants will have an exposure to the Circuit Design & Simulation, Layout, Physical Verification (DRC, LVS), and Extraction.	
Course Outcomes (COs)		**Mapping**
CO1	Analyze the characteristics of Oscillators and amplifiers	Employability, Entrepreneurship
CO2	Analyze the characteristics of Multivibrators	Employability
CO3	Analyze the frequency response of amplifiers using pSpice.	Employability, Entrepreneurship
CO4	Model the design of electronic circuits using PSpice	Employability, Entrepreneurship

Experiment List:

Software proposed: ORCAD/EAGLE/DESIGN SPARK

1. Introduction to PCB Design Software, Editing and Routing.

2. Designing of low pass, high pass, all pass & band pass filters for a given cut off frequency

3. Designing of half-wave rectifier with effects of variable capacitance

4. Designing of full-wave rectifier with effects of variable capacitance.

5. Designing of 5V power supply

6. Designing of Half adder and Full Adder using gates

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

8. Project using design soft.

C0-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECW205B	ELECTRONIC DESIGN WORKSHOP	CO1	3	3	-	-	3	-	-	-	3	3	3	3	3	3
		CO2	3	3	-	3	-	-	-	3	3	-	3	3	3	3
		CO3	3	3	3	3	-	3	3	-	-	-	3	3	3	3
		CO4	3	3	3	3	3	-	-	-	-	-	3	3	3	3

SEMESTER V

Course Title/Code	**MICROCONTROLLERS & INTERFACING (ECH326B-T)**	
Course Type	Core (Departmental)	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	To get familiar with the basic 8-bit (8051) controllers, their architecture, internal organization and their functions, interfacing an external device with the processors/ controllers.	
Course Outcomes (COs)		Mapping
CO1	Describe the concept of microcontrollers and methods of programming the same.	Employability
CO2	Students will be able to differentiate between the various addressing modes and work on the various instruction set.	Employability
CO3	Analyze the working of 8051 Microcontroller by knowing its architecture, addressing modes and interrupts.	Employability
CO4	Students will be able to build microcontroller-based system around 8051 and PIC.	Employability

SECTION-A

INTRODUCTION OF MICROCONTROLLER: Different types of microcontrollers: Embedded microcontrollers, External memory microcontrollers; Processor Architectures: Harvard V/S Princeton, CISC V/S RISC; microcontrollers memory types; microcontrollers features: clocking, i/o pins, interrupts, timers, peripherals.

SECTION-B

MICROCONTROLLER ARCHITECTURE: Introduction to PIC microcontrollers, Architecture and pipelining, program memory considerations, addressing modes, CPU registers, Instruction set, simple operations.

SECTION-C

Microcontrollers - Microcontroller 8051- Architecture, Pin Diagram, I/O Ports, Internal RAM and Registers, Interrupts, Addressing Modes, Memory Organization and External Addressing, Instruction Set, Assembly Language Programming, Real Time Applications of Microcontroller- Interfacing with LCD, ADC, DAC, Stepper Motor, Key Board and Sensors.

SECTION-D

Embedded Systems-Introduction, Classification, Processors, Hardware Units, Software Embedded into System, Applications and Products of Embedded Systems, Structural Units in Processor, Memory Devices, I/O Devices, Buses, Interfacing of Processor Memory and I/O Devices, Case Study of an Embedded System for a Smart Card.

Text Books:

1. B. B. Brey: The Intel Microprocessors, Architecture, Programming and Interfacing, Pearson Education.
2. Design with PIC Microcontrollers by John B. Peatman , Pearson.
3. Raj Kamal: Embedded Systems- Architecture, Programming and Design, TMH, New Delhi.
4. V. Udayashankara and M. S. Mallikarjunaswamy: 8051 Microcontroller, TMH, New Delhi.
5. Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education.
6. D. V. Hall: Microprocessors and Interfacing, TMH

7. Programming and Customizing the 8051 Microcontroller : Predko ; TMH.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH326B-T	MICROCONTROLLERS & INTERFACING	CO1	3	3	2	2	1	-	-	2	2	-	-	2	3	2
		CO2	3	3	3	-	-	-	-	2	2	-	-	2	3	2
		CO3	2	2	-	-	-	-	-	2	-	-	-	-	2	1
		CO4	2	-	-	-	-	-	-	2	-	-	-	-	2	1

Course Title/Code	**MICROCONTROLLERS & INTERFACING LAB. (ECH326B-P)**	
Course Type	Core (Departmental)	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To get familiar with the basic 8-bit (8051) controllers, their architecture, internal organization and their functions, interfacing an external device with the processors/ controllers.	
Course Outcomes (COs)		Mapping
CO1	To demonstrate the microcontroller using 8051 controller and evaluate on various parameters	Employability
CO2	Demonstrate Interfacing of peripherals to microcontroller.	Employability
CO3	Demonstrate data collection and acquisition using 8051 microcontroller	Employability
CO4	Design real world applications using microcontrollers	Employability

List of Experiments:

- Write Assembly language Program to generate 10 kHz square wave Using 8051.
- 02 Study and analysis of interfacing of LCD using 8051controller.
- 03 Study and interfacing of IR (RC5 protocol) and RF Communication using 8051controller.
- 04 To interface PWM based voltage regulator using 8051Microcontroller.
- 05 To study Programming and Transmission & reception of data through Serial port between two PC & study of Parallel printer port using 8051.
- 06 Write an Assembly language Program to generate 10 kHz square wave Using 8051
- 07 To study implementation & interfacing of Display devices Like LCD, LED Bar graph & seven segment display with Microcontroller 8051/AT89C51
- 08 To study implementation & interfacing of Different motors like stepper motor, DC motor & servo Motors. 8051
- 09. Write an ALP for temperature & pressure measurement 8051.
- To study Programming and Transmission & reception of data through Serial port & study of Parallel

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH326B-P	MICROCONTROLLERS & INTERFACING LAB	CO1	3	3	2	2	1	-	-	2	2	-	-	2	3	2
		CO2	3	3	3	-	-	-	-	2	2	-	-	2	3	2
		CO3	2	2	-	-	-	-	-	2	-	-	-	-	2	1
		CO4	2	-	-	-	-	-	-	2	-	-	-	-	2	1

Course Title/Code	**SYSTEM DESIGN USING VERILOG (ECH323B-T)**	
Course Type	CORE	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisites	Digital Hardware design	
Course Objective	Appreciate and apply the System Verilog verification features, including classes, constrained random stimulus, coverage, strings, queues and dynamic arrays, and learn how to utilize these features for more effective and efficient verification.	
Course Outcomes (COs)		Mapping
CO1	Use System Verilog RTL design and synthesis features, including new data types, literals, procedural blocks, statements, and operators, relaxation of Verilog language rules.	Employability/Skill Development
CO2	Analyze synthesis issues, enhancements to tasks and functions, new hierarchy and connectivity features, and interfaces.	Employability/Skill Development
CO3	Appreciate and apply the System Verilog verification features, including classes, constrained random stimulus, coverage, strings, queues and dynamic arrays.	Employability/Skill Development
CO4	Utilize the features of System Verilog for more effective and efficient verification.	Employability/Skill Development

SECTION A

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

SECTION B

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

SECTION C

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

SECTION D

Processes, Coverage & Assertion: Final block, Block statement, Fork join, fork join_any, fork join_none, Wait and disable, what is event? Conditional event control, named event, Event triggering, Blocking and non-blocking, What is

program block? Re-active region, what is Interface? Modport, Parameterized interface, Virtual interface, What is coverage? Code coverage, Functional coverage, Covergroup, Coverpoint, Embedded covergroup, Bins, types of bins,bins for transition, wildcard, illegal bins, ignore bins, cross-coverage, coverage option , What is assertion? Immediate and concurrent, Assertion severity, Property blocks and sequences, Assertion operator (Basic).

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH234B-T	HARDWARE VERIFICATION USING SYSTEM VERILOG	CO1	3	2	2	2	1	1	1	1	1	2	3	3	3	3
		CO2	3	3	2	3	1	2	1	1	1	2	3	3	3	3
		CO3	3	2	3	2	2	1	1	1	1	2	3	3	3	3
		CO4	3	2	3	2	2	1	1	1	1	2	3	3	3	3

Course Title/Code	**SYSTEM DESIGN USING VERILOG (ECH323B-P)**	
Course Type	CORE	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	Digital hardware design	
Course Objective	Appreciate and apply the System Verilog verification features, including classes, constrained random stimulus, coverage, strings, queues and dynamic arrays, and learn how to utilize these features for more effective and efficient verification.	
Course Outcomes (COs)		Mapping
CO1	Apply System Verilog verification features, including classes, constrained random stimulus, coverage, strings, queues and dynamic arrays, and learn how to utilize these features for more effective and efficient verification.	Employability/Skill Development
CO2	Synthesis features, including new data types, literals, procedural blocks, statements, and operators, relaxation of Verilog language rules, fixes for synthesis issues, enhancements to tasks and functions, new hierarchy and connectivity features, and interfaces.	Employability/Skill Development

List of Experiments:

- Design and verify combinational circuits using System Verilog.
- Design and verify D Flip-Flop using System Verilog.
- Design and verify Sequential circuits using System Verilog.
- Example of a simple UVM testbench consisting of a single uvm_env class.
- Basic UVM "Hello World" program using System Verilog.
- Create multiple objects of a class, calling the constructor and a print method using System Verilog.
- Example of Random-Access Memory using System Verilog.
- Example of testing a UVM scoreboard using SVUnit.
- projects

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH234B-T	HARDWARE VERIFICATION USING SYSTEM VERILOG	CO1	3	2	2	2	1	1	1	1	1	2	3	3	3	3
		CO2	3	3	2	3	1	2	1	1	1	2	3	3	3	3

Course Title/Code	**CMOS VLSI DESIGN (ECH314B-T)**	
Course Type	Elective (Departmental)	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	VLSI design	
Course Objective	To understand the foundation of fabrication and designing of integrated circuits	
Course Outcomes (COs)		Mapping
CO1	Analyze complex microelectronics circuits and systems	Employability
CO2	Design layout and schematics related with various CMOS based application	Employability
CO3	Analyzing combinational circuits based on CMOS by understanding their working principles	Employability
CO4	Analyze the performance issues & inherent trade off involved in system design.	Employability

SECTION A

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

SECTION B

Timing Issues in Digital Circuits: Introduction, Timing classification of digital systems, Synchronous interconnect, Mesochronous interconnect, Plesiochronous interconnect, Asynchronous interconnect, Synchronous design – Synchronous timing basics, Sources of Skew & Jitter, Clock distribution techniques, Latch based clocking, Self-timed circuit design – Self timed logic, Completion –signal generation, Self-timed 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- Addressable or Associative memory (CAM), Memory peripheral circuitry, Address decoders, Sense amplifiers, Voltage references, Drivers / Buffers, Timing & control, Memory reliability and yield, Static noise margin, Memory yield, Power disspation in memories, Sources of power dissipation in memories, Partitioning of the memory, Addressing the active power dissipation, Data retention dissipation, Case study in memory design, PLA, 4 –Mbit SRAM, 1-Gbit NAND flash memory.

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH314B-T	CMOS VLSI DESIGN	CO1	3	2	1	1	1	1	1	-	1	1	-	-	3	1
		CO2	3	3	2	1	1	1	1	-	1	1	-	-	3	1
		CO3	3	3	3	2	1	1	1	-	1	2	-	-	3	2
		CO4	3	3	2	2	2	1	1	-	1	1	-	-	3	3

Course Title/Code	**CMOS VLSI DESIGN LAB.(ECH314B-P)**	
Course Type	Elective (Departmental)	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	VLSI design	
Course Objective	To understand the foundation of fabrication and designing of integrated circuits	
Course Outcomes (COs)		Mapping
CO1	Design combinational circuits using VLSI designing Platforms like Tanner	Employability
CO2	Design layout and schematics related with various CMOS based application	Employability
CO3	Design and analyze sequential circuits using VLSI designing Platforms like Tanner	Employability
CO4	Implementing the VLSI design for real time problems.	Employability

List of Experiments:

- To construct & Analyze CMOS Inverter in Tanner EDA.
- To construct & analyze the logic gates in Tanner EDA.
- To construct & analyze the half adder in Tanner EDA.
- To Construct & analyze Full adder in Tanner EDA.
- To construct & analyze D – Flip Flop in Tanner EDA.
- To construct & analyze current mirror in Tanner EDA.
- To construct & analyze differential amplifier in Tanner EDA.
- To construct & analyze operational amplifier in Tanner EDA.
- To construct & analyze trans-conductance amplifier in Tanner EDA.
- Mini Project

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH314B-P	CMOS VLSI DESIGN LAB.	CO1	3	2	1	1	1	1	1	-	1	1	-	-	3	1
		CO2	3	3	2	1	1	1	1	-	1	1	-	-	3	1
		CO3	3	3	3	2	1	1	1	-	1	2	-	-	3	2
		CO4	3	3	2	2	2	1	1	-	1	1	-	-	3	3

Course Title/Code	**INFORMATION THEORY AND CODING (ECH401B-T)**	
Course Type	Elective (Departmental)	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	Students will be able to formulate and reduce the performance of channel and error probability respectively by implementing the techniques of information measurement and error correction coding.	
Course Outcomes (COs)		Mapping
CO1	Design the channel performance using Information theory	Employability, Skill Development
CO2	Comprehend various error control code properties	Employability, Skill Development
CO3	Apply linear block codes for error detection and correction	Employability, Skill Development
CO4	Design BCH & RS codes for Channel performance improvement against burst errors.	Employability, Skill Development

SECTION-A

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

SECTION-B

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

SECTION-C

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

SECTION-D

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

Text Books:

1. Information Theory and Coding by "N Abramson"

2. Information Theory by "R B Ash"

3. Error control coding by "Shu Lin and D J Costello"

Reference Books:

1. Information theory and Coding Basics and Practices by “Veluswamy S”

2. Information Theory and Coding by “MuralidharKulkarni and K S Shivaprakasha”

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH401B-T	INFORMATION THEORY AND CODING	CO1	3	2	1	1	1	1	1	-	1	1	-	-	3	1
		CO2	3	3	2	1	1	1	1	-	1	1	-	-	3	1
		CO3	3	3	3	2	1	1	1	-	1	2	-	-	3	2
		CO4	3	3	2	2	2	1	1	-	1	1	-	-	3	3

Course Title/Code	**INFORMATION THEORY AND CODING LAB (ECH401B-P)**	
Course Type	Elective (Departmental)	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	Students will be able to formulate and reduce the performance of channel and error probability respectively by implementing the techniques of information measurement and error correction coding.	
Course Outcomes (COs)		Mapping
CO1	explain what is the significance of this quantitative measure of information in the communications systems	Employability, Skill Development
CO2	decide an efficient data compression scheme for a given information source	Employability, Skill Development
CO3	calculate entropy, joint entropy, relative entropy, conditional entropy, and channel capacity of a system	Employability, Skill Development
CO4	Describe the theoretical framework upon which error-control codes are built	Employability, Skill Development

LIST OF EXPERIMENTS

- Determination of entropy of a given source
- Determination of various entropies and mutual information of given channel (Noise free channel)
- Determination of various entropies and mutual information of a given channel (Binary symmetric channel)
- Generation and evaluation of variable length source coding using MATLAB (Huffman Coding and decoding)
- Coding & decoding of Linear block codes
- Coding & decoding of Cyclic codes
- Coding and decoding of convolutional codes
- Coding and decoding of BCH codes.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH401B-P	INFORMATION THEORY AND CODING LAB	CO1	3	2	1	1	1	1	1	-	1	1	-	-	3	1
		CO2	3	3	2	1	1	1	1	-	1	1	-	-	3	1
		CO3	3	3	3	2	1	1	1	-	1	2	-	-	3	2
		CO4	3	3	2	2	2	1	1	-	1	1	-	-	3	3

Course Title/Code	**WIRELESS SENSOR NETWORKS (ECH403B-T)**	
Course Type	Elective (Departmental)	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisites	NA	
Course Objective	Provide students with the fundamentals of WSN architecture, network platforms, and applications to design energy-efficient MAC protocols for sensor networks in IoT environments.	
Course Outcomes (COs)		Mapping
CO1	Explain the concept of Wireless Sensor Networks by studying the architecture of a single node	Employability, Skill Development
CO2	Differentiate and understand the various routing protocols for ad-hoc wireless networks	Employability, Skill Development
CO3	Describe the concept of MAC protocols in Wireless Sensor Networks and identify devices based on these MAC standards	Employability, Skill Development
CO4	Analyze design constraints and challenges in WSN like network lifetime, security, and analyzing a few networks through simulations.	Employability, Skill Development

SECTION A

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

SECTION B

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

SECTION C

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

SECTION D

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

Suggested Text / Reference Books

1. C. Siva Ram Murthy and B. S. Manoj, ―Ad Hoc Wireless Networks Architectures and Protocols‖, Prentice Hall, PTR, 2004.

2. Holger Karl , Andreas willig, ―Protocol and Architecture for Wireless Sensor Networks‖, John wiley publication, Jan 2006
3. Feng Zhao, Leonidas Guibas, ―Wireless Sensor Networks: an information processing approach‖, Elsevier publication, 2004.
4. Charles E. Perkins, ―Ad Hoc Networking‖, Addison Wesley, 2000.
5. I.F. Akyildiz, W. Su, Sankara subramaniam, E. Cayirci, ―Wireless sensor networks: a survey‖, computer networks, Elsevier, 2002, 394 - 422.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH403B-T	WIRELESS SENSOR NETWORKS	CO1	3	2	1	1	1	1	1	-	1	1	-	-	3	1
		CO2	3	3	2	1	1	1	1	-	1	1	-	-	3	1
		CO3	3	3	3	2	1	1	1	-	1	2	-	-	3	2
		CO4	3	3	2	2	2	1	1	-	1	1	-	-	3	3

Course Title/Code	**WIRELESS SENSOR NETWORKS LAB (ECH403B-P)**	
Course Type	Elective (Departmental)	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	Provide students with the fundamentals of WSN architecture, network platforms, and applications to design energy-efficient MAC protocols for sensor networks in IoT environments.	
Course Outcomes (COs)		Mapping
CO1	Data sensing and analysis using platform like MKR1000	Employability, Skill Development
CO2	Demonstrate data exchange for MKR1000	Employability, Skill Development
CO3	Demonstrating audio data and analysing the parameters.	Employability, Skill Development
CO4	Analysing a few networks through simulations and implementing for real time problems.	Employability, Skill Development

LIST OF EXPERIMENTS

- Sensing data using the MKR1000 board.
- Programming a MKR1000 board over the air in a standlone WiFi network.
- Collecting and exchanging data on 433mHz frequenzy.
- Sensing audio data and interpreting results.
- Visualizing sensed data.
- Project

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH403B-P	WIRELESS SENSOR NETWORKS LAB	CO1	3	2	1	1	1	1	1	-	1	1	-	-	3	1
		CO2	3	3	2	1	1	1	1	-	1	1	-	-	3	1
		CO3	3	3	3	2	1	1	1	-	1	2	-	-	3	2
		CO4	3	3	2	2	2	1	1	-	1	1	-	-	3	3

Course Title/Code	**OOPS USING JAVA (CSH201B-T)**	
Course Type	Elective (Departmental)	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	Student will be able to apply the object-oriented programming principles and techniques for solving the real life problems.	
Course Outcomes (COs)		Mapping
CO1	Explain the concept of Object Oriented Programming with introduction to JAVA.	Employability, Skill Development
CO2	Describe the principles of Inheritance and encapsulation and use them to create public and private classes and member functions.	Employability, Skill Development
CO3	Explain the concept of exception handling in JAVA and also learn about the various API packages.	Employability, Skill Development
CO4	Quantify the challenges in JAVA programming by understanding the features of applets and Input Output streams.	Employability, Skill Development

SECTION-A

Overview of Applications: Desktop Based Application like Library Management System in order to understand problem solving skills. Introduction to OOPS: Paradigms of Programming Languages - Basic concepts of Object Oriented Programming, Differences between Procedure Oriented Programming and Object Oriented Programming, Objects and Classes, Data abstraction and Encapsulation, Inheritance, Polymorphism, Dynamic binding, Message communication, Benefits of OOP, Application of OOPs. Introduction to Java: History of Java, Java features, Java Environment: JDK API. Types of java program, Creating and Executing a Java program, Java Tokens: Keywords, Character set, Identifiers, Literals, Separator, Java Virtual Machine (JVM), Comments in Java program, Command line input and Arguments, Data Types, Variables, Operators, Control Statements, Arrays, String handling.

SECTION-B

Class and objects: Defining a class, Methods, creating objects, Accessing class members. Constructors, Method overloading, Static members, Nesting of Methods, this keyword. Inheritance: Defining a subclass, deriving a sub class, Single Inheritance, Multilevel Inheritance, Hierarchical Inheritance, overriding methods, super keyword, Final variables and methods, Final classes, Final methods, Abstract methods and classes, Visibility Control, Public access, Private access, protected. Defining interface, extending interface, Implementing Interface, Accessing interface variables.

SECTION-C

Packages: Java API Packages: System Packages, Naming Conventions, Creating & Accessing a Package, Adding Class to a Package, Hiding Classes-Exception Handling: Exception Handling Mechanism, using try and catch blocks, nesting try Statements, Multiple catch Block, Throwing Exceptions, using finally clause, creating a Custom Exception. Multithreading: Getting the main thread, naming a Thread, pausing a thread, creating a Thread with the Runnable Interface, Creating a Thread with Thread Class, Creating Multiple Threads, Waiting for (joining) Threads, Checking whether thread is alive, Setting Thread Priority and Stopping Threads, Thread Synchronization, Suspending and Resuming Threads.

SECTION-D

I/O Streams: I/O Basics Reading Console Input Writing Console Output, Using the File Class, 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

Text Books:

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

Reference Book:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSH201B-T	OOPS USING JAVA	CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Course Title/Code	**OOPS USING JAVA LAB. (CSH201B-P)**	
Course Type	Elective (Departmental)	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	Student will be able to apply the object-oriented programming principles and techniques for solving the real life problems.	
Course Outcomes (COs)		Mapping
CO1	Demonstrating the syntax using concepts	Employability, Skill Development
CO2	Demonstrating the interfaces and packages	Employability, Skill Development
CO3	To analyze the semantics of the given problem statement and illustrate the programming techniques to solve them.	Employability, Skill Development
CO4	To integrate the learned and applied concepts into given java projects to produce real life solutions.	Employability, Skill Development

List of Experiments

- Basic programs in java, use of if else construct and switch construct.
- Programs on Loops and Arrays.
- Programs on Strings and classes creation in java.
- Programs on constructors and use of keyword this keyword, static keyword, final keyword, finalize method.
- Programs on single inheritance,
- Programs on multilevel inheritance, Hierarchical inheritance.
- Programs on method overriding, super keyword and final method.
- Programs on interfaces
- Programs on Packages
- Programs Exception Handling
- Programs on threads
- Programs on File Handling
- Programs on Applets
- Programs on AWT

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSH201B-P	OOPS USING JAVA	CO1	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
		CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Course Title/Code	**INTERNET OF THINGS (ECH305B- T)**	
Course Type	Core (Departmental)	
L-T-P Structure	2-0-0	
Credits	2	
Pre-requisities	NA	
Course Objective	To impart knowledge how to connect devices to network.	
Course Outcomes (COs)		Mapping
CO1	Describe the fundamentals of IoT and to identify the IoT networking components	Employability, Skill Development
CO2	Select IoT protocols and software.	Employability, Skill Development
CO3	Build schematic for IoT solutions	Employability, Skill Development
CO4	Design a simple IoT system made up of sensors, wireless network connection, data analytics and display/actuators, and write the necessary control software.	Employability, Skill Development

SECTION A

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

SECTION B

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

SECTION C

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

SECTION D

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

Textbooks:

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

References:

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

2. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2)
3. Jan Holler, VlasiosTsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), ―Architecting the Internet of Things, Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, 'Reilly Media, 2011

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH305B- T	INTERNET OF THINGS	CO1	3	2	2	-	3	-	-	-	-	-	-	-	-	-
		CO2	3	3	3	-	3	-	-	-	-	-	-	-	-	-
		CO3	3	3	3	-	3	2	-	-	2	2	3	-	2	-
		CO4	3	3	3	2	3	2	-	-	2	2	3	-	2	2

Course Title/Code	**INTERNET OF THINGS LAB (ECH305B- P)**	
Course Type	Core (Departmental)	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To impart knowledge how to connect devices to network.	
Course Outcomes (COs)		Mapping
CO1	To disseminate the design knowledge in analyzing the specific requirements for applications in sensors regarding energy supply, memory, processing, and transmission capacity	Employability, Skill Development
CO2	Proactive in understating the routing protocols function and their implications on data transmission delay and bandwidth	Employability, Skill Development
CO3	Familiarize the protocol, design requirements, suitable algorithms, and the state-of-the-art cloud platform to meet the industrial requirement.	Employability, Skill Development
CO4	On a profound level to implement hardware & software for wireless sensor networks in day to day life	Employability, Skill Development

LIST OF EXPERIMENTS

- Understanding Arduino IDE environment and blinking on-board LED.
- Temperature Sensor interfacing with Arduino and displaying the output on LCD.
- Arduino interfacing with Wi-Fi module ESP8266 for sending data on ThingSpeak.
- Arduino interfacing with Wi-Fi module ESP8266 for sending temperature and humidity data on ThingSpeak
- Arduino interfacing with RFID module to send data on ThingSpeak.
- To perform LED blinking using Raspberry-Pi.
- To perform push-button interfacing using Raspberry-Pi.
- To send data over ThingSpeak using Raspberry-Pi.
- To interface 7 segment display with Raspberry-Pi.
- To interface LCD with Raspberry-Pi.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH305B- P	INTERNET OF THINGS LAB	CO1	3	2	2	-	3	-	-	-	-	-	-	-	-	-
		CO2	3	3	3	-	3	-	-	-	-	-	-	-	-	-
		CO3	3	3	3	-	3	2	-	-	2	2	3	-	2	-
		CO4	3	3	3	2	3	2	-	-	2	2	3	-	2	2

Course name/ code	**PROTOTYPING IOT BASED AFFORDABLEHEALTHCARE SYSTEMS (ECH327B-T)**	
Course Type	Elective (Departmental)	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	Student will be able design and build prototypes of healthcare instruments	
Course Outcomes (COs)		Mapping
CO1	Analyze the requirements and applications of IOT in healthcare.	Employability
CO2	Design prototypes of wireless and wearable devices for healthcare diagnosis and care.	Employability

SECTION A - Introduction to IoT

Basics of IoT and Communication Technologies, Uses of IoT – Smart Cities, Smart Living, Smart Energy, Smart Learning, and Smart Health, Wireless Communication Standards – ZigBee, Bluetooth, and WiFi. Challenges of using IoT in Healthcare, Uses of IoT in Healthcare Systems – Patient monitoring & diagnostics, home healthcare, personal health care, and fitness

SECTION B - Wearable Health Monitoring System (WHMS)

Basics of Wearable Health Monitoring System (WHMS), Need for Wearable Systems, Applications of WHMS - Soldiers, Astronauts, SIDS, Home Healthcare, Sports/Fitness, Disaster, COVID, Haptics, and more. Design of Wearable Computer - Introduction, Architecture, and Attributes. Design of Smart Textiles, Wearable Electronics, Dry Electrodes, and Textile Electrodes. Issues of WHMS & Factors Inhibiting Growth

SECTION C - IoT Architecture and Protocols

Networking Architectures, OSI and TCP/IP, Protocols and Standardization for IoT - M2M, RFID, SCADA, and BACNet, Basic Client-Server Communication Model, Network Sockets, Ports, IP and APIs, Sensor Interfaces – ECG, EEG, PPG, Pulse Oximeter, Temperature Sensors, and Pressure Sensors, Raspberry Pi and Python Programming

SECTION D: Basics of Wireless Sensor Networks and Applications

Wireless Body Area Network (WBAN, WBAN Architecture and Topology. Routing Protocols and Security

Energy Harvesting, OMT in Healthcare Introduction and Architecture, Wearable IoMT, Data Handling, Analysis, and Cloud Computing

E-resources:

1. https://www.frontiersin.org/articles/10.3389/frcmn.2020.610879/full
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3279202/
3. https://www.mdpi.com/2227-9032/10/10/1993

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH327B-T	PROTOTYPING IOT BASED HEALTHCARE SYSTEMS.	CO1	3	3	3	3	2	1	1	1			2	2	1	1
		CO2	3	3	3	3	2	1	1	1			2	2	1	1

Course name/ code	**PROTOTYPING IOT BASED AFFORDABLE HEALTHCARE SYSTEMS LAB (ECH327B-P)**	
Course Type	Elective (Departmental)	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	Student will be able design and build prototypes of healthcare instruments	
Course Outcomes (COs)		Mapping
CO1	Demonstrate the protocol requirements of IOT in healthcare.	Employability
CO2	Students will be able to design prototypes of wireless and wearable devices for healthcare diagnosis and care.	Employability

Lab: Prototyping projects

- To develop a Prototype of low cost portable ECG machine.
- To develop a Prototype of low cost BP monitoring machine.
- To develop a Prototype of low cost portable ventilator.
- To develop a Prototype of low cost portable Eye care machine for disease diagnosis.
- To analyze EEG signals generated due to various actions of body.

E-resources:

https://www.frontiersin.org/articles/10.3389/frcmn.2020.610879/full

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3279202/

https://www.mdpi.com/2227-9032/10/10/1993

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH327B-P	PROTOTYPING IOT BASED HEALTHCARE SYSTEMS.	CO1	3	3	3	3	2	1	1	1			2	2	1	1
		CO2	3	3	3	3	2	1	1	1			2	2	1	1

Course Title/Code	**ARTIFICIAL INTELLIGENCE (CSH310B-T)**	
Course Type	Elective	
L-T-P Structure	(3-0-0)	
Credits	3	
Pre-requisities	NA	
Course Objective	The student will be able to solve computationally complex problems using artificial intelligence techniques.	
Course Outcomes (COs)		Mapping
CO1	Analyze the need and foundation of Artificial Intelligence and expert systems	Employability, Skill Development
CO2	Apply searching algorithms.	Employability, Skill Development
CO3	Apply techniques of representing knowledge & reasoning.	Employability, Skill Development
CO4	Analyze the role of AI techniques in applications and current trends of AI.	Employability, Skill Development

SECTION-A

Intelligent agents and AI Problems: Introduction to AI, Foundation and History of AI, Turing Test, Intelligent Agents: Architectures, Types: reactive, deliberative, goal-driven, utility-driven, and learning agents, Applications and Current Trends of AI. Problem Representation in AI, State Space Representation and Problem Reduction, Production Systems: Inference Engine, Working Memory, Knowledgebase and Control Strategy using Water Jug Problem and n-Queens Problem.

SECTION-B

Search Strategies and Knowledge Representation: Search Strategies: Uninformed Search Strategies, Informed Search strategies (Heuristic Search): Generate and Test, Hill Climbing, Best First Search, A*algorithm, AO*Algorithm, Constraint Satisfaction, Means End Analysis. Game Playing: Minmax Strategy, Alpha-beta Pruning.Introduction to Knowledge, Types of Knowledge, Issues in Knowledge Representation, Approaches to Knowledge Representation: Logic, Semantic Nets, Partitioned Semantic Nets, Frames and its types, Conceptual Dependency.

SECTION-C

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

SECTION-D

Advanced Topics and Applications of AI: Expert Systems: Architecture, Characteristics, Types, Advantages and Drawbacks, Knowledge Acquisition Principles, Study of MYCIN and DENDRAL, Overview of Knowledge Discovery from Databases, Web Intelligence, Robotics.Semantic Webs, Natural Language Processing, Neural Networks, Genetic Algorithms, Big Data, Speech Processing.

Text Books:

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

Reference Books:

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

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSH310B-T	ARTIFICIAL INTELLIGENCE	CO1	3	1						1					3	
		CO2	3	3	3									3	2	1
		CO3	2	3	2			1						3	3	3
		CO4	2		1											

Course Title/Code	ARTIFICIAL INTELLIGENCE LAB (CSH310B-P)
Course Type	Elective
L-T-P Structure	(0-0-2)
Credits	1
Pre-requisities	NA
Course Objective	The student will be able to solve computationally complex problems using artificial intelligence techniques.

Course Outcomes (COs)		Mapping
CO1	Analysis of problem solving, knowledge and reasoning.	Employability, Skill Development
CO2	Apply difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing	Employability, Skill Development
CO3	Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques..	Employability, Skill Development
CO4	Examine the issues involved in knowledge bases, reasoning systems and planning.	Employability, Skill Development

List of experiments

- Write a python program to implement Breadth First Search Traversal?
- Write a python program to implement Water Jug Problem?
- Write a python program to remove punctuations from the given string?
- Write a python program to sort the sentence in alphabetical order?
- Write a program to implement Hangman game using python.
- Write a program to implement Tic-Tac-Toe game using python.
- Write a python program to remove stop words for a given passage from a text file using NLTK?
- Write a python program to implement stemming for a given sentence using NLTK?
- Write a python program to POS (Parts of Speech) tagging for the give sentence using NLTK?
- Write a python program to implement Lemmatization using NLTK?
- Write a python program to for Text Classification for the give sentence using NLTK

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSH310B-P	ARTIFICIAL INTELLIGENCE	CO1	3	1						1					3	
		CO2	3	3	3									3	2	1
		CO3	2	3	2			1						3	3	3
		CO4	2		1											

Course Title/Code	**BASICS OF ECONOMICS (MCS231)**	
Course Type	Open Elective (Allied)	
L-T-P Structure	1-1-0	
Credits	2	
Pre-requisities	NA	
Course Objective	Students will analyze the performance and functioning of government, markets and institutions in the context of social and economic problems	
Course Outcomes (COs)		Mapping
CO1	Describe the concept with definitions of Economics and the laws of utilities associated with it	Employability, Skill Development
CO2	Analyze the concept for demand and supply and the laws governing the elasticity of demand and supply.	Employability, Skill Development
CO3	Identify the factors affecting the production and differentiate between the various types of costs involved in the factory environment.	Employability, Skill Development
CO4	Analyze the different types of markets and apply the features of markets to understand the role of supply and demand.	Employability, Skill Development

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MCS231	BASICS OF ECONOMICS	CO1	3	2	2	-	3	-	-	-	-	-	-	-	-	-
		CO2	3	3	3	-	3	-	-	-	-	-	-	-	-	-
		CO3	3	3	3	-	3	2	-	-	2	2	3	-	2	-
		CO4	3	3	3	2	3	2	-	-	2	2	3	-	2	2

Course Title/Code	**FUNDAMENTALS OF FINANCE (MCS232)**	
Course Type	Elective (Allied)	
L-T-P Structure	1-1-0	
Credits	2	
Pre-requisities	NA	
Course Objective	To Provide an in-depth view of the process in financial management of the firm	
Course Outcomes (COs)		Mapping
CO1	Describe the fundamental concepts of Financial Management and Financial system.	Employability, Skill Development
CO2	Analyze the Financial statements and apply the knowledge in decision making.	Employability, Skill Development
CO3	Identify the sources for raising capital in Business(s) and analyze.	Employability, Skill Development
CO4	Identify different techniques of capital budgeting.	Employability, Skill Development

SECTION-A

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

SECTION-B

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

SECTION-C

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

SECTION-D

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

Suggested Readings:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MCS232	FUNDAMENTALS OF FINANCE	CO1	-	-	2	-	-	1	-	1	-	1	3	2	-	-
		CO2	-	-	2	1	-	2	-	-	-	-	2	2	-	-
		CO3	1	-	2	1	-	2	-	1	-	-	2	2	-	-
		CO4	-	-	2	-	-	1	-	-	-	-	3	2	-	-

Course name/ code	**PROFESSIONAL COMPETENCY ENHANCEMENT-III (CDO301)**	
Course Type	Core (Allied)	
L-T-P Structure	4-0-0	
Credits	0.5	
Pre-requisites	NA	
Course Objective	To improve students basic knowledge about Arithmetic Aptitude and make students solve aptitude problems quickly utilizing the short cuts and develop ability to 'quickly think on their feet and strengthen the communication skills	
Course Outcomes (COs)		Mapping
CO1	To improve student's basic knowledge about Arithmetic Aptitude .	Employability
CO2	Solve aptitude problems quickly utilizing the short cuts, quick thinking and good communication skills	Employability

SECTION A – Quantitative Aptitude

Unit 1: Arithmetic I

.1 Simplification

1.1.1 Use of BODMAS rule and Formulas for solving equations.

1.1.2 Simple Fractions and Decimal Fractions.

1.1.3 Surds and Indices.

1.2 Ratio and Proportion

1.2.1 Changes in Ratios, Combined Ratio and Continued Proportion.

1.2.2 Application in different questions.

1.2.3 Variations and Partnership.

1.3 Percentage

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

1.3.2 Application in Areas and Volumes.

1.4 Profit and Loss

1.4.1 Sales and Purchase Transactions.

1.4.2 MRP and Discount, Equivalent discounts.

1.4.3 Errors in weight (Dishonest Dealer).

1.5 Average

1.5.1 Combined and Mistaken Averages.

1.5.2 Changes in Average.

1.5.3 Application in Cricket and others.

1.5.4 Practice Exercise.

1.6 Interest

1.6.1 Simple and Compound Interest Formulae.

1.6.2 Relations and their Applications.

1.6.3 Practice Exercise.

Unit 2: Arithmetic II

2.1 Time and work

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

2.1.2 Working Alternatively, Work and Equations.

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

2.2 Alligations & Mixtures

2.2.1 Formula Based

2.2.2 Successive Displacement

2.2.3 Mixtures

2.2.4 Error in Measurement

2.2.5 Profit on False Weight

2.3 Revision & Practice

2.3.1 Problems on Ages & Numbers

2.3.2 Calendar

2.3.3 Coding & Decoding

2.3.4 Data Sufficiency

SECTION B – Verbal Ability Test

Unit 3. Communication Skills in English

1.1 Relevance of Verbal Ability AND PREPARATORY GUIDELINES

1.2 Functional Grammar – Subject Verb Agreement

1.3 Tenses – Perfect, Simple , Continuous

1.4 Common Errors and rectification

Unit 4: Word Power Building Skills

2.1 Words: Antonyms, Synonyms, Analogies,

2.2 Compound words: Homophones, Homonyms, Word Families

2.3 Root Word Technique for Prefixes & Suffixes

2.4: Word Power: 7 Tips for Learning New Words

2.5 Practice Vocabulary Exercises

SECTION C

Unit 5: Writing Skills

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

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

3.3 Paragraph Writing: Construction, Linkage & Cohesion

3.4 Practice Exercises: Writing Skills

SECTION D

Unit 6: Reading Skills

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

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

4.2 Practice Exercises: Short & Medium Passages

Text Books/Reference Books:

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

Web links:

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

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

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CDO301	PROFESSIONAL COMPETENCY ENHANCEMENT-III	CO1	3	1						1					3	
		CO2	3	3	3									3	2	1

Course Title/Code	**ALTAIR WORKSHOP(ECW210B)**	
Course Type:	Domain Core (Workshop)	
Course Nature:	Hard	
L-T-P-O Structure	0-0-2	
credits	1	
Pre-requisites	NA	
Objective	To impart fundamental knowledge and practical abilities in Altair required utilizing it to build programs and solve engineering problems effectively.	
Course Outcomes (COs)		Mapping
CO1	To perform math calculations, manipulating, and visualizing data	Employability, Skill Development
CO2	solve typical engineering related mathematical tasks	Employability

LIST OF EXPERIMENTS:

- INTRODUCTION TO ALTAIR COMPOSE AND ACTIVATE.
- COMMANDS AND DATA TYPES
- COMMANDS FOR MATH AND CURVE FITTING
- MATRICES AND VECTORS
- PLOT ATTRIBUTES AND HANDLE MANAGEMENT
- LOGIC AND LOOPING ANDFUNCTIONS AND DEBUGGING
- STRINGS, FILES AND I/O
- INTERFACING WITH OTHER LANGUAGES AND HIGHER LEVEL COMMANDS
- IMPLEMENTATION OF DIGITAL CIRCUITS
- PROJECT

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECW 210B	ALTAIR WORKSHOP	CO1	3	2	2	2	1	1	1	1	1	2	3	3	3	3
		CO2	3	3	2	3	1	2	1	1	1	2	3	3	3	3

Course name/ code	**DIGITAL SYSTEM DESIGN (ECH309B-T)**	
Course Type	Domain Core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	Digital electronics	
Course Objective	Students shall be able to analyze the function of combinational and sequential circuits using simulator and synthesis tools. Hence they can design any sort of applications with well verse knowledge of the subject.	
Course Outcomes (COs)		Mapping
CO1	Describe the design units of VHDL and implementation of circuits using different modelling styles.	Employability
CO2	Implement circuits using Behavioral Modelling, concept of Delays, Dataflow Modelling and the concept of Resolution Function.	Employability
CO3	Implementation of combinational and sequential circuits using VHDL.	Employability
CO4	Analysis of FSM and Test bench and Logic of several PLDs.	Employability

Detailed Syllabus

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 Modelling: 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, DE multiplexer, encoders, decoders, code converters, comparators, Implementation of Boolean functions; VHDL models and simulation of sequential circuits: flip flops, shift registers, counters, State diagrams, Implementation of Mealy and Moore FSM using VHDL, Creating test benches.

SECTION D

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

Text Books:

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

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

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH309B-T	DIGITAL SYSTEM DESIGN	CO1	3	2	2	2	1	1	1	1	1	2	3	3	3	3
		CO2	3	3	2	3	1	2	1	1	1	2	3	3	3	3
		CO3	3	2	3	2	2	1	1	1	1	2	3	3	3	3
		CO4	3	2	3	2	2	1	1	1	1	2	3	3	3	3

Course name/ code	**DIGITAL SYSTEM DESIGN LAB(ECH309B-P)**	
Course Type	Domain Core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisites	Digital Electronics	
Course Objective	Students shall be able to analyze the function of combinational and sequential circuits using simulator and synthesis tools. Hence they can design any sort of applications with well verse knowledge of the subject.	
Course Outcomes (COs)		Mapping
CO1	Analyze the operation of medium complexity standard combinational circuits like the encoder, decoder.	Employability
CO2	Analyze the operation of medium complexity standard combinational circuits like the multiplexer, Demultiplexer.	Employability
CO3	Design complex digital systems such as ALU.	Employability
CO4	Develop and simulate register-level models of hierarchical digital systems	Employability

List of Experiments:

- Introduction to Xilinx ISE Foundation tool and synthesize and simulate half adder, full adder and half subtractor using schematic capture.
- To model, simulate and synthesize all digital gates in VHDL.
- To model, simulate and synthesize full adder and full Subtractor using Dataflow Modeling style in VHDL.
- 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.
- To model and simulate Binary to Gray Code converter and BCD to Seven segment using VHDL and verify using Test Bench.
- To model and simulate 3-bit comparator using VHDL and verify using Test Bench.
- To model and simulate all flip flops using VHDL and verify using Test Bench.
- To model and simulate 4-bit register (SIS0, PIPO, shift left and shift right) using VHDL and verify using Test Bench.
- To model and simulate up counter, decade counter and up/down counter using VHDL and verify using Test Bench.
- VHDL synthesis of models in FPGA from lab 3 and 4.
- VHDL modeling and implementation of Project.

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH309B-P	DIGITAL SYSTEM DESIGN	CO1	3	2	2	2	1	1	1	1	1	2	3	3	3	3
		CO2	3	3	2	3	1	2	1	1	1	2	3	3	3	3
		CO3	3	2	3	2	2	1	1	1	1	2	3	3	3	3
		CO4	3	2	3	2	2	1	1	1	1	2	3	3	3	3

SEMESTER-VI

Course Title/Code	**NEURAL NETWORK AND FUZZY LOGIC (ECH310B-T)**	
Course Type	Domain Elective	
L-T-P Structure	2-1-0	
Credits	3	
Pre-requisites	NA	
Course Objective	Provide a thorough understanding of the concepts of neural network and Fuzzy logic architectures, algorithms, applications from an engineering perspective.	
Course Outcomes (COs)		Mapping
CO1	Describe the elementary concepts of neural networks; categorize different neural network architectures, algorithms, applications and their limitations.	Employability, Skill development
CO2	Comprehend the concepts of feed forward neural networks and appropriate learning rules for each of the architectures	Employability, Skill development
CO3	Realize the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory	Employability, Skill development
CO4	Analyze the application of fuzzy logic control to real time systems.	Employability, Skill development

SECTION A

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

SECTION B

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

SECTION C

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

SECTION D

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

Suggested Text / Reference Books:

1. S.N. Sivanandam , S. Sumati ,S.N.Deepa “Introduction to Neural Networks” Tata Mcgraw hill.

2. LawrenceFausett, “Fundamentals of Neural Networks”, Pearson Education, New Delhi. 2. Bart Kosho “Neural Networks & Fuzzy systems”, Prentice Hall of India.

3. Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, S. Rajasekaran and G. A. VijayalakshmiPai, Prentice Hall of India, New Delhi.

4. S.N.Sivanandam, S.Sumathi, S.N.Deepa “Introduction to Fuzzy Logic ” Springer publications.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH310B-T	NEURAL NETWORK AND FUZZY LOGIC	CO1	3	2	2	2	1	1	1	1	1	2	3	3	3	3
		CO2	3	3	2	3	1	2	1	1	1	2	3	3	3	3
		CO3	3	2	3	2	2	1	1	1	1	2	3	3	3	3
		CO4	3	2	3	3	1	2	1	1	1	2	3	3	3	3

Course Title/Code	**NEURAL NETWORK AND FUZZY LOGIC LAB (ECH310B-P)**	
Course Type	Domain Elective	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	Provide a thorough understanding of the concepts of neural network and Fuzzy logic architectures, algorithms, applications from an engineering perspective.	
Course Outcomes (COs)		Mapping
CO1	Select appropriate neural network architectures for a given application (i.e. they shall recognize the class of applications and relate it to specific architectures).	Employability, Skill development
CO2	Design and implement a neural network simulation (with two modes of operation: learning and processing) using a high-level language	Employability, Skill development
CO3	Develop models for different applications using fuzzy systems and MATLAB.	Employability, Skill development
CO4	Analyze the application of fuzzy logic control to real time systems	Employability, Skill development

List of Experiments:

- Introduction to MATLAB and NN Toolbox.
- Generation of few activation functions that are being used in neural networks.
- Computing and plotting with different neuron models.
- Computing hebbian learning.
- Computing and plotting with multilayer perceptron (MLP) for classification and regression problems.
- Computing with RBF network as classifier (XOR Design)
- Computing with kohonen's net (SOM) for clustering and visualization of data.
- Computing with K-means algorithm for clustering data.
- Hopfield net and designing associative memory.
- Neural net techniques for object or image recognition and biometrics.
- Solving problems on fuzzy sets and operations on fuzzy sets

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH310B-P	NEURAL NETWORK AND FUZZY LOGIC	CO1	3	2	2	2	1	1	1	1	1	2	3	3	3	3
		CO2	3	3	2	3	1	2	1	1	1	2	3	3	3	3
		CO3	3	2	3	2	2	1	1	1	1	2	3	3	3	3
		CO4	3	2	3	3	1	2	1	1	1	2	3	3	3	3

Course Title/Code	**WAVELETS AND MULTIRATE SYSTEM (ECH316B-T)**	
Course Type	Elective (Departmental)	
L-T-P Structure	2-1-0	
Credits	3	
Pre-requisites	NA	
Course Objective	This course will provide an introduction to the theory of wavelets and its applications in mathematics and signal processing.	
Course Outcomes (COs)		Mapping
CO1	characterize continuous and discrete wavelet transforms	Employability
CO2	Apply multi resolution analysis	Employability
CO3	identify various wavelets and evaluate their time- frequency resolution properties	Employability

SECTION A

CONTINUOUS WAVELET TRANSFORM: Introduction, C-T wavelets, Definition of CWT, The CWT as a correlation. Constant Q-Factor Filtering Interpolation and time frequency resolution, the CWT as an operator, inverse CWT.INTRODUCTION TO DISCRETE WAVELET TRANSFORM AND ORTHOGONAL WAVELET DECOMPOSITION: Introduction. Approximation of vectors in nested linear vector spaces, (i) example of approximating vectors in nested subspaces of a finite dimensional liner vector space, (ii) Example of approximating vectors in nested subspaces of an infinite dimensional linear vector space. MRA.(i) Bases for the approximations subspaces and Harr scaling function, (ii) Bases for detail subspaces and Haar wavelet.

SECTION B

MRA, ORTHO NORMAL WAVELETS AND THEIR RELATIONSHIP TO FILTER BANKS: Introduction, Formal definition of an MRA. Construction of a general orthonormal MRA, (i) scaling function and subspaces, (ii) Implication of dilation equation and orthogonality, a wavelet basis for MRA. (i) Two scale relations for (t), (ii) Basis for the detail subspace (iii) Direct sum decomposition, Digital filtering interpolation (i) Decomposition filters, (ii) reconstruction, the signal. EXAMPLES OF WAVELETS: Examples of orthogonal basis generating wavelets, (i) Daubechies D4 scaling function and wavelet. (ii) band limited wavelets, Interpreting orthonormal MRAs for Discrete time MRA, (iii) Basis functions for DTWT.

SECTION C

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

SECTION D

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

Text books:

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

References:

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

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH316B-T	WAVELETS AND MULTIRATE SYSTEM	CO1	2	2	2	2	2	1	1	1	1	1	2	2	2	3
		CO2	1	1	1	1	2	1	1	3	3	3	2	2	2	3
		CO3	1	1	1	1	3	1	2	3	3	3	3	3	3	3

Course Title/Code	**WAVELETS AND MULTIRATE SYSTEM LAB (ECH316B-P)**	
Course Type	Elective (Departmental)	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisites	NA	
Course Objective	This course will provide an introduction to the theory of wavelets and its applications in mathematics and signal processing.	
Course Outcomes (COs)		Mapping
CO1	Analyze multirate DSP systems.	Employability
CO2	Determine coefficients for perfect reproduction filter banks and wavelets.	Employability
CO3	Choose parameters to take a wavelet transform, and interpret and process the result.	Employability

LIST OF EXPERIMENTS

- Time frequency analysis of a synthetic signal. Construct the scalogram.
- Extract the components of a signal in different time and frequency bands.
- Use empirical mode decomposition to extract the components of a signal in different time and
- Frequency bands.
- Use variation mode decomposition to extract the components of a signal in different time and
- frequency bands
- Extract the components of the seismic sample signal (provided by the instructor)
- Reconstruct the signals from the components extracted in Ex 2 and Ex 5.
- Minor project.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH316B-T	WAVELETS AND MULTIRATE SYSTEM	CO1	2	2	2	2	2	1	1	1	1	1	2	2	2	3
		CO2	1	1	1	1	2	1	1	3	3	3	2	2	2	3
		CO3	1	1	1	1	3	1	2	3	3	3	3	3	3	3

Course Title/Code	**DIGITAL SIGNAL AND IMAGE PROCESSING (ECH302B-T)**	
Course Type	Domain core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisites	Signals and systems	
Course Objective	To provide an exposure to the specific application areas like image analysis, handwriting recognition, speech processing etc.	
Course Outcomes (COs)		Mapping
CO1	Analyze images in the frequency domain using various transforms	Employability, Skill development
CO2	Analyze images in the frequency domain using various transforms	Employability, Skill development
CO3	Interpret signal and image segmentation and representation techniques	Employability, Skill development

SECTION A

Discrete-Time Signal and Discrete-Time System: Introduction to Digital Signal Processing, Sampling and Reconstruction, Standard DT Signals, Concept of Digital Frequency, Representation of DT signal using Standard DT Signals, Signal Manipulations (shifting, reversal, scaling, addition, multiplication). Classification of Discrete-Time Signals, Classification of Discrete-Systems, Linear Convolution formulation for 1-D and 2-D signal (without mathematical proof), Circular Convolution (without mathematical proof), Linear convolution using Circular Convolution. Auto and Cross Correlation formula evaluation, LTI system, Concept of Impulse Response and Step Response, Output of DT system using Time Domain Linear Convolution.

SECTION B

Discrete Fourier Transform: Introduction to DTFT, DFT, Relation between DFT and DTFT, IDFT, Properties of DFT without mathematical proof (Scaling and Linearity, Periodicity, Time Shift and Frequency Shift, Time Reversal, Convolution Property and Parsevals'Energy Theorem). DFT computation using DFT properties. Transfer function of DT System in frequency domain using DFT. Linear and Circular Convolution using DFT, Convolution of long sequences, Introduction to 2-D DFT. Fast Fourier Transform: Need of FFT, Radix-2 DIT-FFT algorithm, DIT-FFT Flow graph for N=4 and 8, Inverse FFT algorithm. Spectral Analysis using FFT.

SECTION C

Digital Image Fundamentals: Introduction to Digital Image, Digital Image Processing System, Sampling and Quantization, Representation of Digital Image, Connectivity, Image File Formats: BMP, TIFF and JPEG.

SECTION D

Image Enhancement in Spatial domain: Gray Level Transformations, Zero Memory Point Operations, Histogram Processing, Histogram equalization. Neighborhood Processing, Spatial Filtering, Smoothing and Sharpening Filters, Median Filter. Image Segmentation: Segmentation based on Discontinuities (point, Line, Edge), Image Edge detection using Robert, Sobel, Previtt masks, Image Edge detection using Laplacian Mask.

Text Books:

1. John G. Proakis, Dimitris and G.Manolakis, _Digital Signal Processing: Principles, Algorithms, and Applications' 4th Edition 2007, Pearson Education.

2. A. Anand Kumar, _Digital Signal Processing', PHI Learning Pvt. Ltd. 2013.

3. Rafel C. Gonzalez and Richard E. Woods, _Digital Image Processing‘, Pearson Education Asia, 3rd Edition, 2009,

4. S. Sridhar, _Digital Image Processing‘, Oxford University Press, Second Edition, 2012.

Reference Books:

1. Sanjit Mitra, _Digital Signal Processing: A Computer Based Approach‘, TataMcGraw Hill, 3rd Edition.
2. S. Jayaraman, E. Esakkirajan and T. Veerkumar, _Digital Image Processing‘ TataMcGraw Hill Education Private Ltd, 2009.
3. Anil K. Jain, _Fundamentals and Digital Image Processing‘, Prentice Hall of India Private Ltd, 3rd Edition.

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH302B-T	DIGITAL SIGNAL AND IMAGE PROCESSING	CO1	2	2	2	2	2	1	1	1	1	1	2	2	2	3
		CO2	1	1	1	1	2	1	1	3	3	3	2	2	2	3
		CO3	1	1	1	1	3	1	2	3	3	3	3	3	3	3

Course Title/Code	**DIGITAL SIGNAL AND IMAGE PROCESSING LAB (ECH302B-P)**	
Course Type	Domain core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisites	Signals and systems	
Course Objective	To provide an exposure to the specific application areas like image analysis, handwriting recognition, speech processing etc.	
Course Outcomes (COs)		Mapping
CO1	Assess the techniques, skills, and modern engineering tools necessary for analysis of different electrical signals and filtering out noise signals in engineering practice	Employability, Skill development
CO2	Design digital filters using various techniques	Employability, Skill development
CO3	Implement different signal and image processing techniques.	Employability, Skill development

List of Experiments

- Signal generation using MATLAB.
- Analysis of LTI system and Z-transform of signal using MATLAB.
- MATLAB simulation for DFT & IDFT.
- DIT and DIF FFT by MATLAB simulation
- MATLAB Simulation of FIR filters using windows technique (Rectangular, Hamming and Hanning).
- MATLAB simulation of LPF and high pass filter by FIR filter.
- Design of IIR Butterworth filter from filter specification (both programming & and by using FDA tool box).
- Design of IIR low pass Butterworth filter using impulse invariant transformation from filter specification.
- Image read and writes operation using MATLAB.
- Reading an image and display the grayscale, color and B/W image using MATLAB.
- Reading an RGB Image and extract the color components using MATLAB.
- MATLAB Simulation of Image noising using different noise distribution.
- MATLAB Simulation of Image De-noising using Arithmetic mean and median filter.
- MATLAB Simulation of Image De-noising using Order Statistics Filter (Median, Min-Max Filter).

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH302B-P	DIGITAL SIGNAL AND IMAGE PROCESSING	CO1	2	2	2	2	2	1	1	1	1	1	2	2	2	3
		CO2	1	1	1	1	2	1	1	3	3	3	2	2	2	3
		CO3	1	1	1	1	3	1	2	3	3	3	3	3	3	3

Course Title/Code	**CONTROL SYSTEMS (ECH304B-T)**	
Course Type	Domain core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	Students will be able to understand, model and analyze a control system under various factors (disturbance, inputs, orders) which limit the achievable control system performance by graphical, block representation and different stability techniques	
Course Outcomes (COs)		Mapping
CO1	To represent and demonstrate the electrical modeling of mechanical systems and various reduction techniques.	Employability, Skill development
CO2	Analyses the time and frequency-domain responses of first and second-order systems to various inputs.	Employability, Skill development
CO3	apply root locus and frequency domain techniques to design a feedback control system to meet specific performance requirements.	Employability, Skill development
CO4	Synthesize control system models on state space models and express state transition matrix for the calculation of variables.	Employability, Skill development

SECTION A

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

SECTION B

Time Response Analysis: Standard test signals, Time response of first order systems to various standard inputs, Impulse and step response analysis of second order systems, Design specifications for second-order systems based on the time-response. Application of initial and final value theorem. Steady state and dynamic errors and error constants. Techniques for stability analysis in time domain: Stability, Routh-Hurwitz criterion, Relative stability, Root Locus technique, Construction of Root Locus, Stability, Dominant poles, Application of Root Locus diagram, Relative stability.

SECTION-C

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

SECTION-D

Basic Modes of Feedback Control: Proportional, Integral and Derivative PID Controllers. Hardware: Control hardware and their model.State Variable Analysis: Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems: Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

Text/References:

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

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

3. K. Ogata, “Modern Control Engineering”, Prentice Hall, 1991.

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

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH304B-T	CONTROL SYSTEMS	CO1	3	3	2	2	2	1	1	1	1	1	1	2	2	1
		CO2	3	3	2	2	1	1	1	1	1	1	1	1	2	1
		CO3	3	2	3	2	2	2	1	1	1	1	1	1	3	1
		CO4	2	2	3	2	1	1	1	1	1	1	1	3	2	1

Course Title/Code	**PLC PROGRAMMING AND APPLICATIONS (ECH419B-T)**	
Course Type	Domain Elective	
L-T-P Structure	2-1-0	
Credits	3	
Pre-requisites	NA	
Course Objective	Describe the operation, working, importance of Electronic Sensors, their selection criteria and characterize their various applications in the design of Mechatronics system	
Course Outcomes (COs)		Mapping
CO1	Describe typical components, basic concepts and I/O devices of a PLC	Employability
CO2	Apply the concept of electrical ladder logic, its history, and its relationship to programmed PLC instruction.	Employability
CO3	Design and program PLC circuits for various real time PLC applications.	Employability
CO4	Demonstrate the use of PLC timers and counters for the control of industrial processes	Employability

SECTION A

Introduction; definition & history of the PLC; Principles of Operation; Various Parts of a PLC: CPU & programmer/ monitors; PLC input & output modules; Solid state memory; the processor; I/O modules: Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O specifications, The CPU, Memory design, Memory Types, Programming Devices, Selection of wire types and size, Power supplies. PLC advantage & disadvantage; PLC versus Computers, PLC Application. Programming equipment; proper construction of PLC ladder diagrams; process scanning consideration; PLC operational faults.

SECTION B

The Binary Concept, AND, OR and NOT functions, Boolean Algebra, developing circuits from Boolean Expression expressions, Producing the Boolean equation from given circuit, Hardwired logic versus programmed logic, Programming word level logic instructions. Converting Relay schematics and Boolean equation into PLC Ladder Programs, Writing a ladder logic program directly from a narrative description. Different types of Input devices: Switches: Push button Switches, Toggle Switches, Proximity switches, Photo switches, Temperature Switch, Pressure Switch, and Level Switch, Flow Switches, manually operated switches, Motor starters, Transducers and sensors, Transmitters etc. Their working, specification and interfacing with PLC. Different types of Output devices: Electromagnetic Control Relays, Latching relays, Contactors, Motors, Pumps, Solenoid Valves etc. Their working, specification and interfacing with PLC.

SECTION-C

Processor Memory Organization, Program Scan, PLC Programming languages, Relay type instructions, Instruction addressing, Branch Instructions, Internal Relay Instructions, Programming Examine if Closed and examine If Open instructions, Entering the ladder diagram, Modes of operation. Creating Ladder Diagrams from Process Control Descriptions. Ladder diagram & sequence listing; large process ladder diagram construction, Industrial Examples: Conveyer Belt, Car Parking System, Automatic Door System, Fan On/Off System, Electric Pump and Motor System, Staircase Lightning.

SECTION-D

Mechanical Timing relay, Timer instructions, ON delay timer instruction, Off-Delay timer instruction, Retentive Timer, Cascading Timers, examples of timer function industrial application; industrial process timing application.Counter Instructions, Up-counter, down counter, Up-Down counter, Cascading counters, Incremental encoder counter applications, Combining counter and timer functions, High Speed counter instruction, HSC, PLS, examples of counter function industrial application.

Suggested Text/Reference Books

1. Programmable logic controllers by W.Bolton
2. Programmable logic controllers by Frank D. Petruzella

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH419B-T	PLC PROGRAMMING AND APPLICATIONS	CO1	3	3	3	1	1	1	1	2	2	1	1	2	3	2
		CO2	2	1	2	1	1	1	1	2	1	1	1	1	1	1
		CO3	2	1	1	1	1	1	1	2	1	1	1	1	1	1
		CO4	3	3	1	2	1	2	1	2	2	2	1	2	3	2

Course Title/Code	**PLC PROGRAMMING AND APPLICATIONS (ECH419B-P)**
Course Type	Domain Elective
L-T-P Structure	0-0-2
Credits	1
Pre-requisites	NA
Course Objective	Describe the operation, working, importance of Electronic Sensors, their selection criteria and characterize their various applications in the design of Mechatronics system

Course Outcomes (COs)		Mapping
CO1	Use timer, counter, and other intermediate programming functions.	Employability
CO2	Design and program basic PLC circuits for entry-level PLC applications.	Employability
CO3	Design and program a small, automated industrial production line.	Employability

List of Lab Experiments

I (Virtual Lab)

1. Plot the LVDT characteristics.

2. Characterize the temperature sensor (Thermocouple)

3. Demonstrate BJT CE Amplifier operation and Characteristics.

4. Practical Application Based on Logic Gates:

a. Washing machine control using basic AND & NOT gates

b. Universal NOR gate and its application in automobile alarm system

5. Speed Control of DC Motor

(PLC IDEC Software)

6. PLC control system: - Basic ladder logic implementation using IDEC Software (Logic Gates).

1. Demonstration of Staircase Lightning System using PLC.
2. Demonstration of Bottle Filling System using PLC.
3. Demonstration of Automatic Car Parking System using PLC.
4. Demonstration of Elevator/Automatic Door System using PLC.
5. Virtual Project of Mechatronics on Proteus Platform.

CO-PO MAPPING Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH419B-P	PLC PROGRAMMING AND APPLICATIONS LAB	CO1	3	3	3	1	1	1	1	2	2	1	1	2	3	2
		CO2	2	1	2	1	1	1	1	2	1	1	1	1	1	1
		CO3	2	1	1	1	1	1	1	2	1	1	1	1	1	1

Course Title/Code	**HEALTH CARE SYSTEMS (DESIGN AND ANALYSIS) (ECH321B-T)**	
Course Type	Domain Elective	
L-T-P Structure	2-1-0	
Credits	3	
Pre-requisites	NA	
Course Objective	Distinguish among structured, object-oriented, and agile systems development methods AND Perform clinical and analytical workflows in an electronic health record	
Course Outcomes (COs)		Mapping
CO1	Demonstrate the applications of knowledge of the requirements, design, and control of major business processes that are integral within a healthcare enterprise system including registration, order entry and result reporting, clinical documentation, scheduling and patient billing.	Employability
CO2	Demonstrate the applications of knowledge systems analysis & design methodologies and techniques including: requirement analysis, development strategies, project management, and system implementation / operation.	Employability
CO3	Demonstrate the applications of knowledge of control and audit of healthcare information systems including: controls for privacy and confidentiality, controls for computer crimes (fraud and abuse) and systems reliability (information security, processing integrity, and availability.)	Employability

SECTION-A

HEALTHCARE INFORMATION SYSTEMS DEVELOPMENT OVERVIEW: Healthcare Information Systems, Systems Development Process & Health Care Settings. Strategic Planning for IT Projects

SECTION-B

SYSTEM REQUIREMENTS ANALYSIS: Electronic Health Record, Standard Terminology and Language in Healthcare, Personal Health Record, Health Information Exchanges

SECTION-C

SYSTEM PROPOSAL DESIGN & IMPLEMENTATION: Selecting a Healthcare Information System, Usability of Health Informatics Applications

SECTION-D

SYSTEM MAINTENANCE & SUPPORT: System Maintenance and Support, Information Systems Training, Information Security and Confidentiality, Systems Integration and Interoperability, Legal and Regulatory Issues

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH321B-T	HEALTH CARE SYSTEMS (DESIGN AND ANALYSIS	CO1	3	3	3	1	1	1	1	2	2	1	1	2	3	2
		CO2	2	1	2	1	1	1	1	2	1	1	1	1	1	1
		CO3	2	1	1	1	1	1	1	2	1	1	1	1	1	1

Course Title/Code	**HEALTH CARE SYSTEMS (DESIGN AND ANALYSIS) LAB (ECH321B-P)**	
Course Type	Domain Elective	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisites	NA	
Course Objective	Distinguish among structured, object-oriented, and agile systems development methods AND Perform clinical and analytical workflows in an electronic health record	
Course Outcomes (COs)		Mapping
CO1	Recognize the different types of measures used in outcomes research, including clinical, health status, quality of life, work/role performance, health care utilization, and patient satisfaction	Employability
CO2	interpret and understand scale performance and measurement concepts such as reliability, validity, responsiveness, and sensitivity	Employability
CO3	Demonstrate the applications of knowledge of control and audit of healthcare information systems including: controls for privacy and confidentiality, controls for computer crimes (fraud and abuse) and systems reliability (information security, processing integrity, and availability.)	Employability

LIST OF EXPERIMENTS

1. Prototyping projects

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH321B-P	HEALTH CARE SYSTEMS (DESIGN AND ANALYSIS)	CO1	3	3	3	1	1	1	1	2	2	1	1	2	3	2
		CO2	2	1	2	1	1	1	1	2	1	1	1	1	1	1
		CO3	2	1	1	1	1	1	1	2	1	1	1	1	1	1

Course Title/Code	**BIOMEDICAL SIGNAL AND IMAGE PROCESSING (ECH322B-T)**	
Course Type	Domain Elective	
L-T-P Structure	2-1-0	
Credits	3	
Pre-requisites	NA	
Course Objective	To know the fundamental tools that are used to describe, analyze and process biomedical signals.	
Course Outcomes (COs)		Mapping
CO1	Possess the basic mathematical, scientific and computational skills necessary to analyze ECG and EEG signals.	Employability/Skill Development
CO2	Apply classical and modern filtering and compression techniques for ECG and EEG signals	Employability/Skill Development
CO3	Develop a thorough understanding of basics of ECG and EEG feature extraction.	Employability/Skill Development

SECTION-A

Neurological Signal Processing: The Brain and its potentials; The Electrophysiology origin of brain waves; the EEG Signal and its characteristics; EEG analysis; Linear prediction theory; The autoregressive (AR) method; Transient detection and elimination-the case of epileptic patients. Adaptive Filter and Algorithm: A Review of the Wiener filtering problem; Principle of an adaptive filter; Steepest – descent algorithm; Windrow-hoff least –mean-square adaptive algorithm

SECTION B

Cardiological Signal Processing: Basic electrocardiography; ECG data acquisition; ECG lead system; ECG parameters and their estimation; Use of multi-scale analysis for parameters estimation of ECG waveforms.

SECTION C

Adaptive Noise Canceling: Adaptive noise canceller; Cancellation of 60 Hz interference in electrocardiography, canceling donor heart interference in heart –transplant electrocardiography, cancellation of the electrocardiography signal from the electrical activity of the chest muscles, canceling method to enhance fetal ECG monitoring ECG Recording and Analysis: Long term continuous ECG recording; The wavelet approximation- discrete wavelet series; Discrete wavelet transform (DWT); Multi-resolution analysis; Pyramid algorithm

SECTION D

HRV and Arrhythmia analysis: Heart rate variability-definition; comparison of short-term and long term HRV analysis; Time domain and spectral domain parameters of short-term recording.

Suggested Text/Reference Books

1. Reddy D C. “Modern Biomedical Signal Processing – Principles and Techniques”, TMH,

New Delhi, 2005

2. Akay M. “Biomedical Signal Processing”, Academic press, California,1994.

3. Tompkins W J “Biomedical Signal Processing”, Prentice hall of India, New Delhi, 1999.

4. Bronzino J D “The Biomedical Engineering handbook”, CRC and Free press, Florida, 1995.

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH322B-T	BIOMEDICAL SIGNAL PROCESSING	CO1	3	3	3	1	1	1	1	2	2	1	1	2	3	2
		CO2	2	1	2	1	1	1	1	2	1	1	1	1	1	1
		CO3	2	1	1	1	1	1	1	2	1	1	1	1	1	1

Course Title/Code	**BIOMEDICAL SIGNAL AND IMAGE PROCESSING LAB (ECH322B-P)**	
Course Type	Domain Elective	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisites	NA	
Course Objective	To know the fundamental tools that are used to describe, analyze and process biomedical signals.	
Course Outcomes (COs)		Mapping
CO1	Implement algorithms based on discrete time signals.	Employability/Skill Development
CO2	Apply appropriate signal processing techniques in analyzing various bio signals	Employability/Skill Development
CO3	Design IIR and FIR filters for bio-signal processing.	Employability/Skill Development

LIST OF EXPERIMENTS

- Representation of basic signals
- Linear convolution
- Autocorrelation and cross correlation
- FFT and IFFT
- Difference equation Representation
- Digital IIR Butterworth filter-LPF & HPF
- Digital IIR Chebyshev filter-LPF & HPF
- Design of FIR filter using windowing technique
- Up sampling and down sampling
- Analysis of ECG
- Analysis of EEG
- Analysis of PCG

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH322B-P	BIOMEDICAL SIGNAL PROCESSING	CO1	3	3	3	1	1	1	1	2	2	1	1	2	3	2
		CO2	2	1	2	1	1	1	1	2	1	1	1	1	1	1
		CO3	2	1	1	1	1	1	1	2	1	1	1	1	1	1

Course Title/Code	**CYBER LAW (LWS323)**
Course Type	Elective
L-T-P Structure	2-0-0
Credits	2
Pre-requisities	NA
Course Objective	The Objective is this paper is to focus on basic concepts of Cyber Law relevant for understanding evolution of Cyber law and its conformity in any changing society.

Course Outcomes (COs)		Mapping
CO1	Describe the concept of Cybercrimes and cyber Law	Employability/Skill Development
CO2	Critically analyses the problems arising out of online transactions and find solutions	Employability/Skill Development
CO3	Analyze Intellectual Property issues in the cyber space and apply relevant laws to protect or fight infringement	Employability/Skill Development
CO4	Explain Information Technology Act 2000 and critically analyze various SECTIONs to apply such laws appropriately	Employability/Skill Development

SECTION A

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

A. Cyber Crime: Meaning & Categories -B. Nature of Cyber Crime, Cyber Crimes v. Conventional Crimes-C. Kinds of Cyber Crime- hacking, spamming, phishing, cyber stalking, cyber pornography, malware etc

SECTION B

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

A. Freedom of speech and expression in Cyberspace- B. Right to Privacy and Right to Data Protection. - C. Access Rights

SECTION C

Unit 3: Cyber Space & Legal framework: - (Contact Hours -3)

A. Cyber Security- B. Cyber Space, Concept of Property in Cyber Space-C. Jurisdiction in Cyber Space

SECTION D

Unit 4: Information and Technology Act 2000 & IT Amendment Act 2008 (Contact Hours - 3)

A. Need of Cyber Law in India-B. Enactment & Scheme of the IT Act-C. Objectives of the IT Act 2000, Amendments to the Act-D. Justice Dispensation System for Cyber Crimes under IT Act

Reference Books:

1. Cyber Law - Pavan Duggal

2. Cyber Crimes & Laws-Sushma Arora & Raman Arora-Taxmann's

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
LWS323	CYBER LAW	CO1	2	1	-	-	-	-	2	-	-	1	-	3	-	-
		CO2	3	2	-	-	-	-	-	-	2	-	-	1	-	-
		CO3	3	1	2	-	-	-	-	1	-	-		2	-	-
		CO4	3	1	-	-	-	-	-	-	-	-	-	3	-	-

Course Title/Code	**LAW RELATING TO INTELLECTUAL PROPERTY RIGHTS (LWS325)**	
Course Type	Elective	
L-T-P Structure	2-0-0	
Credits	2	
Pre-requisities	NA	
Course Objective	The objective of this paper is to orient students to legal studies. The paper focuses on generally about law and legal system.	
Course Outcomes (COs)		Mapping
CO1	Describe the basics of Intellectual Property Rights	Employability/Skill Development
CO2	Categorize different types of intellectual properties	Employability/Skill Development
CO3	Recognize the crucial role of intellectual property in different industries	Employability/Skill Development
CO4	Explain the procedural aspect pertaining to application and grant of patent, trademark, geographical indication etc	Employability/Skill Development

SECTION A

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

Introduction to various types of IPR Laws-Protection of Trademarks under Trademarks Act – Basic legal Framework

Trade Secrets and protection thereof

SECTION B

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

Legal Framework relating to Copyright protection in India-Protection of Industrial Designs under Designs Act-

Protection of integrated circuits

SECTION C

Law relating to Patents (Contact Hours - 4)

Legal Framework for registration and protection of patents and related rights-

SECTION D

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

Introduction to Information Technology Act, 2002-Cyber Offences-Geographical Indicators and PPVFBR

Tutorial activities 1 Hr/Week

Statutes and Case Laws-Case studies from India and abroad

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
LWS325	LAW RELATING TO INTELLECTUAL PROPERTY RIGHTS	CO1	2	-	-	-	-	-	-	2	-	-	-	-	-	2
		CO2	3	-	-	-	-	-	-	-	-	-	-	1	-	-
		CO3	3	1	-	-	-	-	-	-		-	-	-	-	3
		CO4	2	-	-	2	-	-	-	-	-	-	-	-	-	-1

Course Title/Code	**PROFESSIONAL COMPETANCY ENHANCEMENT-IV (CDO302)**	
Course Type	CORE	
L-T-P Structure	4-0-0	
Credits	1	
Pre-requisites	NA	
Course Objective	To strengthen students Modern Math concepts To help students perform well during placements To help students get proficient with problem solving at various levels like basic, intermediate and advanced To help students with shortcuts to problem solving To improve students communication skills to help the engineering student to correlate his field with various aspects of environment.	
Course Outcomes (COs)		Mapping
CO1	To strengthen students Modern Math concepts	Skill Development
CO2	To help students perform well during placements	Skill Development
CO3	To help students get proficient with problem solving at various levels like basic, intermediate and advanced	Skill Development
CO4	To help students with shortcuts to problem solving	Skill Development
CO5	To improve student's communication skills	Skill Development

Part A – Quantitative Aptitude

Unit 1: Modern Math

1.1 Permutation and Combination

1.1.1 Principal of counting and basic formulas

1.1.2 Arrangements, Selection and Selection + Arrangement.

1.1.3 Linear/Circular arrangements, Digits and Alphabetic Problems and Applications.

1.2 Probability

1.2.1 Events and Sample Space, Basic Formulas.

1.2.2 Problems on Coins, Cards and Dices.

1.2.3 Conditional Probability, Bayes' Theorem and their Applications.

Unit 2: Advanced Math

Mensuration 1- Areas

2.1.1 Different types of Triangles and their area and perimeter.

2.1.2 Different types of Quadrilateral and their area and perimeter.

2.1.3 Circumference and Area of Circle, Area of Sector and length of Sector.

2.1.4 Mixed Figures and their Applications.

2.2 Mensuration 2- Surface Areas and Volumes

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

2.2.2 Prism and Pyramid.

2.2.3 Mixed Figures and their Applications.

Unit 3: ALGEBRA:

3.1 Linear and Quadratic equations.

3.2 Inequalities.

3.3 Integral Solutions and Max and Min values.

Part B – Soft Skills

Unit 4: Professional Writing

4.1. Profiling on Social Sites: LinkedIn, Facebook, Instagram

4.2. Cover Letter/Emails

4.3. Resume Writing

Unit 5: Group Discussions

5.1. Do's and Dont's of a Group Discussion

5.2. Roles played in a Group Discussion

5.3. Tips for Cracking a Group Discussion

Unit 6: Managing Interviews

6.1. Developing the employability mindset

6.2. Preparing for Self -Introduction

6.3. Researching the employer

6.4. Portfolio Management

6.5. Answering Questions in an Interview

Text Books/Reference Books:

Quantitative Aptitude : R S Aggarwal, S Chand & Company Pvt Ltd

Quantitative Aptitude for CAT: Arun Sharma

Verbal Ability and Reading Comprehension: MVN Enterprises

Web links:

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

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CDO302	PROFESSIONAL COMPETENCY ENHANCEMENT-IV	CO1	1	1	1	2	1	1	2	2	2	3	2	2	1	2
		CO2	1	1	1	2	1	1	2	2	2	3	2	2	1	2
		CO3	1	1	1	2	1	1	2	2	2	3	2	2	1	2
		CO4	1	1	1	2	1	1	2	2	2	3	2	2	1	2
		CO5	1	1	1	2	1	1	2	2	2	3	2	2	1	2

Course Title/Code	**HARDWARE VERIFICATION USING SYSTEM VERILOG (ECH324B-T)**	
Course Type	CORE	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisites	NA	
Course Objective	Appreciate and apply the System Verilog verification features, including classes, constrained random stimulus, coverage, strings, queues and dynamic arrays, and learn how to utilize these features for more effective and efficient verification.	
Course Outcomes (COs)		Mapping
CO1	use System Verilog RTL design and synthesis features, including new data types, literals, procedural blocks, statements, and operators, relaxation of Verilog language rules.	Employability/Skill Development
CO2	Analyze synthesis issues, enhancements to tasks and functions, new hierarchy and connectivity features, and interfaces.	Employability/Skill Development
CO3	Appreciate and apply the System Verilog verification features, including classes, constrained random stimulus, coverage, strings, queues and dynamic arrays.	Employability/Skill Development
CO4	Utilize the features of system Verilog for more effective and efficient verification.	Employability/Skill Development

SECTION A

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

SECTION B

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

SECTION C

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

SECTION D

Processes, Coverage & Assertion: Final block, Block statement, Fork join, fork join any, fork join none, Wait and disable, what is event? Conditional event control, named event, Event triggering, Blocking and non-blocking, what is program block? Re-active region, what is Interface? Modport, Parameterized interface, Virtual interface, what is

coverage? Code coverage, Functional coverage, Cover group, Cover point, Embedded cover group, Bins, types of bins,bins for transition, wildcard, illegal bins, ignore bins, cross-coverage, coverage option , What is assertion? Immediate and concurrent, Assertion severity, Property blocks and sequences, Assertion operator (Basic).

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH234B-T	HARDWARE VERIFICATION USING SYSTEM VERILOG	CO1	3	2	2	2	1	1	1	1	1	2	3	3	3	3
		CO2	3	3	2	3	1	2	1	1	1	2	3	3	3	3
		CO3	3	2	3	2	2	1	1	1	1	2	3	3	3	3
		CO4	3	2	3	2	2	1	1	1	1	2	3	3	3	3

Course Title/Code	**HARDWARE VERIFICATION USING SYSTEM VERILOG (ECH324B-P)**	
Course Type	CORE	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisites	NA	
Course Objective	Appreciate and apply the System Verilog verification features, including classes, constrained random stimulus, coverage, strings, queues and dynamic arrays, and learn how to utilize these features for more effective and efficient verification.	
Course Outcomes (COs)		Mapping
CO1	Apply System Verilog verification features, including classes, constrained random stimulus, coverage, strings, queues and dynamic arrays, and learn how to utilize these features for more effective and efficient verification.	Employability/Skill Development
CO2	Synthesis features, including new data types, literals, procedural blocks, statements, and operators, relaxation of Verilog language rules, fixes for synthesis issues, enhancements to tasks and functions, new hierarchy and connectivity features, and interfaces.	Employability/Skill Development

List of Experiments:

- Design and verify combinational circuits using System Verilog.
- Design and verify D Flip-Flop using System Verilog.
- Design and verify Sequential circuits using System Verilog.
- Example of a simple UVM testbench consisting of a single uvm_env class.
- Basic UVM "Hello World" program using System Verilog.
- Create multiple objects of a class, calling the constructor and a print method using System Verilog.
- Example of Random-Access Memory using System Verilog.
- Example of testing a UVM scoreboard using SVUnit.
- projects

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH234B-T	HARDWARE VERIFICATION USING SYSTEM VERILOG	CO1	3	2	2	2	1	1	1	1	1	2	3	3	3	3
		CO2	3	3	2	3	1	2	1	1	1	2	3	3	3	3

Course Title/Code	**WIRELESS AND MOBILE COMMUNICATION (ECH426B-T)**	
Course Type	Domain core	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisites	NA	
Course Objective	Provide understanding of advanced multiple access techniques, Mobile radio Propagation Models and modulation techniques	
Course Outcomes (COs)		Mapping
CO1	Comprehend various standards, technologies and architecture used in Analog and Digital Mobile Radio systems.	Employability, Skill development
CO2	Describe various mechanisms of propagation and fading in mobile radio channels and their impact on designing the radio systems.	Employability, Skill development
CO3	Comprehend various concepts of equalization and diversity techniques and their applications in designing the mobile radio systems.	Employability, Skill development
CO4	Appreciate the system design concept in wireless radio systems and their applications in wireless communication.	Employability, Skill development

SECTION A: CELLULAR CONCEPTS AND SYSTEM DESIGN FUNDAMENTALS

Cellular concept and frequency reuse, Multiple Access Schemes, channel assignment and handoff, Interference and system capacity, Trunking and Erlang capacity calculations.

SECTION B: MOBILE RADIO PROPAGATION MODELS

Radio wave propagation issues in personal wireless systems, Propagation models, Multipath fading and Base band impulse response models, parameters of mobile multipath channels, Antenna systems in mobile radio.

SECTION C: MODULATION TECHNIQUES

Overview analog and digital modulation techniques, Performance of various modulation techniques-Spectral efficiency, Error-rate, Power Amplification, Equalizing Rake receiver concepts, Diversity and space-time processing, Speech coding and channel coding.

SECTION D: SYSTEM EXAMPLES AND DESIGN ISSUES

Multiple Access Techniques-FDMA, TDMA and CDMA systems, operational systems, Wireless networking, design issues in per-sonal wireless systems

TEXT BOOKS

1. S. Rappaport, Wireless digital communications; Principles and practice, Prentice Hall, NJ, 1996.
2. Schiller, Mobile Communications; Pearson Education Asia Ltd., 2000.

REFERENCE BOOKS

3. Feher, Wireless digital communications, PHI, New Delhi, 1999.
4. C. Y. Lee, Mobile communications engineering: Theory and Applications, Second Edition, McGraw Hill, New York.1998.

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH426B-T	WIRELESS AND MOBILE COMMUNICATION	CO1	3	3	3	1	1	1	1	2	2	1	1	2	3	2
		CO2	2	1	2	1	1	1	1	2	1	1	1	1	1	1
		CO3	2	1	1	1	1	1	1	2	1	1	1	1	1	1
		CO4	3	3	1	2	1	2	1	2	2	2	1	2	3	2

Course Title/Code	**WIRELESS AND MOBILE COMMUNICATION LAB (ECH426B-P)**	
Course Type	Domain core	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisites	NA	
Course Objective	Provide understanding of advanced multiple access techniques, Mobile radio Propagation Models and modulation techniques	
Course Outcomes (COs)		Mapping
CO1	Develop ad-hoc network applications using appropriate algorithms/protocols.	Employability, Skill development
CO2	Develop ad-hoc network applications using appropriate algorithms/protocols.	Employability, Skill development
CO3	Identify and simulate the medium access control mechanisms suitable for given applications.	Employability, Skill development

List of Experiments

1. Evaluate the impact of path loss and shadowing in estimation of received signal power in mobile cellular communication using fading channel mobile communication virtual lab.

2. Calculate the boundary coverage probability in a cellular system using fading channel mobile communication virtual lab.

3. Demonstrate the impact the received power levels for hand-off in case of mobile cellular communication using fading channel mobile communication virtual lab.

4. Estimate the impact of sectoring in increasing cellular system capacity using fading channel mobile communication virtual lab.

5. Examine the impact of co-channel interference on the value of SIR in mobile cellular communication using fading channel mobile communication virtual lab.

6. Setting up of LTE 2x2 MIMO system for establishing two way communication.

7. Study of pure ALOHA and slotted ALOHA protocols for WLAN System.

8. Configure ZigBee module as an end device and, set up a communication link with two ZigBee modules.

9.Study of RFID system and its applications.

CO-PO MAPPING

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH426B-T	WIRELESS AND MOBILE COMMUNICATION	CO1	3	3	3	1	1	1	1	2	2	1	1	2	3	2
		CO2	2	1	2	1	1	1	1	2	1	1	1	1	1	1
		CO3	2	1	1	1	1	1	1	2	1	1	1	1	1	1
		CO4	3	3	1	2	1	2	1	2	2	2	1	2	3	2

SEMESTER VII

Course Title/Code	**DATA COMMUNICATION (ECH315B-T)**	
Course Type	CORE	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisites	NA	
Course Objective	To learn the layered architecture of communication protocols and digital signal transmission and encoding techniques along with multiplexing techniques	
Course Outcomes (COs)		Mapping
CO1	Understand and Analyze the basics of data communication, networking, internet and their importance.	Employability/Skill Development
CO2	Differentiate wired and wireless computer networks	Employability/Skill Development
CO3	Analyze TCP/IP their protocols and multiplexing.	Employability/Skill Development
CO4	Recognize the different internet devices and their functions.	Employability/Skill Development

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).

Text Books:

1. Forauzan, Data Communication and Networking (2nd edition), McGraw Hill.
2. Andrew S. Tanenbaum, Computer Networks, PHI India.
3. Reference Books:
4. Leon-Garcia, Widjaja, Communication Networks, TMH.
5. William Stallings, Data & Computer Communication, Prentice Hall.

E-resources:

1. https://ocw.mit.edu/courses/6-263j-data-communication-networks-fall-2002/
2. https://nptel.ac.in/courses/106105082

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH315B-T	DATA COMMUNICATION	C01	1	2	1	2	1	1	1	1	1	2	1	2	1	3
		CO2	2	1	2	1	1	1	1	1	1	1	1	2	1	2
		CO3	3	2	2	2	1	1	1	2	1	1	2	1	2	2
		CO4	3	2	1	1	2	1	1	1	1	1	2	1	1	3

Course Title/Code	**EMBEDDED SYSTEM DESIGN(ECH317B)**	
Course Type	CORE	
L-T-P Structure	3-1-0	
Credits	4	
Pre-requisities	NA	
Course Objective	To provide exposure to embedded system development tools with hands on experience in using basic programming techniques.	
Course Outcomes (COs)		Mapping
CO1	Develop real time systems that are highly time bounded.	Employability and skill development
CO2	Apply various real time algorithms in building embedded systems.	Employability
CO3	Implement the RTOS development tools in building real time embedded systems.	Employability

SECTION A

INTRODUCTION TO EMBEDDED SYSTEMS Overview of embedded systems, embedded system design process, challenges - common design metrics and optimizing them. Hardware - Software code sign embedded product development.

SECTION B

REAL TIME OPERATING SYSTEM Real time operating systems Architecture - Tasks and Task states - Tasks and Data - Semaphore and shared data - Message queues, mail boxes and pipes - Encapsulating semaphores and queues - interrupt routines in an RTOS Environment. Introduction to Vx works, RT Linux.

SECTION C

AVR 8515 MICROCONTROLLER Architecture and Programming in assembly and C. Interfacing Analog and digital blocks: Analog-to-Digital Converters (ADCs), Digital to-Analog, Converters (DACs)., Communication basics and basic protocol concepts, Microprocessor interfacing: I/O addressing, Port and Bus based, I/O, Memory mapped I/O, Standard I/O interrupts, Direct memory access, Advanced communication principles parallel, serial and wireless, Serial protocols I2C, Parallel protocols PCI bus, Wireless protocol IrDA, blue tooth., DMA.

SECTION D

PERIPHERAL DEVICES Buffers and latches, Crystal, reset circuit, Chip select logic circuit, timers and counters and watch dog timers, Universal asynchronous receiver, transmitter (UART), Pulse width modulators, LCD controllers, Keypad controllers. Design tradeoffs due to thermal considerations and Effects of EMI/ES etc

Text Books:

1. Frankvahid/Tony Givargis, “Embedded System Design- A unified Hardware/software Introduction”.
2. David E Simon, " An embedded software primer ", Pearson education Asia, 2001.

Reference books

1. Dreamteach Software team,” Programming for Embedded Systems” AVR 8515 manual
2. J.W. Valvano, "Embedded Microcomputor System: Real Time Interfacing"
3. Jack Ganssle, "The Art of Designing Embedded Systems", Newnes, 1999.

E- Resources:

1.https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/

2. https://nptel.ac.in/courses/108102045

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH317B	EMBEDDED SYSTEM DESIGN	CO1	3	2	3	1	2	2	1	2	2	2	1	2	2	1
		CO2	3	2	3	2	2	2	1	2	2	3	1	2	3	2
		CO3	3	3	3	2	2	2	1	2	1	3	1	2	2	2

Course Title/Code	**MICROWAVE AND RADAR ENGINEERING (ECH311B-T)**	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisites	NA	
Course Objective	To understand the theoretical principles underlying microwave devices and networks.	
Course Outcomes (COs)		Mapping
CO1	Identify the Microwave components based upon the applications	Employability and skill development
CO2	Analyze the components for efficiency and range of frequencies	Employability
CO3	Design the components for Microwave applications	Employability

SECTION A

WAVEGUIDES: Introduction, comparison with transmission lines, propagation in TE & TM mode, rectangular wave guide, TEM mode in rectangular wave guide, characteristic impedance, introduction to circular waveguides and planar transmission lines.

SECTION B

MICROWAVE COMPONENTS: Directional couplers, tees, hybrid ring, S-parameters, attenuators, cavity resonators, mixers & detectors, matched Load, phase shifter, wave meter, Ferrite devices: Isolators, circulators. Limitation of conventional tubes; Construction, operation and properties of Klystron amplifier, reflex Klystron, magnetron, TWT, BWO, crossed field amplifiers.

SECTION C

MICROWAVE SOLID STATE DEVICE and MICROWAVE MEASUREMENTS: Varactor diode, Tunnel diode, Schottky diode, GUNN diode, IMPATT, TRAPATT and PIN diodes. MASER, parametric amplifiers. Power measurement using calorimeter & bolometers, measurement of SWR, frequency, wavelength and impedance. Microwave bridges.

SECTION D

INTRODUCTION TO RADAR: Block Diagram and operation, Radar Frequencies, Simple form of Radar Equation, Prediction of Range Performance, Pulse Repetition frequency and Range Ambiguities, Applications of Radar.

Text Books

1. Microwave devices and circuits: Samuel Liao; PHI
2. Microwave devices & Radar Engg: M. Kulkarni; mesh
3. Reference Books
4. Microwaves and Radar: A.K. Maini; Khanna
5. Microwave Engineering by A Dass and S K Dass
6. Microwave by K.C. Gupta

E-resources:

https://in.coursera.org/learn/microwave-antenna

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH411B-T	MICROWAVE AND RADAR ENGINEERING	CO1	2	2	2	2	2	1	1	-	-	2	2	2	2	3
		CO2	2	2	2	2	2	1	1	-	-	2	2	2	2	3
		CO3	2	2	2	2	2	1	1	-	-	2	2	2	2	3

Course Title/Code	**VLSI TESTING (ECH411B-T)**	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisites	NA	
Course Objective	Students learn to test of static and dynamic circuits. Fault diagnosis: Fault models for diagnosis, Cause- effect diagnosis, Effect-cause diagnosis. Design for testability: Scan design, Partial scan, use of scan chains, boundary scan, DFT for other test objectives, Memory Testing.	
Course Outcomes (COs)		Mapping
CO1	Apply the concepts in testing which can help them design a better yield in IC design.	Employability and skill development
CO2	Characterize & Apply the concepts and working principles of Diodes for its various applications	Employability
CO3	Demonstrate familiarity with electronic devices viz., Transistors, Feedback Amplifiers and Oscillators and design implementation.	Employability
CO4	Analyze and Design Operational Amplifiers and real-life applications using 555 Timer	Employability and Skill Development

SECTION A

Scope of testing and verification in VLSI design process. Issues in test and verification of complex chips, embedded cores and SOCs.

SECTION B

Fundamentals of VLSI testing. Fault models. Automatic test pattern generation. Design for testability. Scan design.

SECTION C

Test interface and boundary scan. System testing and test for SOCs. Iddq testing. Delay fault testing. BIST for testing of logic and memories. Test automation.

SECTION D

Design verification techniques based on simulation, analytical and formal approaches. Functional verification. Timing verification. Formal verification. Basics of equivalence checking and model checking. Hardware emulation.

Text Books:

1. M. L. Bushnell and V.D. Agrawal, Essentials of Electronic Testing for Digital Memory and Mixed Signal VLSI Circuits, Springer, 2005

2. H. Fujiwara, Logic Testing and Design for Testability, MIT Press, 1985

3. M. Abramovici, M. Breuer, and A. Friedman, Digital System Testing and Testable Design, IEEE Press, 1994

Reference Books:

4. M. Huth and M. Ryan, Logic in Computer Science, Cambridge Univ. Press, 2004

5. T. Kropf, Introduction to Formal Hardware Verification, Springer Verlag, 2000

E-resources:

1.https://ocw.mit.edu/courses/6-374-analysis-and-design-of-digital-integrated-circuits-fall-2003/pages/lecture-notes/

2. https://nptel.ac.in/courses/117105137

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH411B-T	VLSI TESTING	CO1	3	1	2	2	2	1	1	1	1	1	2	3	3	1
		CO2	3	3	2	2	1	1	1	1	1	1	2	3	3	3
		CO3	2	3	3	3	2	1	1	1	1	1	2	3	2	3
		CO4	3	2	2	3	2	1	1	1	1	1	1	3	3	2

Course Title/Code	MEMS (ECH412B-T)	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisites	NA	
Course Objective	Students learn to test static and dynamic circuits. Fault diagnosis: Fault models for diagnosis, Cause- effect diagnosis, Effect-cause diagnosis. Design for testability: Scan design, Partial scan, use of scan chains, boundary scan, DFT for other test objectives, Memory Testing.	
Course Outcomes (COs)		Mapping
CO1	The students will be able to understand the basic concepts of MEMS and Microsystems.	Employability/Skill Development
CO2	The students will be able to know various materials used for MEMS Fabrications.	Employability/Skill Development
CO3	The students will be able to appreciate various steps involved in the fabrication of MEMS.	Employability/Skill Development
CO4	The students will be able to appreciate various steps involved in the fabrication of MEMS.	Employability/Skill Development

SECTION A

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication – Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

SECTION B

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph – Applications – Magnetic Actuators – Micro magnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.Piezoresistive sensors – Piezo resistive sensor materials – Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

SECTION C

Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies – Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process – Assembly of 3D MEMS – Foundry process.

SECTION D

Polymers in MEMS– Polyimide – SU-8 – Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon – Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

Text Books:

1. Chang Liu, ‘Foundations of MEMS’, Pearson Education Inc., 2012.
2. Stephen D Senturia, ‘Microsystem Design’, Springer Publication, 2000.
3. Tai Ran Hsu, “MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002.

4. NadimMaluf,“ An Introduction to Micro Electro Mechanical System Design”, Artech House, 2000.

Reference Books:

1. Mohamed Gad-el-Hak, editor, “The MEMS Handbook”, CRC press Baco Raton, 2001.
2. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
3. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
4. Thomas M.Adams and Richard A.Layton, “Introduction MEMS, Fabrication and Application,” Springer, 2010.

E-resources:

1.https://ocw.mit.edu/courses/6-777j-design-and-fabrication-of-microelectromechanical-devices-spring-2007/

2. https://nptel.ac.in/courses/117105082

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH412B-T	MEMS	CO1	3	1	2	2	2	1	1	1	1	1	2	3	3	1
		CO2	3	3	2	2	1	1	1	1	1	1	2	3	3	3
		CO3	2	3	3	3	2	1	1	1	1	1	2	3	2	3
		CO4	3	2	2	3	2	1	1	1	1	1	1	3	3	2

Course Title/Code	**DIGITAL IMAGE PROCESSING AND COMPUTER VISION (ECH313B-T)**	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisites	NA	
Course Objective	To familiarize students with image enhancement and restoration techniques and explain different image compression techniques.	
Course Outcomes (COs)		Mapping
CO1	Develop and apply computer vision techniques for solving practical problems	Employability/Skill Development
CO2	Choose appropriate image processing methods for image filtering, image restoration, image reconstruction, segmentation, classification and representation,	Employability/Skill Development
CO3	Implement and test the techniques and algorithms studied	Employability/Skill Development

SECTION A

Digital Image Fundamentals & Image Transforms: Digital Image Fundamentals, Sampling and Quantization, Relationship between Pixels. Image Transforms: 2-D FFT, Properties, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar Transform, Slant Transform, Hotelling Transform. Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighborhood criterion, Median Filter, Spatial Domain High-Pass Filtering. Image Enhancement (Frequency Domain): Filtering in Frequency Domain, Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

SECTION B

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

SECTION C

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

SECTION D

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

Text books

1 Digital Image Processing, Gonzalez.R.C& Woods.R.E., 3/e, Pearson Education, 2008.

2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall, 1998.

3. Fundamentals of Digital image Processing, Anil Jain.K, Prentice Hall of India,

4. Digital Image Processing Using MATLAB, Gonzalez.R.C& Woods. R.E., 3/e, Pearson Education, 2014

References

1. Digital Image Processing, S. Jayaraman, S. Esakkirajan, T. Veerakumar, McGraw Hill Education ,2009. Pvt Ltd, NewDelhi

2. 1989Digital Image Processing, Kenneth R Castleman, Pearson Education, 1995.

E-Resources:

1.https://ocw.mit.edu/courses/res-2-006-girls-who-build-cameras-summer-2016/pages/image-processing/

2. https://onlinecourses.nptel.ac.in/noc21_ee23/preview

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH413B-T	DIGITAL IMAGE PROCESSING AND COMPUTER VISION	CO1	3	1	2	2	2	1	1	1	1	1	2	3	3	1
		CO2	3	3	1	2	1	1	1	1	1	1	2	3	3	1
		CO3	2	3	3	3	2	1	1	1	1	1	2	3	2	3

Course Title/Code	**MECHATRONICS (ECH418B-T)**	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisites	NA	
Course Objective	To design systems with integrated different domains, including a mechanical domain, electrical and electronic control domains	
Course Outcomes (COs)		Mapping
CO1	Describe the operation, working, importance of Electronic Sensors, their selection criteria and characterize their various applications in the design of mechatronics systems	Employability/Skill Development
CO2	Analyze various electronic, electrical and mechanical systems, their interconnection and apply the gained knowledge in the field of Mechanical Engineering.	Employability/Skill Development
CO3	Develop and design controllers with the help of programming and its implementation on applications of real-life systems.	Employability/Skill Development
CO4	Integrate mechanical, electronics, control and computer engineering in the design, building, interfacing and actuation of mechatronics systems for a set of specifications.	Employability/Skill Development

SECTION A

Introduction and Basics: What is Mechatronics? A Measurement System with its constituent elements and Hardware; Open and Closed Loop Systems; Sequential Controllers; Micro-processor Based Controllers. A review of Displacement, Liquid Flow, Liquid Level, Temperature Sensors along with Performance Terminology; Selection of Sensors; Introduction to signal conditioning: Signal Conditioning Processes, Inverting Amplifiers, Non-Inverting Amplifiers, Summing, Integrating, Differential, Logarithmic Amplifiers, Comparators, Amplifiers Error, Filtering, Wheatstone Bridge; Digital Signals; Logic Gates, Application of Logic Gates. Introduction to Combinational and sequential logic circuits. Data Presentation Systems – Displays; Magnetic Recording; Data Acquisition Systems; Testing & Calibration; Problems. (Chap-1,2,3,4+notes)

SECTION B

Introduction to Electrical Actuation Systems: Switching Devices, Mechanical Switches – SPST, SPDT, DPDT, keypads; Relays, Solid State Switches, Diodes, Transistors, Solenoid Type Devices: Solenoid Operated Hydraulic and Pneumatic Valves. Control of DC Motors, Permanent Magnet DC Motors, Brush less Permanent Magnet DC Motors, AC Motors and speed controls, Stepper Motors, Servo Motors. System Interfacing and data acquisition: Data acquisition systems, Analog to Digital Conversion, Digital to Analog Conversion, Sample and Hold Amplifiers, Interfacing Motor drives. (ch-7+notes uploaded)

SECTION C

Introduction and description of modes and types of Controllers: Closed Loop Controllers: Continuous and Discrete Processes, Control Modes; Two- step Mode; Proportional Mode – Electronic Proportional Controllers; Derivative Control – Proportional plus Derivative Control; Integral Control - Proportional plus Integral Control; PID Controller. Programmable Logic Controllers: Basic Structure of Programmable Logic Controllers; Input/ Output Processing; Programming; Timers, Internal Relays and Counters, Analogue Input/ Output; Selection of a PLC; Problems.

SECTION D

Brief description of Microprocessors and Input / Output Systems: Control; Microcomputer Structure; Programming Languages; Instruction Sets; Assembly Language Programs; Subroutines. Introduction to Micro- controllers;

Applications Input / Output Systems: Interfacing, Requirements, Addressing, Serial/Parallel Interface, Examples of Interfacing. Mechatronics Applications and Case Studies: A Pick & Place Robot, Automatic Camera, Bar Code Recorder etc.

Text Books/Reference Books:

1. W. Bolton, "Mechatronics – Electronic control systems in Mechanical & Electrical Engineering", Pearson Education Ltd., 2003.

2. Nitaigour Premchand Mahalik, Mechatronics principles, concepts and applications, Tata Mc Graw Hill. Reference Books: [R1] Joji P, Pneumatic Controls, Wiley.

Reference Books:

3. David g Alciatore, Michael B Histand, "Introduction to Mechatronics and measurement systems", Mc Graw Hill Education.

4. A Smaili, F Mrad, "Mechatronics – Integrated Technologies for Intelligent Machines, Oxford Higher Education.

E-resources:

1.https://ocw.mit.edu/courses/2-737-mechatronics-fall-2014/

2. https://onlinecourses.nptel.ac.in/noc21_me27/preview

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH418B-T	MECHATRONICS	CO1	1	3	1	3	2	1	1	1	1	1	3	1	2	2
		CO2	1	2	2	2	3	2	1	2	1	1	3	1	3	3
		CO3	1	3	3	3	3	1	1	3	2	1	3	3	3	3
		CO4	1	3	3	1	3	3	1	3	2	2	3	3	2	3

Course Title/Code	**THEORY OF AUTOMATA AND COMPILER DESIGN (CSH311B-T)**	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisities	NA	
Course Objective	To design systems with integrated different domains, including a mechanical domain, electrical and electronic control domains	
Course Outcomes (COs)		Mapping
CO1	Solve simple decision problems by constructing DFA and NFA over regular language as well as minimizing DFA	Employability
CO2	Demonstrate advanced knowledge of formal computation and its relationship to languages and Automata.	Employability
CO3	Demonstrate phases of compilation and the impact of language features upon the compilation process	Employability
CO4	Acquire knowledge and analyze different techniques for intermediate code and machine code optimization	Employability

SECTION-A

Finite Automaton: Finite State Systems, Representation of finite automaton, Non-Deterministic finite automata (NDFA), Deterministic finite automata (DFA), Equivalence of DFA and NDFA. Removals of ε – moves from finite automata, Minimization of finite Automata, Regular Expressions: - regular expression, Equivalence of finite automata and Regular Expressions, Arden's theorem. The Pumping Lemma for Regular Sets, Closure properties of regular sets and regular language.

SECTION-B

Context free grammar: - Reduced forms, Chomsky Normal Form (CNF), Griebach Normal Form (GNF). Pushdown Automata: - NDPDA, DPDA, LBA. Turing Machines: - Deterministic and Non-Deterministic Turing Machines, universal Turing machine, Design of TM Chomsky hierarchy.

SECTION-C

Compilers and translators, structure of compiler. Lexical Analyser: Lexical Analysis, recognition of tokens, Syntax Analysis: parsing, Parsing Technique: Topdown approach (Recursive Descent, Recursive Predictive and Non Recursive Predictive Parsing Techniques). Bottom Up approach: Shift- reduce parsing, operator precedence parsing, LR parsers, SLR, LALR and Canonical LR parser.

SECTION-D

Syntax Directed Translations: Syntax directed definition, construction of syntax trees, syntax directed translation scheme, and implementation of syntax directed translation, three address code, quadruples and triples. Code Optimization & Code Generation: Code generation, forms of objects code, machine dependent code, optimization, register allocation for temporary and user defined variables. Peephole optimization.

Text Books:

1.Compilers Principle, Techniques & Tools - Alfread V. AHO, Ravi Sethi& J.D.Ullman; - 1998 Addison Wesley.

2.Compiler Design by O.G. Kakde, 1995, Laxmi Publ.

Reference Books:

Theory and practice of compiler writing, Tremblay & Sorenson, 1985, Mc. Graw Hill.

E-resources:

https://ocw.mit.edu/courses/6-045j-automata-computability-and-complexity-spring-2011/

https://onlinecourses.nptel.ac.in/noc21_cs19/preview

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSH311 B-T	THEORY OF AUTOMATA AND COMPILER DESIGN	CO1	1	3	1	3	2	1	1	1	1	1	3	1	2	2
		CO2	1	2	2	2	3	2	1	2	1	1	3	1	3	3
		CO3	1	3	3	3	3	1	1	3	2	1	3	3	3	3
		CO4	1	3	3	1	3	3	1	3	2	2	3	3	2	3

Course Title/Code	**BIG DATA(CSH402B-T)**	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisities	NA	
Course Objective	To design systems with integrated different domains, including a mechanical domain, electrical and electronic control domains	
Course Outcomes (COs)		Mapping
CO1	Know the fundamentals of Big data and Big data Frameworks that makes it useful to solve real world problems	Employability
CO2	Demonstrate the understanding of Big data programming using Hadoop	Employability
CO3	Apply the knowledge to perform Big data analytics using NoSQL Databases	Employability
CO4	Analyze the performance of various frameworks for Business Intelligence	Employability
CO5	Design solutions to a range of complex real world problems	Employability

SECTION-A

Introductory Concepts (Digital Data and Big Data): Digital Data Basics, Types of Digital Data (Structured, Semi-Structured, Unstructured), Introduction to Big Data, Why Big Data? Dimensions of Big Data, Challenges with Big Data, Big Data Stack, Scaling Problems. Big data processing tools(AWS). Hadoop overview: Brief history of Hadoop, Hadoop 1.0 vs. Hadoop 2.0, Hadoop Components, High level architecture of Hadoop, Hadoop Streaming, Hadoop Compression.

SECTION-B

Big data programming using Hadoop: Hadoop Distributed File System: Architecture, Daemons related to HDFS, working with HDFS command, Special features of Hadoop, Introduction to functional programming, How Map Reduce Works, Mapreduce on YARN, Map Reduce Joins, Map Reduce Work Flows. HDFS and Hadoop Ecosystem.

SECTION C

Big Data Analytics: Analytics 1.0, Analytics 2.0, Analytics 3.0, Traditional BI vs. Big Data Environment, Big Data Technology Landscape, NoSQL Databases, NoSQL Vs. RDBMS, New SQL.

SECTION-D

Frameworks: APACHE HIVE: History of HIVE, HIVE architecture, Hive Primitive Data Types and Collection Types, Hive File Formats, Hive Query Language – Statements, DDL DML, Fundamentals of APACHE PIG & HBASE, Business Intelligence on Hadoop.

Text Books:

1. Tom White “Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.
2. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
3. Michael Minelli (Author), Michele Chambers (Author), AmbigaDhiraj (Author) , Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses,Wiley Publications,2013.

Reference Book:

1. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill Publishing, 2012.
2. AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.

3. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley &sons, 2012.
4. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007.
5. Pete Warden, “Big Data Glossary”, O’Reilly, 2011.
6. Paul Zikopoulos , Dirk deRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corrigan , Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2012.
7. Zikopoulos, Paul, Chris Eaton,

E-resources:

1.https://ocw.mit.edu/courses/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/

2.https://onlinecourses.nptel.ac.in/noc22_cs65/preview

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSH402B-T	BIG DATA	CO1	2	-	-	1	-	2	-	1	-	-	2	2	-	1
		CO2	-	-	-	2	-	2	-	3	1	2	3	3	2	1
		CO3	1	2	-	2	-	1	-	2	2	2	3	3	1	2
		CO4	2	-	-	2	-	2	-	2	2	1	2	3	3	1
		CO5	1	3	2	3	2	3	3	3	3	2	3	3	3	3

Course Title/Code	**MICROWAVE AND RADAR ENGINEERING LAB(ECH311B-P)**	
Course Type	Elective	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	To understand the theoretical principles underlying microwave devices and networks.	
Course Outcomes (COs)		Mapping
CO1	Analyze typical microwave networks using impedance, admittance, transmission and scattering matrix representations.	Employability and skill development
CO2	Design microwave matching networks using L SECTION, single and double stub and quarter wave transformer	Employability
CO3	Perform measurements on microwave devices and networks using power meter and VNA.	Employability

List of Experiments:

1. Designing and building a microwave oscillator to generate a continuous wave signal.
2. Measuring the reflection coefficient of a sample using a microwave reflection measurement system.
3. Characterizing the frequency response of a microwave amplifier using a network analyzer.
4. Designing and building a microwave filter to select a specific frequency range.
5. Determining the gain and directivity of a microwave antenna using a gain measurement system.
6. Measuring the scattering parameters of a microwave device using a scattering parameter measurement system.
7. Designing and building a microwave waveguide system to transmit microwave signals over long distances.
8. Characterizing the noise figure of a microwave amplifier using a noise figure measurement system.
9. Measuring the insertion loss of a microwave transmission line using a vector network analyzer.
10. Determining the range and velocity of a moving object using a radar system.

Text Books

1. Microwave devices and circuits :Samuel Liao;PHI
2. Microwave devices & Radar Engg :M .Kulkarni;Umesh
3. Reference Books
4. Microwaves and Radar : A.K. Maini; Khanna
5. Microwave Engineering by A Dass and S K Dass
6. Microwave by K.C.Gupta
7. Microwave engineering Rajeswari Chatterjee

E-resources:

https://in.coursera.org/learn/microwave-antenna

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH311 B-P	MICROWAVE AND RADAR ENGINEERING LAB	CO1	3	3	3	1	2	2	2	2	-	-	-	-	3	3
		CO2	3	3	3	1	2	2	2	2	-	-	-	-	3	3
		CO3	3	3	3	1	2	2	2	2	-	-	-	-	3	3
											-	-	-	-		

Course Title/Code	**VLSI TESTING LAB(ECH411B-P)**	
Course Type	Elective	
L-T-P Structure	0-0-2	
Credits	1	
Course Objective	Students learn to test static and dynamic circuits. Fault diagnosis: Fault models for diagnosis, Cause- effect diagnosis, Effect-cause diagnosis. Design for testability: Scan design, Partial scan, use of scan chains, boundary scan, DFT for other test objectives, Memory Testing.	
Course Outcomes (COs)		Mapping
CO1	Design CMOS logic circuits	Employability and skill development
CO2	simulate circuits within a CAD tool and compare to design specifications	Employability
CO3	Design, implement, and simulate circuits using VHDL.4. write machine language programs and assembly language programs for the simple computer.	Employability

List of Experiments:

1. Adders and Subtractors. Half Adder. Full Adder
2. Multiplexers and Demultiplexers. 2:1 Multiplexer & 1:2 Demultiplexer
3. Fliplflops. JK-Flipflop
4. Shift Registers and Counters. Parallel In Serial Out.
5. Adders. Ripple Carry Adder
6. Comparators and Parity Generators. 4 bit Comparator
7. Multipliers. 4*4 Array Multiple
8. Mini Project
9. Major Project

Text Books:

1. M. L. Bushnell and V.D. Agrawal, Essentials of Electronic Testing for Digital Memory and Mixed Signal VLSI Circuits, Springer, 2005

2. H. Fujiwara, Logic Testing and Design for Testability, MIT Press, 1985

3. M. Abramovici, M. Breuer, and A. Friedman, Digital System Testing and Testable Design, IEEE Press, 1994

Reference Books:

4. M. Huth and M. Ryan, Logic in Computer Science, Cambridge Univ. Press, 2004

5. T. Kropf, Introduction to Formal Hardware Verification, Springer Verlag, 2000

E-resources:

1.https://ocw.mit.edu/courses/6-374-analysis-and-design-of-digital-integrated-circuits-fall-2003/pages/lecture-notes/

2. https://nptel.ac.in/courses/117105137

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH411B-P	VLSI TESTING LAB	CO1	3	1	2	2	2	1	1	1	1	1	2	3	3	1
		CO2	3	3	2	2	1	1	1	1	1	1	2	3	3	3
		CO3	2	3	3	3	2	1	1	1	1	1	2	3	2	3

Course Title/Code	MEMS LAB (ECH412B -P)	
Course Type	Elective	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	Students learn to test static and dynamic circuits. Fault diagnosis: Fault models for diagnosis, Cause-effect diagnosis, Effect-cause diagnosis. Design for testability: Scan design, Partial scan, use of scan chains, boundary scan, DFT for other test objectives, Memory Testing.	
Course Outcomes (COs)		Mapping
CO1	apply the knowledge of sensing and transduction mechanisms to design different MEMS devices..	Employability/Skill Development
CO2	identify the necessity of fabrication steps of the different MEMS devices	Employability/Skill Development
CO3	identify the necessity of fabrication steps of the different MEMS devices in microsensors .	Employability/Skill Development
CO4	The students will be able to appreciate various steps involved in the fabrication of MEMS.	Employability/Skill Development

List of Experiments

1. Simulation of cantilever.
2. Simulation of micro machined structures.
3. Simulation of accelerometers.
4. Simulation of micromirror.
5. Simulation MEMS structures using sacrificial layer method.
6. Simulation of MEMS sensors.
7. Simulation study of integration of circuits and MEMS

Text Books:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.
4. NadimMaluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.

Reference Books:

1. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2001.
2. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
3. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
4. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

E-resources:

1.https://ocw.mit.edu/courses/6-777j-design-and-fabrication-of-microelectromechanical-devices-spring-2007/

2. https://nptel.ac.in/courses/117105082

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH412B-P	MEMS LAB	CO1	3	1	2	2	2	1	1	1	1	1	2	3	3	1
		CO2	3	3	2	2	1	1	1	1	1	1	2	3	3	3
		CO3	2	3	3	3	2	1	1	1	1	1	2	3	2	3
		CO4	3	2	2	3	2	1	1	1	1	1	1	3	3	2

Course Title/Code	**DIGITAL IMAGE PROCESSING AND COMPUTER VISION LAB (ECH313B-P)**	
Course Type	Elective	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To familiarize students with image enhancement and restoration techniques and explain different image compression techniques.	
Course Outcomes (COs)		Mapping
CO1	Develop any image processing application.	Employability/Skill Development
CO2	Apply feature extraction techniques for image analysis and recognition	Employability/Skill Development
CO3	Implement image compression and to learn the spatial and frequency domain techniques of image compression.	Employability/Skill Development

List of Experiments:

1. Introduction: Key features/functions of image processing.
2. Image Representation in spatial domain
3. Grayscale Image -Data type and bit-plane
4. Image Enhancement
5. Histogram Equalization
6. Smoothing: Low pass filter
7. Generate HDL Code for Image Sharpening
8. Generate HDL Code for Image Sharpening (contd.)
9. Image Acquisition Object detection by colour thresholding
10. Object detection by colour thresholding

Text books

1 Digital Image Processing, Gonzalez.R.C& Woods.R.E., 3/e, Pearson Education, 2008.

2. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall, 1998.

3. Fundamentals of Digital image Processing, Anil Jain.K, Prentice Hall of India,

4. Digital Image Processing Using MATLAB, Gonzalez.R.C& Woods. R.E., 3/e, Pearson Education, 2014

References

1. Digital Image Processing, S. Jayaraman, S. Esakkirajan, T. Veerakumar, McGraw Hill Education ,2009. Pvt Ltd, NewDelhi

2. 1989Digital Image Processing, Kenneth R Castleman, Pearson Education, 1995.

E-Resources:

1.https://ocw.mit.edu/courses/res-2-006-girls-who-build-cameras-summer-2016/pages/image-processing/

2. https://onlinecourses.nptel.ac.in/noc21_ee23/preview

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH313B-P	DIGITAL IMAGE PROCESSING AND COMPUTER VISION LAB	CO1	3	1	2	2	2	1	1	1	1	1	2	3	3	1
		CO2	3	3	1	2	1	1	1	1	1	1	2	3	3	1
		CO3	2	3	3	3	2	1	1	1	1	1	2	3	2	3

Course Title/Code	**SECURITY IN WIRELESS AND MOBILE COMMUNICATION (ECH404B-T)**	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisites	NA	
Course Objective	The main objective of this wireless security course is to introduce the students to the field of wireless security and its importance, compare wired and wireless security, review OSI layers and state their security mechanisms, and discuss the security requirements, security vulnerabilities, and attacks in wireless.	
Course Outcomes (COs)		**Mapping**
1	Evaluate constraints, design challenges and security issues associated with wireless networks.	Employability
2	Acquire understanding and knowledge of security mechanisms and protocols in wireless communication networks.	Employability
3	Implement the design principles, models, mechanisms and solutions used in wireless network security to obtain authentication and key transport protocols.	Employability

SECTION-A

Security Issues in Mobile Communication: Mobile Communication History, Security – Wired Vs Wireless, Security Issues in Wireless and Mobile Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application – level Security.

SECTION-B

Security of Device, Network, and Server Levels: Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. Application Level Security in Wireless Networks: Application of WLANs, Wireless Threats, Some Vulnerabilities and Attach Methods over WLANs, Security for 1G Wi-Fi Applications, Security for 2G Wi-Fi Applications, Recent Security Schemes for Wi-Fi Applications

SECTION-C

Application Level Security in Cellular Networks: Generations of Cellular Networks, Security Issues and attacks in cellular networks, GSM Security for applications, GPRS Security for applications, UMTS security for applications, 3G security for applications, Some of Security and authentication Solutions.

SECTION-D

Application Level Security in MANETs: MANETs, Some applications of MANETs, MANET Features, Security Challenges in MANETs, Security Attacks on MANETs, External Threats for MANET applications, Internal threats for MANET Applications, Some of the Security Solutions. Ubiquitous Computing, Need for Novel Security Schemes for UC, Security Challenges for UC, and Security Attacks on UC networks, Some of the security solutions for UC.

Text Books:

1. Man Young Rhee, “Mobile Communication Systems and Security”, John Wiley & Sons, 2009

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

Reference Books:

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

E-Resources:

1. **https://nptel.ac.in/courses/106105160**
2. **https://ocw.mit.edu/courses/1-264j-database-internet-and-systems-integration-technologies-fall-2013/7ed97701d93fa60abae3643005ac64b7_MIT1_264JF13_lect_36.pdf**

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH414B-P	SECURITY IN WIRELESS AND MOBILE COMMUNICATION	2	3	3	1	2	1	1	1	1	1	1	1	2	2	2
		3	2	1	1	2	1	1	1	1	1	1	1	1	2	3
		2	2	3	2	1	1	1	1	1	2	1	1	2	1	2

Course Title/Code	**SECURITY IN WIRELESS AND MOBILE COMMUNICATION LAB (ECH404B-P)**	
Course Type	Elective	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	The main objective of this wireless security course is to introduce the students to the field of wireless security and its importance, compare wired and wireless security, review OSI layers and state their security mechanisms, and discuss the security requirements, security vulnerabilities, and attacks in wireless.	
Course Outcomes (COs)		Mapping
1	Evaluate constraints, design challenges and security issues associated with wireless networks.	Employability
2	Acquire understanding and knowledge of security mechanisms and protocols in wireless communication networks.	Employability
3	Implement the design principles, models, mechanisms and solutions used in wireless network security to obtain authentication and key transport protocols.	Employability

Lab Experiments

1. Study of different wireless network components and features of any one of the Mobile Security Apps.
2. Study of the features of firewall in providing network security and to set Firewall Security in windows.
3. Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)
4. Study of different types of vulnerabilities for hacking a websites / Web Applications.
5. Analysis the Security Vulnerabilities of E-commerce services.
6. Analysis the security vulnerabilities of E-Mail Application

Text Books:

1. Man Young Rhee, “Mobile Communication Systems and Security”, John Wiley & Sons, 2009

2. HakimaChaouchi, Maryline Laurent-Maknavicius, “Wireless and Mobile Networks Security”,John Wiley & Sons, 2010

3. S. Kami Makki, “Mobile and Wireless Network Security and Privacy”, Springer, 2007

4. Merritt Maxim, David Pollino, “Wireless Security”, McGraw Hill Professional, 2002

Reference Books:

1. Aaron E. Earle, “Wireless Security Handbook”, CRC Press, 2010

2. Nichols, Lekkas, “Wireless Security Models, Threats, and Solutions”, McGraw-Hill

3. Aaron E. Earle ,“Wireless Security Handbook”, Auerbach

4. Steven Furnell, “Mobile Security”, IT Governance Ltd, 2009

E-Resources:

1. https://nptel.ac.in/courses/106105160

2. https://ocw.mit.edu/courses/1-264j-database-internet-and-systems-integration-technologies-fall-2013/7ed97701d93fa60abae3643005ac64b7_MIT1_264JF13_lect_36.pdf

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH404B-P	SECURITY IN WIRELESS AND MOBILE COMMUNICATION LAB	2	3	3	1	2	1	1	1	1	1	1	1	2	2	2
		3	2	1	1	2	1	1	1	1	1	1	1	1	2	3
		2	2	3	2	1	1	1	1	1	2	1	1	2	1	2

Course Title/Code	**MECHATRONICS LAB (ECH418B-P)**	
Course Type	Elective	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To design systems with integrated different domains, including a mechanical domain, electrical and electronic control domains	
Course Outcomes (COs)		Mapping
CO1	Determine various signal conditioning units, amplifiers, logic gates and their role in programmable logic controllers	Employability/Skill Development
CO2	Describe and demonstrate Mechatronics systems and overview of control systems & actuators.	Employability/Skill Development
CO3	Distinguish between various sensors, transducers and actuators and their applications.	Employability/Skill Development

Lab Experiments

I (Virtual Lab)

1. Plot the LVDT characteristics.

2. Characterize the temperature sensor (Thermocouple)

3. Demonstrate BJT CE Amplifier operation and Characteristics.

4. Practical Application Based on Logic Gates:

a. Washing machine control using basic AND & NOT gates

b. Universal NOR gate and its application in automobile alarm system

c. Seat belt warning system using basic AND & NOT gates

5. Speed Control of DC Motor

II (PLC IDEC Software)

1. PLC control system: - Basic ladder logic implementation using IDEC Software (Logic Gates).
2. Demonstration of Staircase Lightning System using PLC.
3. Demonstration of Bottle Filling System using PLC.
4. Demonstration of Automatic Car Parking System using PLC.
5. Demonstration of Elevator/Automatic Door System using PLC.
6. Virtual Project of Mechatronics on Proteus Platform.

Text Books:

1. W. Bolton, “Mechatronics – Electronic control systems in Mechanical & Electrical Engineering”, Pearson Education Ltd., 2003.

2. Nitaigour Premchand Mahalik, Mechatronics principles, concepts and applications, Tata Mc Graw Hill. Reference Books: [R1] Joji P, Pneumatic Controls, Wiley.

Reference Books:

3. David g Alciatore, Michael B Histand, “Introduction to Mechatronics and measurement systems”, Mc Graw Hill Education.

4. A Smaili, F Mrad, “Mechatronics – Integrated Technologies for Intelligent Machines, Oxford Higher Education.

E-resources:

1.https://ocw.mit.edu/courses/2-737-mechatronics-fall-2014/

2. https://onlinecourses.nptel.ac.in/noc21_me27/preview

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH418B-P	MECHATRONICS LAB	CO1	1	3	1	3	2	1	1	1	1	1	3	1	2	2
		CO2	1	2	2	2	3	2	1	2	1	1	3	1	3	3
		CO3	1	3	3	3	3	1	1	3	2	1	3	3	3	3

Course Title/Code	**THEORY OF AUTOMATA AND COMPILER DESIGN LAB (CSH311B-P)**	
Course Type	Elective	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To design systems with integrated different domains, including a mechanical domain, electrical and electronic control domains	
Course Outcomes (COs)		Mapping
CO1	Solve simple decision problems by constructing DFA and NFA over regular language as well as minimizing DFA	Employability
CO2	Demonstrate advanced knowledge of formal computation and its relationship to languages and Automata.	Employability
CO3	Demonstrate phases of compilation and the impact of language features upon the compilation process	Employability
CO4	Acquire knowledge and analyze different techniques for intermediate code and machine code optimization	Employability

List of Lab Experiments:

1. Design a lexical analyzer for given language and the lexical analyzer
2. Write a C program to identify whether a given line is a comment or not.
3. Write a C program to recognize strings under 'a', 'a*b+', 'abb'.
4. Write a C program to test whether a given identifier is valid or not.
5. Write a C program to simulate lexical analyzer for validating operators.
6. Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools
7. Write a C program for implementing the functionalities of predictive parser for the mini language
8. Write a C program for constructing of LL (1) parsing.
9. Write a C program for constructing recursive descent parsing.
10. Write a C program to implement LALR parsing.
11. Write a C program to implement operator precedence parsing.
12. Write a C program to implement Program semantic rules to calculate the expression that takes an expression with digits, + and * and computes the value.
13. Convert the BNF rules into Yacc form and write code to generate abstract syntax tree for the mini language
14. 14.Write a C program to generate machine code from abstract syntax tree generated by the parser.

Text Books:

1.Compilers Principle, Techniques & Tools - Alfread V. AHO, Ravi Sethi& J.D.Ullman; - 1998 Addison Wesley.

2.Compiler Design by O.G. Kakde, 1995, Laxmi Publ.

Reference Books:

1.Theory and practice of compiler writing, Tremblay & Sorenson, 1985, Mc. Graw Hill.

E-resources:

https://ocw.mit.edu/courses/6-045j-automata-computability-and-complexity-spring-2011/

https://onlinecourses.nptel.ac.in/noc21_cs19/preview

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSH311B-P	THEORY OF AUTOMATA AND COMPILER DESIGN LAB	CO1	1	3	1	3	2	1	1	1	1	1	3	1	2	2
		CO2	1	2	2	2	3	2	1	2	1	1	3	1	3	3
		CO3	1	3	3	3	3	1	1	3	2	1	3	3	3	3
		CO4	1	3	3	1	3	3	1	3	2	2	3	3	2	3

Course Title/Code	**BIG DATA LAB (CSH402B-P)**	
Course Type	Elective	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To design systems with integrated different domains, including a mechanical domain, electrical and electronic control domains	
Course Outcomes (COs)		Mapping
CO1	Demonstrate the knowledge of big data analytics and implement different file management task in Hadoop	Employability
CO2	Analyze and perform different operations on data using Pig Latin scripts.	Employability
CO3	Illustrate and apply different operations on relations and databases using Hive.	Employability

List of Lab Experiments

1. Analyzing Twitter data to identify trends and patterns.
2. Analyzing social media data to predict consumer behavior.
3. Analyzing web traffic data to optimize website performance.
4. Analyzing financial data to identify market trends and predict stock prices.
5. Analyzing customer data to identify buying patterns and personalize marketing efforts.
6. Analyzing sensor data from Internet of Things (IoT) devices to identify patterns and improve efficiency.
7. Analyzing genomics data to identify genetic variations and predict disease risk.
8. Analyzing text data to identify sentiment and perform natural language processing tasks.
9. Analyzing video data to identify objects and classify content.
10. Analyzing satellite data to identify trends and patterns in Earth's surface and atmosphere.

Text Books:

1. Tom White “Hadoop: The Definitive Guide” Third Edition, O’reilly Media, 2012.
2. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
3. Michael Minelli (Author), Michele Chambers (Author), AmbigaDhiraj (Author), Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications,2013.

Reference Book:

1. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill Publishing, 2012.
2. AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
3. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley &sons, 2012.
4. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007.
5. Pete Warden, “Big Data Glossary”, O’Reilly, 2011.
6. Paul Zikopoulos , Dirk deRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corrigan , Harness the Power of Big Data The IBM Big Data Platform, Tata McGraw Hill Publications, 2012.

E-resources:

1.https://ocw.mit.edu/courses/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/

2.https://onlinecourses.nptel.ac.in/noc22_cs65/preview

CO-PO Mapping

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSH402B-P	BIG DATA LAB	1	2	-	-	1	-	2	-	1	-	-	2	2	-	1
		1	-	-	-	2	-	2	-	3	1	2	3	3	2	1
		2	1	2	-	2	-	1	-	2	2	2	3	3	1	2
		1	2	-	-	2	-	2	-	2	2	1	2	3	3	1

Course Title/Code	**MOBILE COMPUTING WITH ANDROID (CSH303B-T)**	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisities	NA	
Course Objective	This course covers the fundamentals of Android programming using the Android SDK. Topics discussed in this course include: fundamental concepts in Android programming - activities and intents, designing user interface using views, data persistence, content providers, messaging and networking, location-based services, and developing android services	
Course Outcomes (COs)		Mapping
CO1	Ability to identify general programming knowledge to develop mobile applications and recall their skills of using Android software development tools.	Employability
CO2	Demonstrate the interaction between user interface and underlying application components and infrastructure.	Employability
CO3	Classify the plan and carry out a design work including developing a prototype that can be evaluated with a specified user group and illustrate the deployment of app on various mobile API level.	Employability
CO4	Have developed practical skills and knowledge to construct software for a mobile application and justify their ability to debug program/application running on mobile devices	Employability

SECTION –A

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

SECTION-B

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

SECTION-C

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

SECTION-D

MOBILE COMPUTING: Introduction to Mobile technology and generations of various wireless technology, characteristics and Application of mobile Computing. Architecture and Security Issues, Design considerations for mobile computing. Modes used for Mobile Technology, Services and Architecture of GSM and CDMA, Mobile IP

and Mobile Communication Protocol. Middleware and Gateway Required for Mobile Computing. Mobile Communication via Satellite: Low orbit satellite, Medium orbit satellite, Geo stationary satellite, Satellite phones

Text Books:

1. Lauren Darcey and Shane Conder"Android Wireless Application Development", Pearson Education, 2nd ed. (2011)

Reference Book:

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

Course Codes	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CSH303B-T	MOBILE COMPUTING WITH ANDROID	CO1	2	-	-	1	-	2	-	1	-	-	2	2	-	1
		CO2	-	-	-	2	-	2	-	3	1	2	3	3	2	1
		CO3	1	2	-	2	-	1	-	2	2	2	3	3	1	2
		CO4	2	-	-	2	-	2	-	2	2	1	2	3	3	1

ourse Title/Code	**ASIC DESIGN AND FPGA (ECH406B)**	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisities	NA	
Course Objective	To understand and learn various ASIC architectures, ASIC design flow, issues in ASIC design and testing of ASICs and SOC Design	
Course Outcomes (COs)		Mapping
CO1	The students will be able to understand basic concept about partitioning, floor planning, placement and routing including circuit extraction of ASIC.	Employability
CO2	Student will demonstrate the synthesis, Simulation and testing of systems	Employability and Skill development
CO3	Student will be able to describe the different phases of the design flow for digital ASICs	Employability
CO4	Student will be able to Categorize different types of ASIC's and explain how non-functional design constraints affect the design process	Employability

SECTION A

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

SECTION B

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

SECTION C

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

SECTION D

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

Text Books:

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

Reference Books :

1. M.J.S. Smith, ―Application Specific Integrated Circuits‖, Pearson Education, 2008
2. Wayne Wolf, ―FPGA-Based System Design‖, Prentice Hall PTR, 2009.
3. Farzad Nekoogar and Faranak Nekoogar, ―From ASICs to SOCs: A Practical Approach‖, Prentice Hall PTR, 2003.

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH406B	ASIC DESIGN AND FPGA	CO1	2	2	2	1	2	2	1	-	-	1	2	1	2	2
		CO2	2	1	2	1	2	1	2	-	-	2	2	1	2	2
		CO3	2	2	2	2	1	2	2	-	-	2	1	1	2	2
		CO4	2	2	2	1	2	2	1	-	-	1	2	2	2	2

Course Title/Code	**RF SYSTEM DESIGN (ECH407B)**	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisities	NA	
Course Objective	To understand the principle of operation of radio frequency devices and circuits and expose the RF technologies used in various applications	
Course Outcomes (COs)		Mapping
CO1	Identify the RF components based upon the applications	Employment and Skill development
CO2	Analyze the components for efficiency and range of frequencies	Skill Development
CO3	Design the components for RF applications	Entrepreneurship

SECTION A

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

SECTION B

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

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

SECTION C

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

SECTION D

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

Text Books:

1. David M. Pozar, “Microwave Engineering”, Wiley India Limited, Fourth Edition, 2012.
2. Samuel. Y. Liao, “Microwave Devices and Circuits”, Pearson Education, Third Edition, 2004

References:

1.Ludwig R, Bogdanov G, RF Circuit Design, Theory and Applications, Pearson Education Inc, Second Edition, 2013.

e-Resources (websites/Wikipedia pages/webtutorials/online courses, etc.)

1.e Book Modeling and Simulation for RF System Design by Frevert

2.Free course by Purdue University https://www.classcentral.com/course/edx-rf-system-design-21145

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ECH407B-T	RF SYSTEM DESIGN	CO1	2	2	2	2	2	2	2	-	-	2	2	2	2	3
		CO2	2	2	2	2	2	2	2	-	-	2	2	2	2	3
		CO3	2	2	2	2	2	2	2	-	-	2	2	2	2	3

Course Title/Code	**SPEECH PROCESSING AND RECOGNITION(ECH405B)**	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisities	NA	
Course Objective	The course provides an introduction to speech processing oriented to human-computer interaction, i.e. especially to speech synthesis, speech recognition and dialogue systems.	
Course Outcomes (COs)		Mapping
CO1	Record, analyze, characterize, modify, and synthesize speech (and other vocal) signals.	Employability
CO2	Apply speech analysis and synthesis technologies, explain how they work, and discuss their strengths and limitations.	Employability
CO3	Design, execute, interpret, and evaluate simple studies that utilize speech processing	Employability

SECTION A

Digital Models for The Speech Signal Process of speech production, Acoustic theory of speech production, Lossless tube models, and Digital models for speech signals.Time Domain Models for Speech Processing Time dependent processing of speech, Short time energy and average magnitude, Short time average zero crossing rate, Speech vs silence discrimination using energy & zero crossings, Pitch period estimation, Short time autocorrelation function, Short time average magnitude difference function, Pitch period estimation using autocorrelation function, Median smoothing.

SECTION B

Digital Representations of the Speech Waveform: Sampling speech signals, Instantaneous quantization, Adaptive quantization, Differential quantization, Delta Modulation, Differential PCM, Comparison of systems, direct digital code conversion. Short Time Fourier Analysis: Linear Filtering interpretation, Filter bank summation method, overlap addition method, Design of digital filter banks, Implementation using FFT, Spectrographic displays, Pitch detection, Analysis by synthesis, Analysis synthesis systems.

SECTION C

Homomorphic Speech Processing: Homomorphic systems for convolution, Complex cestrum, Pitch detection, Formant estimation, Homomorphic vocoder. Linear Predictive Coding of Speech: Basic principles of linear predictive analysis, Solution of LPC equations, Prediction error signal, Frequency domain interpretation, Relation between the various speech parameters, Synthesis of speech from linear predictive parameters, Applications. Speech Enhancement: Spectral subtraction & filtering, Harmonic filtering, parametric re-synthesis, Adaptive noise cancellation. Speech Synthesis: Principles of speech synthesis, Synthesizer methods, Synthesis of intonation, Speech synthesis for different speakers, Speech synthesis in other languages, Evaluation, Practical speech synthesis.

SECTION D

Automatic Speech Recognition: Introduction, Speech recognition vs. Speaker recognition, Signal processing and analysis methods, Pattern comparison techniques, Hidden Markov Models, Artificial Neural Networks. Audio Processing: Auditory perception and psychoacoustics - Masking, frequency and loudness perception, spatial perception, Digital Audio, Audio Coding - High quality, low-bit-rate audio coding standards, MPEG, AC- 3, Multichannel audio - Stereo, 3D binaural and Multichannel surround sound.

Text Books:

1. L. R. Rabiner and R. W. Schafer, “Digital Processing of Speech Signals", Pearson Education (Asia) Pte. Ltd., 2004.

2. D. O’Shaughnessy, “Speech Communications: Human and Machine”, Universities Press, 2001.

Reference Books:

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

e-Resources (websites/Wikipedia pages/webtutorials/online courses, etc.)

1.MIT course: Signals and Systems, for free via their OpenCourseware program http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-003-signals-and-systems-spring-2010/index.htm

2. http://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2
ECH405B	SPEECH PROCESSING AND RECOGNITION	CO1	2	2	2	2	2	1	1	1	1	1	2	2	2	3
		CO2	1	1	1	1	2	1	1	3	3	3	2	2	2	3
		CO3	1	1	1	1	3	1	2	3	3	3	3	3	3	3

Course Title/Code	**RANDOM PROCESSES FOR WIRELESS COMMUNICATION (ECH427B)**
Course Type	Elective
L-T-P Structure	3-0-0
Credits	3
Pre-requisities	NA
Course Objective	Students will be able to apply the concepts of probability and random variables/processes for characterizing several components of wireless systems such as the average transmit power, bit-error rate and behavior of the fading channel coefficient.

Course Outcomes (COs)		Mapping
CO1	Understand concepts of probability, conditional probability and independence.	Employability
CO2	Understand random variables and probability distributions.	Employability
CO3	Be familiar with some of the commonly encountered random variables, in particular the Gaussian random variable.	Employability
CO4	Be able to obtain the distributions of functions of random variables.	Employability
CO5	Be able to relate probability theory to real statistical analysis	Employability

SECTION-A

Probability basics: Sample Space and Events, Axioms of Probability, Conditional Probability - Mary-PAM Example, Independent Events - Mary-PAM Example, Independent Events – Block Transmission Example, Independent Events – Multi-antenna Fading Example.

SECTION –B

Random variables use in wireless communication: Bayes Theorem and A-posteriori Probabilities, Maximum A-posteriori Probability (MAP) Receiver, Random Variables, Probability Density Function(PDF), Application: Power of Fading Wireless Channel, Mean, Variance of Random Variables, Application: Average Delay and RMS Delay Spread of Wireless Channel.

SECTION – C

Random processes for wireless: Transformation of Random Variables and Rayleigh Fading Wireless Channel, Gaussian Random Variable and Linear Transformation, Special Case: IID Gaussian Random Variables, Application: Array Processing and Array Gain with Uniform Linear Arrays, Random Processes and Wide Sense Stationarity (WSS), WSS Example Narrowband Wireless Signal with Random Phase.

SECTION –D

Gaussian random processes for wireless: Power Spectral Density (PSD) for WSS Random Process,PSD Application in Wireless Bandwidth Required for Signal Transmission, Transmission of WSS,Random Process Through LTI System,

Special Random Processes Gaussian Process and White Noise AWGN Communication Channel, Gaussian Process Through LTI System Example: WGN Through RC Low Pass Filter.

Text Books:

1. Communication Systems by Simon Haykin, Wiley India Pvt. Ltd.

2. Fundamentals of Wireless Communication by David Tse, Cambridge University Press.

Reference Books:

1.R. Gallager, Stochastic Processes: Theory for Applications, Cambridge, 2014.

2.A. Papoulis, Probability, Random Variables, and Stochastic Processes, Mc-Graw Hill, 2005.

3.Leon-Garcia, Probability, Statistics, and Random Processes for Electrical Engineering, Third Edition, Prentice-Hall, 2008.

e-Resources

1.http://mnit-koha.informindia.co.in/cgi-bin/koha/opac-etail.pl?biblionumber=3901&shelfbrowse_itemnumber=11377

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2
ECH427B	RANDOM PROCESSES FOR WIRELESS COMMUNICATION	CO1	2	2	2	2	2	1	1	1	1	1	2	2	2	3
		CO2	1	1	1	1	2	1	1	3	3	3	2	2	2	3
		CO3	1	1	1	1	3	1	2	3	3	3	3	3	3	3
		CO4	1	1	1	1	3	1	2	3	3	3	3	3	3	3
		CO5	1	1	1	1	3	1	2	3	3	3	3	3	3	3

Course Title/Code	**NANOTECHNOLOGY (ECH413B)**	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisities	NA	
Course Objective	To understand the nature and properties of nanomaterials. To provide scientific understanding of application of nanomaterials and nanotechnology in agriculture, health and environmental conservation.	
Course Outcomes (COs)		Mapping
CO1	The students will be able to understand various classes of nanomaterials	Employability
CO2	The students will be able to understand various techniques of synthesis of nanomaterials.	Employability
CO3	The students will be able to understand various characterization techniques of nanomaterials.	Employability
CO4	The students will be able to comprehend applications of nanomaterials in different walks of life	Employability

SECTION A

Background to Nanoscience: Definition of Nano, Scientific Revolution-Atomic Structure and atomic size, emergence and challenge of nanoscience and nanotechnology, carbon age-new form of carbon (CNT to Graphene), influence of nano over micro/macro, size effects and crystals, large surface to volume ration, surface effects on the properties.

SECTION B

Types of nanostructure and properties of nanomaterials: One dimensional, Two dimensional and Three dimensional nanostructured materials, Quantum Dots shell structures, metal oxides, semiconductors, composites, mechanical-physical-chemical properties.

SECTION C

Types of Nanomaterials-Nanoclusters, Solid solutions, Thin film, Nanocomposites (Metal Oxide and Polymer based), Core Shell -Nanostructure, Buckyballs, Carbon nano tubes and, Zeolites minerals, Dendrimers, Micelles, Liposomes, Block Copolymers, Porous Materials, Metal Nanocrystals, Semiconductor nanomaterials

SECTION D

Application of Nanomaterial: Ferroelectric materials, coating, molecular electronics and nanoelectronics, biological and environmental, membrane based application, polymer based application.

Text Books:

1. Chemistry of nanomaterials: Synthesis, properties and applications by CNR Rao et.al.

2. Nanoparticles: From theory to applications – G. Schmidt, Wiley Weinheim 2004.

Reference Books:

1. Instrument E L Principe, P Gnauck and P Hoffrogge, Microscopy and Microanalysis (2005), 11: 830- 831, Cambridge University Press.

2. Processing & properties of structural naonmaterials - Leon L. Shaw, Nanochemistry: A Chemical Approach to Nanomaterials, Royal Society of Chemistry, Cambridge UK 2005.

e-Resources

https://www.classcentral.com/subject/nanotechnology

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2
ECH413B	NANOTECHNOLOGY	CO1	2	2	2	2	2	1	1	1	1	1	2	2	2	3
		CO2	1	1	1	1	2	1	1	3	3	3	2	2	2	3
		CO3	1	1	1	1	3	1	2	3	3	3	3	3	3	3

Course Title/Code	**BLOCKCHAIN DEVELOPMENT (ECH424B)**
Course Type	Elective
L-T-P Structure	3-0-0
Credits	3
Pre-requisities	NA
Course Objective	To provide conceptual understanding of the function of Block chain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.

Course Outcomes (COs)		Mapping
CO1	Describe the basic concepts and technology used for block chain.	Employability
CO2	Describe the primitives of the distributed computing and cryptography related to .	Employability
CO3	Illustrate the concepts of Bitcoin and their usage.	Employability
CO4	Implement Ethereum block chain contract.	Employability

Formatted Table

SECTION A

INTRODUCTION TO BLOCKCHAIN Block chain- Public Ledgers, Block chain as Public Ledgers -Bitcoin, Block chain 2.0, Smart Contracts, Block in a Block chain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Block chain 2.0 - Permissioned Model of Block chain, Cryptographic -Hash Function, Properties of a hash Function-Hash pointer and Merkle tree.

SECTION B

BITCOIN AND CRYPTOCURRENCY A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments-Consensus in a Bitcoin network

SECTION C

BITCOIN CONSENSUS Bitcoin Consensus, Proof of Work (PoW)- Hash cash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Block chains, Execute L T P C 3 0 0 3 87 contracts- Consensus models for permissioned block chain-Distributed consensus in closed environmentPaxos.

SECTION D

BLOCKCHAIN APPLICATIONS Internet of Things-Medical Record Management System-Block chain in Government and Blockchain Security-Blockchain Use Cases –Finance

Text Books:

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran,2017.

2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

Reference Books

1. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.

e-Resources

https://www.quicknode.com/?utm_term=blockchain%20developer&utm_campaign=Brand+%7C+Geo+

wwvfNjkheco3yEmJCkv49WQHDK4MDhzds3LEBAar5KBoCvd8QAvD_BwE

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2
ECH424B	BLOCKCHAIN DEVELOPMENT	CO1	2	2	2	2	2	1	1	1	1	1	2	2	2	3
		CO2	1	1	1	1	2	1	1	3	3	3	2	2	2	3
		CO3	1	1	1	1	3	1	2	3	3	3	3	3	3	3
		CO4	1	1	1	1	3	1	2	3	3	3	3	3	3	3

Course Title/Code	**CLOUD COMPUTING (CSH404B-T)**	
Course Type	Elective	
L-T-P Structure	3-0-0	
Credits	3	
Pre-requisities	NA	
Course Objective	To provide students with the fundamentals and essentials of Cloud Computing.	
Course Outcomes (COs)		Mapping
CO1	Understand fundamental ideas behind Cloud Computing, the evolution of the paradigm and its applicability.	Employability
CO2	Understand the key dimensions of the current and future challenges of Cloud Computing	Employability
CO3	Analyze the assessment of the economics, financial, and technological implications for selecting cloud computing for an organization.	Employability
CO4	Develop cloud application and assess cloud Storage systems and Cloud security, the risks involved, its impact	Employability
CO5	Demonstrate the understanding to know the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing.	Employability

SECTION-A

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

SECTION-B

Working with Public Clouds: Public Cloud, Public Cloud Service Models, and Public Cloud Players. Infrastructure as a Service Offerings, IaaS Vendors, PaaS offerings, PaaS vendors, Software as a Service. Implementing public cloud (one out of AWS, Windows Azure, IBM or Rackspace). Application Development: Service creation environments to develop cloud based applications. Development environments for service development; Amazon, Azure, Google App.

SECTION-C

Cloud Services Management: Reliability, availability and security of services deployed from the cloud. Performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics: Cloud Computing infrastructures available for implementing cloud based services. Cloud Infrastructure: Architectural Design of Compute and Storage Clouds - Layered Cloud Architecture Development –Design Challenges. Inter Cloud Resource Management System – Resource Provisioning and platform Deployment- Global Exchange of Cloud Resources. Future directions in Cloud Computing: Future technology trends in Cloud Computing with a focus on Cloud service models, deployment models, cloud applications, and cloud security. Migration paths for cloud, Selection criteria for cloud deployment. Current issues in cloud computing leading to future research directions.

SECTION-D

Business Clouds: Cloud Computing in Business, Various Biz Clouds focused on industry domains (Retail, Banking and Financial sector, Life Sciences, Social networking, Telecom, Education). Cloud Enablers (Business Intelligence on cloud, Big Data Analytics on Cloud)-Programming Cloud IT Model: Parallel and Distributed Programming Paradigms, Twister and Iterative Map Reduce, Hadoop Library from Apache- Mapping Applications – Programming Support of Google App Engine, Cloud Software Environments – including Eucalyptus, Open Nebula, OpenStack, Aneka and Cloud Sim.

Text Books:

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

Reference Book:

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

e-Resources:

https://analyticsindiamag.com/free-online-resources-to-get-started-on-cloud-computing

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2
CSH404BB-T	CLOUD COMPUTING	CO1	2	2	2	2	2	1	1	1	1	1	2	2	2	3
		CO2	1	1	1	1	2	1	1	3	3	3	2	2	2	3
		CO3	1	1	1	1	3	1	2	3	3	3	3	3	3	3
		CO4	1	1	1	1	3	1	2	3	3	3	3	3	3	3
		CO5	1	1	1	1	3	1	2	3	3	3	3	3	3	3

Course Title/Code	**BASICS OF ENTREPRENEURSHIP (MCS368B)**	
Course Type	Elective	
L-T-P Structure	1-0-0	
Credits	1	
Pre-requisities	NA	
Course Objective	To explain concepts of. Entrepreneurship and build an understanding about business situations in which entrepreneurs	
Course Outcomes (COs)		Mapping
CO1	Understand the fundamental concepts and applicable processes of Entrepreneurship	Employability
CO2	Examine the innovative & entrepreneurial models & their design/actualization for viability & applicability	Employability
CO3	Understand Self-discovery and entrepreneurial fervor	Employability
CO4	Analyze the entrepreneurial acumen towards mapping & application	Employability

SECTION-A

Decision to become an Entrepreneur-Introduction to entrepreneurship- Defining entrepreneurship, characteristics of successful entrepreneurs, importance of entrepreneurship, Myths about entrepreneurs, Corporate entrepreneurship, Self-Discovery & SWOT analysis, Effectuation –Meaning, Five principles of effectuation, Defining a Start-up, 4 Ps of a Startup, Reasons of Start-up failure, Basic Model of entrepreneurial process.

SECTION-B

Opportunity Discovery-Recognizing opportunities and generating Ideas, Validating the market need, identify problem worth solving using Jobs to be done(JTBD) methodology, design Thinking- Meaning, Design Thinking Values, Design Thinking Process, Double diamond approach in design thinking

SECTION-C

Customer and Solution-Customer Vs. Consumer, different market types and their specific requirements, estimate the market size, identify your customer Segment (through STP), Switching costs and psychological biases, understanding Market research for startups, Customer profile, Value proposition Canvas- understanding the jobs, pains and gains.

SECTION-D

Business Model & Validation and Business Plan-Business Model- Concept, Elements of Business Model and Lean Approach, Lean canvas template, , Blue Ocean Strategy, difference between Solution Demo and MVP, Business plan-definition and importance, components of Business plan- market, technical and financial, legal and ethical aspects in a Start-Up.

Text book:

1. Entrepreneurship: Successfully Launching New Ventures, 6th edition, Bruce R. Barringer and R Duane Ireland, Published by Pearson Copyright © 2019, 6th edition

Reference Book:

2. Hispanic-Latino Entrepreneurship
3. e-Resources:eBooks about or by Drucker

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2
MCS368B	BASICS OF ENTREPRENEURSHIP	CO1	1	1	2	2	1	2	2	3	3	3	3	3	1	1
		CO2	1	1	3	3	1	3	2	2	3	3	3	3	2	2
		CO3	1	1	2	3	1	2	2	2	3	3	3	3	2	2
		CO4	2	1	3	2	1	3	3	2	3	3	3	3	2	2

Course Title/Code	**3D PRINTING (CAD)**	
Course Type	Elective	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	NA	
Course Objective	To allow students to design and print complex designs than traditional manufacturing processes	
Course Outcomes (COs)		Mapping
CO1	Understand the design aspects of the 3D printable file.	Employability
CO2	Understanding the advantages and limitations of 3D Printing for different applications	Employability
CO3	Knowledge on 3D Printing approach and basic terminology	Employability
CO4	Knowledge on the process steps for obtaining an object using 3D Printing technology	Employability

SECTION-A

Introduction of 3D Printing, Evolution of 3D Printing, What is additive manufacturing, General procedure of 3D Printing

SECTION-B

3D CAD file formats, Stereo lithography (stl) files, Various Printing technologies (SLA, SLS, FDM, Poly jet printing, Color jet Printing, SHS, SLM, LOM, Multi jet Printing, DLP).

SECTION-C

FDM in detail, Operating Plasto 200 - Live demonstration, STL principles, Object placement.

SECTION-D

Object analysis, Slicing and printing, Print settings.

Textbooks

1. Chua C.K., Leong K.F. and LIM C.S Rapid prototyping: Principles an Applications, World Scientific publications, 3rdEd., 2010

2. D.T. Pham and S.S. Dimov, “Rapid Manufacturing”, Springer, 2001

Reference Books

1. Terry Wohlers, " Wholers Report 2000", Wohlers Associates, 2000

2. Paul F. Jacobs, " Rapid Prototyping and Manufacturing"–, ASME Press, 1996 5. Ian Gibson, Davin Rosen, Brent Stucker "Additive Manufacturing Technologies, Springer, 2nd Ed, 2014.

e-Resources (websites/Wikipedia pages/webtutorials/online courses, etc.)

1. https://nptel.ac.in/courses/112103306

2. 3D printing from zero to hero in blender 3X-3D design -Udemy

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
MEW203B	3D PRINTING (CAD)	CO1	3	3	3	1	1	1	1	1	3	3	1	1	1	1
		CO2	3	3	3	1	1	1	1	1	3	3	1	1	1	1
		CO3	3	3	3	1	1	1	1	1	3	3	1	1	1	1
		CO4	3	3	3	1	1	1	1	1	3	3	1	1	1	1

Course Title/Code	**HARDWARE VERIFICATION USING UVM (ECH421B-T)**

Course Type	CORE
L-T-P Structure	3-1-0
Credits	4
Pre-requisities	Digital hardware modeling using VERILOG
Course Objective	To provide a solid base of understanding of the System Verilog language and instruction for how to use the building blocks of System Verilog Assertions and UVM.

Course Outcomes (COs)		Mapping
CO1	Describe the features of System Verilog, SVA and basics of UVM for verification, and understand the improvements in verification efficiency.	Employability
CO2	Analyse advanced verification features, such as the practical use of classes, randomization, checking, and coverage.	Employability
CO3	Practice developing advanced coverage driven verification environments using advanced System Verilog features, SVA and UVM.	Employability

SECTION-A

System Verilog Intro -Basic Data types - Operators and System Tasks - Flow Control-Training DUT -Tasks and Functions -Arrays and Queues Methods

SECTION-B

System Verilog Classes/Interfaces-Interfaces -Class Basics -Advanced Connections-Advanced Classes -Class Based Randomization

SECTION-C

Test bench Architecture/Checking/Coverage – Test Bench Architecture- Sequence Generation -Class Based Checkers

SECTION-D

System Verilog UVM and SVA -UVM Introduction (Part I) -UVM Introduction (Part II) -Universal Methodology Concepts-SVA Introduction - Concurrent Assertions o

Reference books:

1. System Verilog For Verification: A Guide to Learning the Test bench Language Features by Chris Spear & Greg Tumbush (3rd Edition)
2. A Practical Guide to Adopting Universal Verification Methodology (UVM) by Sharon Rosenberg & Kathleen A Meade (2nd Edition)
3. The UVM Primer: A Step-by-Step Introduction to the Universal Verification Methodology by Ray Salemi

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
ECH421B-T	HARDWARE VERIFICATION USING UVM	CO1	3	3	3	1	1	1	1	1	3	3	1	1	1	1
		CO2	3	3	3	1	1	1	1	1	3	3	1	1	1	1
		CO3	3	3	3	1	1	1	1	1	3	3	1	1	1	1

Course Title/Code	**HARDWARE VERIFICATION USING UVM (ECH421B-P)**	
Course Type	CORE	
L-T-P Structure	0-0-2	
Credits	1	
Pre-requisities	Digital hardware modeling using VERILOG	
Course Objective	To provide a solid base of understanding of the System Verilog language and instruction for how to use the building blocks of System Verilog Assertions and UVM.	
Course Outcomes (COs)		Mapping
CO1	Describe the features of System Verilog, SVA and basics of UVM for verification, and understand the improvements in verification efficiency.	Employability
CO2	Analyse advanced verification features, such as the practical use of classes, randomization, checking, and coverage.	Employability
CO3	Practice developing advanced coverage driven verification environments using advanced System Verilog features, SVA and UVM.	Employability

List of Experiments

- Data Types and Programs
- Using Classes and Defining Class
- Creating a Driver Using an Interface and Clocking Blocks
- CDI Class-Based Randomization and Polymorphism
- Creating a Reusable Testbench Architecture
- Writing a Checker • Functional Coverage
- Writing Functional Coverage Code
- Implication and Boolean Operators • SVA Sequences
- Lab SVA-2: Repetition and goto Operators

CO-PO Mapping

Course Code	Course	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
ECH421B-P	HARDWARE VERIFICATION USING UVM	CO1	3	3	3	1	1	1	1	1	3	3	1	1	1	1
		CO2	3	3	3	1	1	1	1	1	3	3	1	1	1	1
		CO3	3	3	3	1	1	1	1	1	3	3	1	1	1	1

Credits

	ECE	ECE-VLSI
SEMESTER	**CREDITS ASSIGNED**	**CREDITS ASSIGNED**
I	20.5	20.5
II	23	23
III	20	21
IV	20	25
V	17	21
VI	21	26
VII	20	25
VIII	12	12
SUMMER TRAINING POST II SEM	2	2
SUMMER TRAINING POST IV SEM	2	2
SUMMER TRAINING POST VI SEM	3	3
TOTAL CREDITS	**160.5**	**180.5**

COURSE CODE	COURSES	COURSE OUTCOMES	CO STATEMENT
CHH144-T	CHEMISTRY-I	CO1	Apprehend the importance of thermodynamic properties of Gibbs free energy and entropy functions
		CO2	Describe the water chemistry, theories of corrosion and concepts of metallurgy through Ellingham diagram
		CO3	Analyse the basics of stereochemistry and the importance of green synthesis with emphasis on its twelve principles
		CO4	Analyze the importance of spectroscopic techniques and its applications in various fields to deduce structures
CHH144-P	CHEMISTRY LAB	CO1	Develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.
		CO2	Substitute metals with conducting polymers and also produce cheaper biodegradable polymers to reduce environmental pollution.
		CO3	Design economically and new methods of synthesis nano materials.
		CO4	Apply their knowledge for protection of different metals from corrosion
		CO5	Have the knowledge of converting solar energy into most needy electrical energy efficiently and economically to reduce the environmental pollution.
MAH103B	MATHEMATICS (CALCULUS AND LINEAR ALGEBRA)	CO1	Calculate radius of curvature and Evolutes. Write the Taylor series & Maclaurin series expansion of function of single variable and apply in solving other mathematical problems. Find the maximum/minimum values of a function.
		CO2	Apply the tool Fourier series for learning advanced Engineering Mathematics.
		CO3	Determine gradient vector fields and find potential functions and evaluate line integrals directly and by the fundamental theorem.
		CO4	Calculate rank and inverse of a matrix and solve system of linear equations using Cramer's Rule, Gauss elimination and Gauss Jordan method.
ECH101B-T	BASIC ELECTRICAL ENGINEERING	CO1	Analyze DC and AC circuits with different circuit elements.
		CO2	Analyze and represent various parameters of alternating quantities and determine the power in these circuits

		CO3	Transform and regulate the input power for various loads
		CO4	Inspect various Electrical machines and different modules of a back-up system.
ECH101B-P	BASIC ELECTRICAL ENGINEERING LAB	CO1	Experimentally verify the basic circuit theorems
		CO2	Apply the knowledge gained to explain the behavior of the circuit at series & parallel resonance of circuit & the effect of resonance.
		CO3	Apply the knowledge of theorems/laws to analyze the simple circuits
		CO4	Measure the operation and characteristics of AC machines and DC machines
CSH101B-T	PROGRAMMING FOR PROBLEM SOLVING USING C	CO1	Analyze and apply Test Driven Development approach to design programs.
		CO2	Apply the programming language constructs as per given problems
		CO3	Apply C programming language constructs on open source platform
		CO4	learn to work in a team using different online platform for program development
CSH101B-P	PROGRAMMING FOR PROBLEM SOLVING USING C LAB	CO1	Analyze and apply Test Driven Development approach to design programs.
		CO2	apply programming language constructs as per given problems
		CO3	apply C programming language constructs on open source platform
		CO4	learn to work in a team using different online platform for program development
MEW102B	ENGINEERING GRAPHICS AND DRAWING	CO1	Use the drawing instruments effectively and able to dimension the given figures
		CO2	Appreciate the usage of engineering curves in tracing the paths of simple machine components
		CO3	Analyse the concept of projection and acquire visualization skills, projection of points
LWS324	INDIAN CONSTITUTION	CO1	Demonstrate the knowledge and ability to analyze the basic principles of the Constitution of India;
CDS101	PROFESSIONAL	CO1	Students will be able to develop all-round personality by mastering inter-personal skills to function effectively in different circumstances.

	COMMUNICATION	CO2	Students will be able to demonstrate effective communication through grammatically correct
		CO3	Students will be able to apply effective listening and speaking skills in real life scenarios.
ECH103B-T	BASICS OF ELECTRICAL AND ELECTRONICS	CO1	Apply the fundamental concepts of Basic Electrical circuits.
		CO2	Apply the concepts and working principles of Diodes for its various applications
		CO3	Demonstrate familiarity with electronic devices viz., Transistors, Feedback Amplifiers and Oscillators and design implementation.
		CO4	Analyse and Design Operational Amplifiers and real-life applications using 555 Timer.
ECH103B T	BASICS OF ELECTRICAL AND ELECTRONICS LAB	CO1	Describe the electrical properties and characteristics of various materials, used in the electrical appliances , devices , instruments
		CO2	Design circuits using diodes and transistors
		CO3	realize circuits using opamps
SEMESTER-II			
PHH102B-T	PHYSICS FOR ENGINEERS	CO1	Students would be able to describe semiconductors, fermi level, and various types of diodes and demonstrate its applications in electronics.
		CO2	Measure various parameters using CRO
		CO3	Calculate electrical parameters using various measurement techniques
		CO4	Analyze the Electromagnetic Wave equation and its applications
PHH102B-P	PHYSICS FOR ENGINEERS LAB	CO1	Students will be able to analyze various characteristics of the semiconductor devices and circuits.
		CO2	Demonstrate the working of electronic components and devices.
		CO3	Students will be able to measure component values and parameters of the circuits using different measuring devices
		CO4	Apply the knowledge in designing the application based projects.
MAH106B	MATHEMATICS – II (DIFFERENTIAL	CO1	Solve ordinary differential equations(ODE)
		CO2	Apply the tool of power series for learning advanced Engineering Mathematics.

	EQUATIONS)	CO3	Find roots of polynomial and transcendental equations by using numerical techniques.
		CO4	Identify and impute the interpolating polynomial for equispaced and unequi spaced intervals
ECH102B-T	BASIC ELECTRONICS	CO1	Demonstrate the working principle, operation and applications of various types of diodes and special diodes.
		CO2	Differentiate and analyze the working of various transistors
		CO3	List, analyze and design various feedback amplifiers.
ECH102B-P	BASIC ELECTRONICS LAB	CO1	Demonstrate the working of electronic components and various measuring instruments.
		CO2	Analyze the characteristics of diode and implement its various applications
		CO3	Analyze the characteristics of a Transistor in various configurations and their applications
		CO4	Design the oscillator circuits to produce oscillations of desired frequencies and implementation of logic gates.
EDS288	APPLIED PHILOSOPHY	CO1	Examine the philosophical problems implicit in the experience of self, others and the society
		CO2	Explore the philosophy of influential philosophers with respect to society, Science and success in life
		CO3	Demonstrate the understanding of the concepts and theories of moral philosophy.
		CO4	Reflect philosophically and ethically on one's own personal, professional and civic lives.
EDS289	APPLIED PSYCHOLOGY	CO1	Develop critical thinking to understand the application of psychology
		CO2	Identify the impact of Stereotyping, prejudice and discrimination in formation of attitude
		CO3	Identify major attributes of Personality.
		CO4	Understand social psychology and able to solve the inflicts among the group
EDS290	APPLLIED SOCIOLOGY	CO1	analyze the social cultural dynamics that contribute to transformation of Indian Society
		CO2	Develop the necessary skills of social processes which affect our everyday lives.

		CO3	Study and analyze various temporary issues of society and able to provide solutions of social barrier and benefiting the masses.
		CO4	develop basic research skills in the area of sociology and help to find possible solution of specific social barriers of the society
HLS104B	PROFESSIONAL ENGLISH-ADVANCE	CO1	To communicate articulately.
		CO2	To show the basics of presentation skills.
		CO3	To exhibit substantive writing skills.
		CO4	To demonstrate the procedure of debating skills.
		CO5	To display the developed critical aptitude.
HLS103B	PROFESSIONAL ENGLISH-BASIC	CO1	To demonstrate the basic skills of effective communication
		CO2	To build an elementary understanding of form, meaning and use of words in varied dis uses.
		CO3	To equip them with fundamental writing skills.
		CO4	To show the essentials of debating skills.
		CO5	To exhibit creative thinking.
CHH137	ENVIRONMENTAL SCIENCE	CO1	Explain the multidisciplinary dimensions of environmental issues and suggest potential solutions
		CO2	Discuss about the various types of organisms and draw inferences about their interactions in different e systems
ECH106B-T	ELECTRONIC DEVICES & CIRCUITS	CO1	To apply the fundamental concepts of Basic Electronics circuits.
		CO2	Characterize & apply the concepts and working principles of various diodes for real time applications
		CO3	Demonstrate the implementation of transistors and FETs in various circuits
		CO4	To demonstrate the circuit of power supplies and voltage regulators
ECH106B-P	ELECTRONIC DEVICES & CIRCUITS LAB	CO1	Demonstrate the working of electronic components and various measuring instruments.
		CO2	Analyze the characteristics of diode and implement its various applications
		CO3	Analyze the characteristics of Transistors and their applications

		CO4	To demonstrate the circuit of power supplies and voltage regulators and apply the knowledge in designing an Application based Project
CSH112B	INTRODUCTION TO DATA STRUCTURE	CO1	To understand the concept of Dynamic memory management, algorithms and their complexity; demonstrate the abstract properties and operations of Linear data structures (using Static Memory Allocation) : Array ; To apply different Searching and Sorting algorithms.
		CO2	Demonstrate the abstract properties and operations of Linear data structures (using Dynamic Memory Allocation) : Link List and variations of Linked List.
		CO3	Demonstrate the abstract properties and operations of Linear data structures (using Static & Dynamic Memory Allocation) : Stacks, Queues
		CO4	Demonstrate the abstract properties and operations of Non Linear data structures (using Static & Dynamic Memory Allocation) : Trees, Graphs
ECH202B-T	NETWORK THEORY	CO1	A thorough understanding of the fundamental concepts and techniques used in the two-port network terminology.
		CO2	Analyze the transient behavior of electrical networks for various excitations.
		CO3	Analyze different types of filter configuration and Synthesize any filter configuration within a reasonable percentage error.
		CO4	Design the synthesized circuit with practical parts
ECH202B-P	NETWORK THEORY LAB	CO1	To describe and demonstrate the fundamental concepts and techniques used in the two-port network terminology.
		CO2	To analyze the electrical networks using transient analysis for various excitations.
		CO3	To design and analyze different types of filter configuration and Synthesize any filter configuration within a reasonable percentage error.
ECH203B-T	ANALOG ELECTRONICS	CO1	Understand the working of transistor as an amplifier at low and high frequency and do the analysis of single and multistage amplifiers
		CO2	Comprehend the applications of Field effect transistor amplifier.
		CO3	Appreciate the working of power amplifier circuits and Oscillators and implement various designs
		CO4	Visualize the working of operational amplifiers and will be able to demonstrate the same on various applications
ECH203B-P	ANALOG ELECTRONICS LAB	CO1	To describe the operation of the transistor as an amplifier at low and high frequencies and to analyze single-stage and multistage amplifiers.
		CO2	To comprehend the working of FETs and apply it for FET amplifier

			applications.
		CO3	Analyze the operation of power amplifier circuits and oscillators to design circuits for various applications
		CO4	Visualize the operation of operational amplifiers and be able to show it in a variety of applications
ECH204B-T	SIGNALS AND SYSTEMS	CO1	Differentiate between signal types and determine various properties of practical systems
		CO2	Determine the behavior and shape of a signal in frequency domain
		CO3	Characterize and analyze the response of the LTI system to test signals
		CO4	Classify continuous and discrete time signals and illustrate the convergence of discrete time signals
		CO5	Transform signals (both in continuous and discrete time) into more recognizable form of frequency domain for analysis of communication.
ECH208B-T	DIGITAL ELECTRONICS	CO1	Apply the fundamental concepts, techniques and applications of Number Systems and Codes used in digital electronics.
		CO2	Analyse and design various Combinational circuits.
		CO3	Analyse and design various Sequential circuits
		CO4	Describe how analog signals are used to represent digital values in different logic families.
ECH208B-P	DIGITAL ELECTRONICS LAB	CO1	To comprehend and implement the essential principles, techniques, and applications of Number Systems and Codes as they pertain to digital electronics.
		CO2	To design and analyze various Combinational circuits.
		CO3	To design and analyze various Sequential circuits.
		CO4	To demonstrate and interpret the digital signals from analog signals in various logic families.
RDO501	INTRODUCTION TO RESEARCH	CO1	The student shall be able to describe research and its impact.
		CO2	The student shall be able to identify broad area of research, analyze, the processes and procedures to Carryout research
		CO3	The student shall be able to use different tools for literature survey
		CO4	The student is able choose specific area of research and supervisor/mentor is finalized

FLS101	SPANISH-I	CO1	Students will be able to greet each other.
		CO2	Students will be able to make sentences with the verb ser. They will be able to use verb ser with nationality and professions.
		CO3	Students will be able to learn cardinal and ordinal numbers.
		CO4	Students will be able to recognize masculine and feminine words in Spanish. They will be learning the articles and its usages with nouns.
FLS103	FRENCH-I	CO1	Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.
		CO2	Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary.
		CO3	Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.
		CO4	Students will be able to understand audio text and comprehend to the same. They will be able to form paragraph using auxiliary verb and basic verbs.
FLS102	GERMAN-I	CO1	Students will be able to exchange greetings and introductions using formal and informal expressions. They will be able to ask and answer simple questions.
		CO2	Students will be able to discuss restaurant vocabulary, using simple sentences.
		CO3	Students will be able to discuss likes and dislikes, understand simple conversations (e.g., greetings, and daily activities).
		CO4	Students will be able to differentiate certain patterns of behavior in the cultures of the German- speaking world and the student's native culture.
		CO5	Students will be able to exchange greetings and introductions using formal and informal expressions. They will be able to ask and answer simple questions.
CDO201	PROFESSIONAL COMPETANCY ENHANCEMENT-I	CO1	Students will become better at analytics and problem solving
		CO2	Students will be able to solve aptitude problems quickly utilizing the short cuts
		CO3	Students will have enhanced level of reasoning, numerical skills and speed
		CO4	Students will have the ability to 'quickly think on their feet'
		CO5	Students will have enhanced concentration & thinking ability.

ECW107B	Programming Fundamentals using Linux	CO1	To analyze the semantics of the given problem statement and illustrate the programming techniques to solve them
		CO2	To integrate the learned and applied concepts into given LINUX projects to produce real life solutions
ECH206B	ELECTROMAGNETIC FIELD AND WAVES	CO1	Analyze the transmission lines and their parameters using the Smith Chart
		CO2	Describe the depth of static and time-varying electromagnetic field as governed by Maxwell's equations
		CO3	Formulate and analyze problems involving lossy media with planar boundaries using uniform plane waves.
		CO4	Apply concepts of this subject in Antenna Engineering and its applications.
ECH207B-T	ANALOG & DIGITAL COMMUNICATION	CO1	Apply the knowledge of signals and transformation to study different modulation techniques.
		CO2	Identify and implement the modulation techniques required for analog and digital communication.
		CO3	Implement analog to digital conversion and examine the techniques for reducing the error produced in this process.
		CO4	Analyze the effect of distortion and noise on a communication system.
ECH207B-P	ANALOG & DIGITAL COMMUNICATION LAB	CO1	Demonstration of generation and detection of analog modulation techniques using MATLab..
		CO2	Compare the different analog modulation techniques.
		CO3	Analyze digital modulation techniques by using MATLab tools.
		CO4	Analyze different techniques in modern digital communications, in particular in source coding using MATLab tools.
ECH215B-T	MICROPROCESSOR AND INTERFACING	CO1	To develop assembly language program for microprocessors and microcontrollers.
		CO2	To comprehend the architectural and pipelining concepts for Microprocessors.
		CO3	To interface peripherals, sensors and actuators and in embedded systems.
		CO4	To design microprocessor based system.
ECH215B-P	MICROPRO	CO1	Design and implement programs on 8085 microprocessors.

	CESSOR AND INTERFACING LAB	CO2	Design interfacing circuits with 8085 microprocessors.
		CO3	Design and implement programs on 8086 microprocessors.
		CO4	Design and implement programs on 8086 microprocessors.
ECH209B-T	VLSI DESIGN	CO1	Understand different steps involved in the fabrication of ICs using MOS transistor, CMOS/BiCMOS transistors and passive components.
		CO2	Analyse and formulate the circuit characterization and performance estimation for an integrated circuit.
		CO3	Formulate and analyse the performance of various inverter structure through pull-up to pull-down ratios.
		CO4	Apply the concept of this subject for designing combinational logic circuits using CMOS.
FLS105	SPANISH-II	CO1	.Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.
		CO2	.Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed.
		CO3	Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.
		CO4	Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary. Provide basic information about familiar situations and topics of interest.
		CO5	Express or/and justify opinions using equivalents of different verbs. Differentiate certain patterns of behavior in the cultures of the Spanish-speaking world and the student's native culture.
		CO6	Describe various places, location, themselves using simple sentences and vocabulary.
FLS106	GERMAN-II	CO1	Students will be able to write short essays on family and friends. They will have knowledge of
		CO2	Tenses.
		CO3	Students will be able to identify classroom vocabulary in the German language

		CO4	Students will be able to speak ordinal and cardinal numbers and they will also learn months, days in German
		CO5	They will be able to express or/and justify opinions using equivalents of different verbs
		CO6	They will be able to express or/and justify opinions using equivalents of different verbs.
FLS107	FRENCH-II	CO1	.Exchange greetings and do introductions using formal and informal expressions. Understand and use interrogative and answer simple questions.
		CO2	Learn Basic vocabulary that can be used to discuss everyday life and daily routines, using simple sentences and familiar vocabulary. Express their likes and dislikes. Also will have understanding of simple conversations about familiar topics (e.g., greetings, weather and daily activities,) with repetition when needed.
		CO3	Identify key details in a short, highly-contextualized audio text dealing with a familiar topic, relying on repetition and extra linguistic support when needed. Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary.
		CO4	Describe themselves, other people, familiar places and objects in short discourse using simple sentences and basic vocabulary. Provide basic information about familiar situations and topics of interest.
		CO5	Express Gorand justify opinions using equivalents of different verbs. Differentiate certain patterns of behavior in the cultures of the French-speaking world and the student's native culture.
		CO6	Describe various places, location, themselves using simple sentences and vocabulary.
CSW208B	Programming for Problem Solving using Python	CO1	Analyze the concept of Dynamic memory management, algorithms and their complexity; demonstrate the abstract properties and operations of Linear data structures (using Static Memory Allocation) : Array ; To apply different Searching and Sorting algorithms.
		CO2	Demonstrate the abstract properties and operations of Linear data structures (using Dynamic Memory Allocation) : Link List and variations of Linked List.
		CO3	Demonstrate the abstract properties and operations of Linear data structures (using Static & Dynamic Memory Allocation) : Stacks, Queues
		CO4	Demonstrate the abstract properties and operations of Non Linear data structures (using Static & Dynamic Memory Allocation) : Trees, Graphs
ECH214B-T	DIGTAL HARDWAR	CO1	Understand the design units of VHDL and implementation of circuits using different modelling styles.

	E MODELLING USING VHDL	CO2	Understand the implementation of circuits using Behavioral Modelling, concept of Delays, Dataflow Modelling and the concept of Resolution Function.
		CO3	Implementation of combinational and sequential circuits using VHDL.
		CO4	Analysis of FSM and Test bench and Logic of several PLDs.
ECH214B-P	DIGTAL HARDWARE MODELLING USING VHDL LAB	CO1	Designing digital circuits, behavioral and RTL modeling of digital circuits using Verilog HDL
		CO2	Verifying these models and synthesizing RTL models to standard cell libraries and FPGAs
		CO3	Designing, modeling, implementing and verifying combinational and sequential circuits using VHDL.
		CO4	Analysis of FSM and Test bench and Logic of several PLDs.
CDO202	PROFESSIONAL COMPETANCY ENHANCEMENT-II	CO1	To improve students basic knowledge about Arithmetic Aptitude
		CO2	To make students solve aptitude problems quickly utilizing the short cuts
		CO3	To make students have the ability to 'quickly think on their feet'
		CO4	To strengthen students communication skills
ECH326B-T	MICROCONTROLLERS & INTERFACING	CO1	Describe the concept of microcontrollers and methods of programming the same.
		CO2	Students will be able to differentiate between the various addressing modes and work on the various instruction set.
		CO3	Analyse the working of 8051 Microcontroller by knowing its architecture, addressing modes and interrupts.
		CO4	Students will be able to build microcontroller-based system around 8051 and PIC.
ECH326B-P	MICROCONTROLLERS & INTERFACING LAB	CO1	To demonstrate the microcontroller using 8051 controller and evaluate on various parameters
		CO2	Demonstrate Interfacing of peripherals to microcontroller.
		CO3	Demonstrate data collection and acquisition using 8051 microcontroller
		CO4	Design real world applications using microcontrollers
ECH234B-T	HARDWARE	CO1	use System Verilog RTL design and synthesis features, including new data types, literals, procedural blocks, statements, and operators,

	VERIFICATION USING SYSTEM VERILOG		relaxation of Verilog language rules.
		CO2	Analyze synthesis issues, enhancements to tasks and functions, new hierarchy and connectivity features, and interfaces.
		CO3	Appreciate and apply the System Verilog verification features, including classes, constrained random stimulus, coverage, strings, queues and dynamic arrays.
		CO4	Utilize the features of system Verilog for more effective and efficient verification.
ECH234B-P	HARDWARE VERIFICATION USING SYSTEM VERILOG LAB	CO1	Apply System Verilog verification features, including classes, constrained random stimulus, coverage, strings, queues and dynamic arrays, and learn how to utilize these features for more effective and efficient verification.
		CO2	Synthesis features, including new data types, literals, procedural blocks, statements, and operators, relaxation of Verilog language rules, fixes for synthesis issues, enhancements to tasks and functions, new hierarchy and connectivity features, and interfaces.
ECH314B-T	CMOS VLSI DESIGN	CO1	Analyze complex microelectronics circuits and systems
		CO2	Design layout and schematics related with various CMOS based application
		CO3	Analyzing combinational circuits based on CMOS by understanding their working principles
		CO4	Analyze the performance issues & inherent trade off involved in system design.
ECH314B-P	CMOS VLSI DESIGN LAB.	CO1	Design combinational circuits using VLSI designing Platforms like Tanner
		CO2	Design layout and schematics related with various CMOS based application
		CO3	Design and analyze sequential circuits using VLSI designing Platforms like Tanner
		CO4	Implementing the VLSI design for real time problems.
ECH401B-T	INFORMATION THEORY AND CODING	CO1	Design the channel performance using Information theory
		CO2	Comprehend various error control code properties
		CO3	Apply linear block codes for error detection and correction

		CO4	Design BCH & RS codes for Channel performance improvement against burst errors.
ECH401B-P	INFORMATION THEORY AND CODING LAB	CO1	Explain what is the significance of this quantitative measure of information in the communications systems
		CO2	decide an efficient data compression scheme for a given information source
		CO3	calculate entropy, joint entropy, relative entropy, conditional entropy, and channel capacity of a system
		CO4	Describe the theoretical framework upon which error-control codes are built
ECH403B-T	WIRELESS SENSOR NETWORKS	CO1	Explain the concept of Wireless Sensor Networks by studying the architecture of a single node
		CO2	Differentiate and understand the various routing protocols for ad-hoc wireless networks
		CO3	Describe the concept of MAC protocols in Wireless Sensor Networks and identify devices based on these MAC standards
		CO4	Analyse design constraints and challenges in WSN like network lifetime, security, and analyzing a few networks through simulations.
ECH403B-P	WIRELESS SENSOR NETWORKS LAB	CO1	Data sensing and analysis using platform like MKR1000
		CO2	Demonstrate data exchange for MKR1000
		CO3	Demonstrating audio data and analyzing the parameters.
		CO4	Analyzing a few networks through simulations and implementing for real time problems.
CSH201B-T	OOPS USING JAVA	CO1	Explain the concept of Object Oriented Programming with introduction to JAVA.
		CO2	Describe the principles of Inheritance and encapsulation and use them to create public and private classes and member functions.
		CO3	Explain the concept of exception handling in JAVA and also learn about the various API packages.
		CO4	Quantify the challenges in JAVA programming by understanding the features of applets and Input Output streams.
CSH201B-P	OOPS USING JAVA LAB	CO1	Demonstrating the syntax using concepts
		CO2	Demonstrating the interfaces and packages

		CO3	To analyze the semantics of the given problem statement and illustrate the programming techniques to solve them.
		CO4	To integrate the learned and applied concepts into given java projects to produce real life solutions.
ECH305B-T	INTERNET OF THINGS	CO1	Describe the fundamentals of IoT and to identify the IoT networking components
		CO2	Select IoT protocols and software.
		CO3	Build schematic for IoT solutions
		CO4	Design a simple IoT system made up of sensors, wireless network connection, data analytics and display/actuators, and write the necessary control software.
ECH305B-P	INTERNET OF THINGS LAB	CO1	To disseminate the design knowledge in analyzing the specific requirements for applications in sensors regarding energy supply, memory, processing, and transmission capacity
		CO2	Proactive in understating the routing protocols function and their implications on data transmission delay and bandwidth
		CO3	Familiarize the protocol, design requirements, suitable algorithms, and the state-of-the-art cloud platform to meet the industrial requirement.
		CO4	On a profound level to implement hardware & software for wireless sensor networks in day to day life
ECH327B-T	Prototyping IOT based healthcare systems.	CO1	Analyze the requirements and applications of IOT in healthcare.
		CO2	Design prototypes of wireless and wearable devices for healthcare diagnosis and care.
ECH327B-P	Prototyping IOT based healthcare systems LAB	CO1	Demonstrate the protocol requirements of IOT in healthcare.
		CO2	Students will be able to design prototypes of wireless and wearable devices for healthcare diagnosis and care.
CSH310B-T	Artificial Intelligence	CO1	Analysis of problem solving, knowledge and reasoning.
		CO2	Apply difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing
		CO3	Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques..
		CO4	Examine the issues involved in knowledge bases, reasoning systems and planning.

CSH310B-P	Artificial Intelligence LAB	CO1	Analysis of problem solving, knowledge and reasoning.
		CO2	Apply difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing
		CO3	Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques..
		CO4	Examine the issues involved in knowledge bases, reasoning systems and planning.
MCS231	BASICS OF ECONOMICS	CO1	Describe the concept with definitions of Economics and the laws of utilities associated with it
		CO2	Analyse the concept for demand and supply and the laws governing the elasticity of demand and supply.
		CO3	Identify the factors affecting the production and differentiate between the various types of costs involved in the factory environment.
		CO4	Analyse the different types of markets and apply the features of markets to understand the role of supply and demand.
MCS232	Fundamentals of Finance	CO1	Describe of the fundamental concepts of Financial Management and Financial system.
		CO2	Analyse the Financial statements and apply the knowledge in decision making.
		CO3	Identify the sources for raising capital in Business(s) and analyze.
		CO4	Identify different techniques of capital budgeting.
CDO202-P	PROFESSIONAL COMPETANCY ENHANCEMENT-II	CO1	To improve student's basic knowledge about Arithmetic Aptitude
		CO2	Solve aptitude problems quickly utilizing the short cuts, quick thinking and good communication skills
ECW210B	ALTAIR WORKSHOP	CO1	To perform math calculations, manipulating, and visualizing data
		CO2	solve typical engineering related mathematical tasks
ECH309B-T	DIGITAL SYSTEM DESIGN	CO1	Describe the design units of VHDL and implementation of circuits using different modelling styles.
		CO2	Implement circuits using Behavioral Modelling, concept of Delays, Dataflow Modelling and the concept of Resolution Function.
		CO3	Implementation of combinational and sequential circuits using VHDL.

		CO4	Analysis of FSM and Test bench and Logic of several PLDs.
ECH309B-P	DIGITAL SYSTEM DESIGN LAB	CO1	Analyze the operation of medium complexity standard combinational circuits like the encoder, decoder.
		CO2	Analyze the operation of medium complexity standard combinational circuits like the multiplexer, demultiplexers.
		CO3	Design complex digital system such as ALU.
		CO4	Develop and simulate register-level models of hierarchical digital systems
ECH310B-T	NEURAL NETWORK AND FUZZY LOGIC	CO1	Describe the elementary concepts of neural networks, categorize different neural network architectures, algorithms, applications and their limitations.
		CO2	Comprehend the concepts of feed forward neural networks and appropriate learning rules for each of the architectures
		CO3	Realize the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory
		CO4	Analyze the application of fuzzy logic control to real time systems.
ECH310B-P	NEURAL NETWORK AND FUZZY LOGIC LAB	CO1	Select appropriate neural network architectures for a given application (i.e. they shall recognize the class of applications and relate it to specific architectures).
		CO2	Design and implement a neural network simulation (with two modes of operation: learning and processing) using a high-level language
		CO3	Develop models for different applications using fuzzy system and Matlab.
		CO4	Analyze the application of fuzzy logic control to real time systems
ECH316B-T	WAVELETS AND MULTIRATE SYSTEM	CO1	Characterize continuous and discrete wavelet transforms
		CO2	Apply multi resolution analysis
		CO3	Identify various wavelets and evaluate their time- frequency resolution properties
ECH302B-T	DIGITAL SIGNAL AND IMAGE PROCESSING	CO1	Analyze images in the frequency domain using various transforms
		CO2	Analyze images in the frequency domain using various transforms
		CO3	Interpret signal and image segmentation and representation techniques

ECH302B-P	DIGITAL SIGNAL AND IMAGE PROCESSING	CO1	Assess the techniques, skills, and modern engineering tools necessary for analysis of different electrical signals and filtering out noise signals in engineering practice
		CO2	Design digital filters using various techniques
		CO3	Implement different signal and image processing techniques.
ECH304B-T	CONTROL SYSTEMS	CO1	To represent and demonstrate the electrical modeling of mechanical systems and various reduction techniques.
		CO2	Analyses the time and frequency-domain responses of first and second-order systems to various inputs.
		CO3	Apply root locus and frequency domain techniques to design a feedback control system to meet specific performance requirements.
		CO4	Synthesize control system models on state space models and express state transition matrix for the calculation of variables.
ECH419B-T	PLC PROGRAMMING AND APPLICATIONS	CO1	Describe typical components, basic concepts and I/O devices of a PLC
		CO2	Apply the concept of electrical ladder logic, its history, and its relationship to programmed PLC instruction.
		CO3	Design and program PLC circuits for various real time PLC applications.
		CO4	Demonstrate the use of PLC timers and counters for the control of industrial processes
ECH419B-P	PLC PROGRAMMING AND APPLICATIONS LAB	CO1	Use timer, counter, and other intermediate programming functions.
		CO2	Design and program basic PLC circuits for entry-level PLC applications.
		CO3	Design and program a small, automated industrial production line.
ECH321B-T	HEALTH CARE SYSTEMS (DESIGN AND ANALYSIS	CO1	Demonstrate the applications of knowledge of the requirements, design, and control of major business processes that are integral within a healthcare enterprise system including registration, order entry and result reporting, clinical documentation, scheduling and patient billing.
		CO2	Demonstrate the applications of knowledge systems analysis & design methodologies and techniques including: requirement analysis, development strategies, project management, and system implementation / operation.
		CO3	Demonstrate the applications of knowledge of control and audit of healthcare information systems including: controls for privacy and confidentiality, controls for computer crimes (fraud and abuse) and systems reliability (information security, processing integrity, and availability.)

ECH322B-T	BIOMEDICAL SIGNAL PROCESSING	CO1	Possess the basic mathematical, scientific and computational skills necessary to analyze ECG and EEG signals.
		CO2	Apply classical and modern filtering and compression techniques for ECG and EEG signals
		CO3	Develop a thorough understanding on basics of ECG and EEG feature extraction.
ECH322B-P	BIOMEDICAL SIGNAL PROCESSING LAB	CO1	Implement algorithms based on discrete time signals.
		CO2	Apply appropriate signal processing techniques in analyzing various bio signals
		CO3	Design IIR and FIR filters for bio-signal processing.
LWS323	CYBER LAW	CO1	Describe the concept of Cybercrimes and cyber Law
		CO2	Critically analyses the problems arising out of online transactions and find solutions
		CO3	Analyze Intellectual Property issues in the cyber space and apply relevant laws to protect or fight infringement
		CO4	Explain Information Technology Act 2000 and critically analyze various sections to apply such laws appropriately
LWS321	LAWS RELATING TO INTELLECTUAL PROPERTY	CO1	Describe the basics of Intellectual Property Rights
		CO2	Categorize different types of intellectual properties
		CO3	Recognize the crucial role of intellectual property in different industries
		CO4	Explain the procedural aspect pertaining to application and grant of patent, trademark, geographical indication etc
CDO302	PROFESSIONAL COMPETANCY RNHANCEMENT-IV	CO1	To strengthen students Modern Math concepts
		CO2	To help students perform well during placements
		CO3	To help students get proficient with problem solving at various levels like basic, intermediate and advanced
		CO4	To help students with shortcuts to problem solving
		CO5	To improve students communication skills
CHH137	ENVIRONMENTAL	CO1	Explain the multidisciplinary dimensions of environmental issues and suggest potential solutions

	SCIENCE	CO2	Discuss about the various types of organisms and draw inferences about their interactions in different e systems
ECH426B-T	WIRELESS AND MOBILE COMMUNICATION	CO1	Comprehend various standards, technologies and architecture used in Analog and Digital Mobile Radio systems.
		CO2	Describe various mechanisms of propagation and fading in mobile radio channels and their impact on designing the radio systems.
		CO3	Comprehend various concepts of equalization and diversity techniques and their applications in designing the mobile radio systems.
		CO4	Appreciate the system design concept in wireless radio systems and their applications in wireless communication.
ECH426B-P	WIRELESS AND MOBILE COMMUNICATION LAB	CO1	Develop ad-hoc network applications using appropriate algorithms/protocols.
		CO2	Develop ad-hoc network applications using appropriate algorithms/protocols.
		CO3	Identify and simulate the medium access control mechanisms suitable for given applications.
ECH315B-T	DATA COMMUNICATION	CO1	Understand and Analyze the basics of data communication, networking, internet and their importance.
		CO2	Differentiate wired and wireless computer networks
		CO3	Analyze TCP/IP their protocols and multiplexing.
		CO4	Recognize the different internet devices and their functions.
ECH317B	EMBEDDED SYSTEM DESIGN	CO1	Develop real time systems that are highly time bounded.
		CO2	Apply various real time algorithms in building embedded systems.
		CO3	Implement the RTOS development tools in building real time embedded systems.
ECH411B-P	MICROWAVE AND RADAR ENGINEERING	CO1	Identify the Microwave components based upon the applications
		CO2	Analyze the components for efficiency and range of frequencies
		CO3	Design the components for Microwave applications
ECH411B-P	VLSI TESTING	CO1	Apply the concepts in testing which can help them design a better yield in IC design.
		CO2	Characterize & Apply the concepts and working principles of Diodes for its various applications

		CO3	Demonstrate familiarity with electronic devices viz., Transistors, Feedback Amplifiers and Oscillators and design implementation.
		CO4	Analyse and Design Operational Amplifiers and real-life applications using 555 Timer
ECH412B-P	MEMS	CO1	The students will be able to understand the basic concepts of MEMS and Microsystems.
		CO2	The students will be able to know various materials used for MEMS Fabrications.
		CO3	The students will be able to appreciate various steps involved in the fabrication of MEMS.
		CO4	The students will be able to appreciate various steps involved in the fabrication of MEMS.
ECH413B-P	DIGITAL IMAGE PROCESSING AND COMPUTER VISION	CO1	Develop and apply computer vision techniques for solving practical problems
		CO2	Choose appropriate image processing methods for image filtering, image restoration, image reconstruction, segmentation, classification and representation,
		CO3	Implement and test the techniques and algorithms studied
ECH418B-P	MECHATRONICS	CO1	Describe the operation, working, importance of Electronic Sensors, their selection criteria and characterize their various applications in the design of mechatronics systems
		CO2	Analyse various electronic, electrical and mechanical systems, their interconnection and apply the gained knowledge in the field of Mechanical Engineering.
		CO3	Develop and design controllers with the help of programming and its implementation on applications of real-life systems.
		CO4	Integrate mechanical, electronics, control and computer engineering in the design, building, interfacing and actuation of mechatronics systems for a set of specifications.
CSH311B-T	THEORY OF AUTOMATA AND COMPILER DESIGN	CO1	Solve simple decision problems by constructing DFA and NFA over regular language as well as minimizing DFA
		CO2	Demonstrate advanced knowledge of formal computation and its relationship to languages and Automata.
		CO3	Demonstrate phases of compilation and the impact of language features upon the compilation process
		CO4	Acquire knowledge and analyze different techniques for intermediate code and machine code optimization

CSH402B-T	BIG DATA	CO1	Know the fundamentals of Big data and Big data Frameworks that makes it useful to solve real world problems
		CO2	Demonstrate the understanding of Big data programming using Hadoop
		CO3	Apply the knowledge to perform Big data analytics using NoSQL Databases
		CO4	Analyze the performance of various frameworks for Business Intelligence
		CO5	Design solutions to a range of complex real world problems
ECH411B-P	MICROWAVE AND RADAR ENGINEERING LAB	CO1	Analyze typical microwave networks using impedance, admittance, transmission and scattering matrix representations.
		CO2	Design microwave matching networks using L section, single and double stub and quarter wave transformer
		CO3	Perform measurements on microwave devices and networks using power meter and VNA.
ECH411B-P	VLSI TESTING LAB	CO1	Design CMOS logic circuits
		CO2	simulate circuits within a CAD tool and compare to design specifications
		CO3	Design, implement, and simulate circuits using VHDL.4. Write machine language programs and assembly language programs for the simple computer.
ECH412B-P	MEMS LAB	CO1	Apply the knowledge of sensing and transduction mechanisms to design different MEMS devices..
		CO2	identify the necessity of fabrication steps of the different MEMS devices
		CO3	identify the necessity of fabrication steps of the different MEMS devices in micro sensors .
		CO4	The students will be able to appreciate various steps involved in the fabrication of MEMS.
ECH413B-P	DIGITAL IMAGE PROCESSING AND COMPUTER VISION LAB	CO1	Develop any image processing application.
		CO2	Apply feature extraction techniques for image analysis and recognition
		CO3	Implement image compression and to learn the spatial and frequency domain techniques of image compression.
ECH414B-P	SECURITY IN	CO1	Evaluate constraints, design challenges and security issues associated with wireless networks.

	WIRELESS AND MOBILE COMMUNICATION LAB	CO2	Acquire understanding and knowledge of security mechanisms and protocols in wireless communication networks.
		CO3	Implement the design principles, models, mechanisms and solutions used in wireless network security to obtain authentication and key transport protocols.
ECH418B-P	SECURITY MECHATRONICS LAB	CO1	Determine various signal conditioning units, amplifiers, logic gates and their role in programmable logic controllers
		CO2	Describe and demonstrate Mechatronics systems and overview of control systems & actuators.
		CO3	Distinguish between various sensors, transducers and actuators and their applications.
CSH311B-P	THEORY OF AUTOMATA AND COMPILER DESIGN LAB	CO1	Solve simple decision problems by constructing DFA and NFA over regular language as well as minimizing DFA
		CO2	Demonstrate advanced knowledge of formal computation and its relationship to languages and Automata.
		CO3	Demonstrate phases of compilation and the impact of language features upon the compilation process
		CO4	Acquire knowledge and analyze different techniques for intermediate code and machine code optimization
CSH402-P	BIG DATA LAB	CO1	Demonstrate the knowledge of big data analytics and implement different file management task in Hadoop
		CO2	Analyze and perform different operations on data using Pig Latin scripts.
		CO3	Illustrate and apply different operations on relations and databases using Hive.
ECH406B	ASIC DESIGN AND FPGA	CO1	Ability to identify general programming knowledge to develop mobile applications and recall their skills of using Android software development tools.
		CO2	Demonstrate the interaction between user interface and underlying application components and infrastructure.
		CO3	Classify the plan and carry out a design work including developing a prototype that can be evaluated with a specified user group and illustrate the deployment of app on various mobile API level.
		CO4	Have developed practical skills and knowledge to construct software for a mobile application and justify their ability to debug program/application running on mobile devices
ECH407B-T	RF SYSTEM	CO1	Identify the RF components based upon the applications

	DESIGN	CO2	Analyze the components for efficiency and range of frequencies
		CO3	Design the components for RF applications
ECH403B-T	SPEECH PROCESSING AND RECOGNITION	CO1	Record, analyze, characterize, modify, and synthesize speech (and other vocal) signals.
		CO2	Apply speech analysis and synthesis technologies, explain how they work, and discuss their strengths and limitations.
		CO3	Design, execute, interpret, and evaluate simple studies that utilize speech processing
ECH427B-T	RANDOM PROCESSES FOR WIRELESS COMMUNICATION	CO1	Understand concepts of probability, conditional probability and independence.
		CO2	Understand random variables and probability distributions.
		CO3	Be familiar with some of the commonly encountered random variables, in particular the Gaussian random variable.
		CO4	Be able to obtain the distributions of functions of random variables.
		CO5	Be able to relate probability theory to real statistical analysis
ECH413B-T	NANOTECHNOLOGY	CO1	The students will be able to understand various classes of nanomaterials
		CO2	The students will be able to understand various techniques of synthesis of nanomaterials.
		CO3	The students will be able to understand various characterization techniques of nanomaterials.
		CO4	The students will be able to comprehend applications of nanomaterials in different walks of life
ECH424B-T	BLOCKCHAIN DEVELOPMENT	CO1	Describe the basic concepts and technology used for block chain.
		CO2	Describe the primitives of the distributed computing and cryptography related to block chain.
		CO3	Illustrate the concepts of Bitcoin and their usage.
		CO4	Implement Ethereum block chain contract
CSH404BB-T	CLOUD COMPUTING	CO1	Understand fundamental ideas behind Cloud Computing, the evolution of the paradigm and its applicability.
		CO2	Understand the key dimensions of the current and future challenges of Cloud Computing

		CO3	Analyze the assessment of the economics, financial ORGANISATION
		CO4	Develop cloud application and assess cloud Storage systems and Cloud security, the risks involved, its impact
		CO5	Demonstrate the understanding to know the impact of engineering on legal and societal issues involved in addressing the security issues of cloud computing.
MCS368B	BASICS OF ENTREPRENEURSHIP	CO1	Understand the fundamental concepts and applicable processes of Entrepreneurship
		CO2	Examine the innovative & entrepreneurial models & their design/actualization for viability & applicability
		CO3	Understand Self-discovery and entrepreneurial fervor
		CO4	Analyse the entrepreneurial acumen towards mapping & application
MEW203B	3D PRINTING (CAD)	CO1	Understand the design aspects of the 3D printable file.
		CO2	Understanding the advantages and limitations of 3D Printing for different applications
		CO3	Knowledge on 3D Printing approach and basic terminology
		CO4	Knowledge on the process steps for obtaining an object using 3D Printing technology
ECH421-T	HARDWARE VERIFICATION USING UVM	CO1	Describe the features of System Verilog, SVA and basics of UVM for verification,and understand the improvements in verification efficiency.
		CO2	Analyse advanced verification features, such as the practical use of classes, randomization, checking, and coverage.
		CO3	Practice developing advanced coverage driven verification environments using advanced System Verilog features, SVA and UVM.
ECH421-P	HARDWARE VERIFICATION USING UVM LAB	CO1	Describe the features of System Verilog, SVA and basics of UVM for verification,and understand the improvements in verification efficiency.
		CO2	Analyse advanced verification features, such as the practical use of classes, randomization, checking, and coverage.
		CO3	Practice developing advanced coverage driven verification environments using advanced System Verilog features, SVA and UVM.
ECN420	PROJECTPHASE-II/	CO1	Integrate the relevant theory and practices followed in a logical way and draw appropriate conclusions.

	INDUSTRIAL TRAINING		