Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

DECLARATION

We, the Board of Studies in Electronics and Computer Engineering, hereby declare that, We have designed the Curriculum up to B. Tech. Semester-VII of 2020 Pattern w.e.f A.Y 2023-2024 as per the guidelines received from AICTE, UGC. The same is recommended to academic council for the final approval. This document contains final approved syllabus from academic council as well as it contains the proposed structure Sem-VIII of Electronics and Computer Engineering. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information of all the concerned stakeholders.

Recommended by

(Dr. B. S. Agarkar)
Chairman
BoS Electronics and Computer Engineering

Approved by

(Dr. A. G. Thakur)
Chairman
Academic Council
SRES Sanjivani College of Engineering, Kopargaon

SANJIVANI COLLEGE OF ENGINEERING, KOPARGAON
Approved

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DECLARATION

We, the Board of Studies in Electronics and Computer Engineering, hereby declare that, We have designed the Curriculum up to Final Year B. Tech. Semester-VIII of 2020 Pattern w.e.f A.Y 2023-2024 as per the guidelines received from AICTE, UGC. The same is recommended to academic council for final approval. This document contains final approval syllabus from academic council. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information of all the concerned stakeholders.

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S. Y. B. TECH. (Electronics and Computer Engineering) SEMESTER-III

Course			Teaching Scheme (Hours/week)				Evaluation Scheme- Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CIA				
PCC	EC201	Discrete Mathematics and Information Theory	3	-	-	3	30	50	20	-	-	-	100
PCC	EC202	Electronic Devices and Circuits	4	-	-	4	30	50	20	-	-	-	100
PCC	EC203	Digital Logic Design and HDL	4	-	-	4	30	50	20	-	-	-	100
PCC	EC204	Data Structure and Algorithms	3	-	-	3	30	50	20	-	-	-	100
HSMC	HS205	Universal Human Values & Ethics	3	-	-	3	30	50	20	-	-	-	100
LC	EC206	Discrete Mathematics and Information Theory Tutorial		1		1						50	50
LC	EC207	Electronic Devices and Circuits Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC208	Digital Logic Design and HDL Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC209	Data Structure and Algorithms Laboratory	-	-	2	1	-	-	-	50	-	-	50
MC	MC210	Mandatory Course-III Constitution of India – Basic features and fundamental principles	2	-	-	No	-	-	-	-	-	-	-
		Total	**19**	**1**	**6**	**21**	**150**	**250**	**100**	**50**	**100**	**50**	**700**

SEMESTER-IV

Course			Teaching Scheme (Hours/week)				Evaluation Scheme- Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CIA				
BSC	BS202	Engineering Mathematics - III	3	1	-	4	30	50	20	-	-	-	100
PCC	EC212	Principles of Communication	3	-	-	3	30	50	20	-	-	-	100
PCC	EC213	Signals & Systems	3	-	-	3	30	50	20	-	-	-	100
PCC	EC214	Computer Organization & Microcontroller	3	-	-	3	30	50	20	-	-	-	100
PCC	EC215	Theory of Computations	3	-	-	3	30	50	20	-	-	-	100
LC	EC216	Principle of Communication Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC217	Python Laboratory	-	-	2	1	-	-	-		50		50
PROJ	EC218	Mini Project/Choice Based Subject (OOP)	1	-	2	2	-	-	-	50	-	-	50
PROJ	EC219	Electronics and Computer workshop	-	-	2	1	-	-	-	-	-	50	50
MC	MC220	Mandatory Course-IV Innovation - Project based – Sc., Tech, Social, Design & Innovation	2	-	-	No	-	-	-	-	-	-	-
		Total	**18**	**1**	**08**	**21**	**150**	**250**	**100**	**50**	**100**	**50**	**700**

Total Credits: 42 **Total Marks: 1400**

(Dr. B. S. Agarkar)
HOD and Chairman BoS
ECE

(Dr. A. B. Pawar)
Dean Academics

(Dr. A. G. Thakur)
Director and Chairman
Academic Council

T. Y. B. TECH. 2020 Pattern (Electronics and Computer Engineering) SEMESTER-V

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	CIA	ISE	ESE	OR	PR	TW	Total
PCC	EC301	Control Systems	3	1	-	4	20	30	50	-	-	-	100
PCC	EC302	Analog Circuits and Systems	3	-	-	3	20	30	50	-	-	-	100
PCC	EC303	DBMS and SQL	3	-	-	3	20	30	50	-	-	-	100
PCC	EC304	Software Engineering, Modeling and Design	4	-	-	4	20	30	50	-	-	-	100
PEC	EC305	Refer List of PEC1	3	-	-	3	20	30	50	-	-	-	100
LC	EC306	Analog Circuits and Systems Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC307	DBMS and SQL Laboratory	-	-	2	1	-	-	-	50	-	-	50
LC	EC308	Software Engineering, Modeling and Design Laboratory	-	-	2	1	-	-	-	50	-	-	50
PROJ	EC309	Mini Project / Skill Based Credit Course	1	-	-	1	50	-		-	-	-	50
MC	MC310	Mandatory Course-V: Sanjivani ECE Talks	1	-	-	Non Credit	-	-	-	-	-	-	Pass/ Fail
		Total	18	1	6	21	150	150	250	100	50	-	700

SEMESTER-VI

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	CIA	ISE	ESE	OR	PR	TW	Total
PCC	EC311	Advanced Microcontroller and Embedded Systems	4	-	-	4	20	30	50	-	-	-	100
PCC	EC312	System Programming and Operating System	3	-	-	3	20	30	50	-	-	-	100
PCC	EC313	Digital Signal Processing	3	-	-	3	20	30	50	-	-	-	100
PEC	EC314	Refer List of PEC2	3	-	-	3	20	30	50	-	-	-	100
HSMC	HS315	Corporate Readiness	2	-	-	2	50	-	-	-	-	-	50
PROJ	PR316	IPR & EDP	2	-	-	2	20	-	30	-	-	-	50
LC	EC317	Advanced Microcontroller and Embedded Systems Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC318	System Programming and Operating System Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC319	PEC2 Laboratory	-	-	2	1	-	-	-	50	-	-	50
LC	EC320	Creational Activity	-	-	2	1	-	-	-	-	-	50	50
MC	MC321	Mandatory Course-VI:	1	-	-	Non Credit	-	-	-	-	-	-	Pass/ Fail
		Total	18	-	08	21	150	120	230	50	100	50	700

Professional Elective Course 1 (PEC1):		Professional Elective Course 2 (PEC2):	
EC305A	Electromagnetics	EC314A	Autonomous Vehicles
EC305B	Network Theory and Analysis	EC314B	Power Electronics and Drives
EC305C	Web Technology	EC314C	Software Testing and Quality Assurance

Total Credits: 42 **Total Marks: 1400**

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Final Year B. TECH. 2020 Pattern (Electronics and Computer Engineering) SEMESTER-VII

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	CIA	ISE	ESE	OR	PR	TW	Total
PCC	EC401	Big Data & Cloud Computing	3	-	-	3	20	30	50	-	-	-	100
PCC	EC402	IoT & WSN	3	-	-	3	20	30	50	-	-	-	100
PCC	EC403	Computer Networks and Security	3	-	-	3	20	30	50	-			100
PEC	EC404	Refer List of PEC3	4	-	-	4	20	30	50	-	-	-	100
PEC	EC405	Refer List of PEC4	3	-	-	3	20	30	50	-	-	-	100
LC	EC406	Big Data & Cloud Computing Laboratory	-	-	2	1	-	-	-	50	-	-	50
LC	EC407	IoT & WSN Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC408	Computer Networks and Security Laboratory	-	-	2	1	-	-	-	-	50	-	50
PROJ	EC409	Project Stage I	-	-	6	3	-	-	-	50		100	150
MLC	MC410	Mandatory Course-VII :	1	-	-	Non Credit	-	-	-	-	-	-	Pass/ Fail
		Total	**17**	**-**	**12**	**22**	**100**	**150**	**250**	**100**	**100**	**100**	**800**

Professional Elective Course 3 (PEC3):		Professional Elective Course 4 (PEC4):	
EC404A	Communication I	EC405A	Communication II
EC404B	Image Processing and Pattern Recognition	EC405B	Block Chain
EC404C	Distributed Systems	EC405C	Data Mining

SEMESTER-VIII

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	CIA	ISE	ESE	OR	PR	TW	Total
OEC	EC411	OE-I:	3	-	-	3	25	-	75	-	-	-	100
OEC	EC412	OE-II:	3	-	-	3	25	-	75	-	-	-	100
OEC	EC413	OE-III :	2	-	-	2	25	-	75	-	-	-	100
PROJ	EC414	Industrial Internship	-	-	12	6	-	-	-	50	-	100	150
PROJ	EC415	Project Stage-II	-	-	04	2	-	-		50	-		50
		Total	**8**	**-**	**16**	**16**	**75**		**225**	**100**	**-**	**100**	**500**

Total Credits: 38 **Total Marks: 1300**

Code	NPTEL Course Title
EC411A	Deep Learning - IIT Ropar
EC411B	Ethical Hacking
EC411C	Organizational Behavior
EC411D	Programming In Java
EC412A	Introduction To Algorithms And Analysis
EC412B	Modern Digital Communication Techniques
EC412C	Natural Language Processing
EC412D	E-Business

Code	NPTEL Course Title
EC413A	Hardware Modeling Using Verilog
EC413B	Financial Accounting
EC413C	Project Management
EC413D	Google Cloud Computing Foundations
EC413E	Data Science For Engineers

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Approved

Final Year B. TECH. 2020 Pattern (Electronics and Computer Engineering)

SEMESTER-VIII

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks					
							Theory		OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	CIA	ESE				
OEC	EC411	OE-I:	3	-	-	3	25	75	-	-	-	100
OEC	EC412	OE-II:	3	-	-	3	25	75	-	-	-	100
OEC	EC413	OE-III :	2	-	-	2	25	75	-	-	-	100
PROJ	EC414	Industrial Internship	-	-	12	6	-	-	50	-	100	150
PROJ	EC415	Project Stage-II	-	-	04	2	-		50	-		50
		Total	**8**	**-**	**16**	**16**	**75**	**225**	**100**	**-**	**100**	**500**

Total Credits: 38

Total Marks: 1300

	NPTEL Course Title
Open Elective -1	Deep Learning - IIT Ropar
	Ethical Hacking
	Organizational Behavior
	Programming In Java
Open Elective -II	Introduction To Algorithms And Analysis
	Modern Digital Communication Techniques
	Natural Language Processing
	E-Business
Open Elective -III	Hardware Modeling Using Verilog
	Financial Accounting
	Project Management
	Google Cloud Computing Foundations
	Data Science For Engineers

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B. Tech. Electronics and Computer Engineering

Proposed Program Structure

(2020 Pattern)

(B. Tech. with effect from Academic Year 2020-2021)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

Second Year B. Tech. 2020 pattern (Electronics and Computer Engineering) w.e.f. 2021-22

SEMESTER-III

Course			Teaching Scheme (Hours/week)				Evaluation Scheme- Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CIA	OR	PR	TW	Total
PCC	EC201	Discrete Mathematics and Information Theory	3	-	-	3	30	50	20	-	-	-	100
PCC	EC202	Electronic Devices and Circuits	4	-	-	4	30	50	20	-	-	-	100
PCC	EC203	Digital Logic Design and HDL	4	-	-	4	30	50	20	-	-	-	100
PCC	EC204	Data Structure and Algorithms	3	-	-	3	30	50	20	-	-	-	100
HSMC	HS205	Universal Human Values & Ethics	3	-	-	3	30	50	20	-	-	-	100
LC	EC206	DMIT Tutorial		1		1						50	50
LC	EC207	Electronic Devices and Circuits Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC208	Digital Logic Design and HDL Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC209	Data Structure and Algorithms Laboratory	-	-	2	1	-	-	-	50	-	-	50
MC	MC210	Mandatory Course-III Constitution of India	2	-	-	No	-	-	-	-	-	-	-
		Total	**19**	**1**	**6**	**21**	**150**	**250**	**100**	**50**	**100**	**50**	**700**

MC210	**Mandatory Course-III**	**Constitution of India – Basic features and fundamental principles**

Discrete Mathematics and Information Theory (EC201)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

==========

Prerequisite: Course on set theory and propositional logic at 12th class

Course Objectives:
1. To elaborate on set theory and propositional logic.
2. To facilitate understanding of Relations and Functions and their applications
4. To learn the principles of Graph theory and its Engineering applications
4. To learn the properties of trees and algorithms to construct the same
5. To introduce the concept of Group theory and Field theory
6. To introduce the concept of information theory and various coding techniques for the same

Course Outcomes (COs): On completion of the course, student will be able to

CO	CO Statement	Blooms Taxonomy	
		Level	Descriptor
EC201.1	Interpret different types of sets and prepositional logic	2	Understand
EC201.2	Classify different types of relations and functions in real time applications	2	Understand
EC201.3	Summarize different Graphs, Graph models and their terminologies	2	Understand
EC201.4	Implement trees using different algorithms	3	Apply
EC201.5	Solve problems on algebraic structures using coding theories	3	Apply
EC201.6	Summarize different information sources and entropy	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC201.1	2	2	-	0	2	-	-	-	3	3	-	3	-	-
EC201.2	2	2	-	0	2	-	-	-	3	3	-	3	-	-
EC201.3	3	3	1	0	2	-	-	-	3	3	-	3	-	2
EC201.4	3	3	1	0	2	-	-	-	3	3	-	3	-	2
EC201.5	3	3	1	0	2	-	-	-	3	3	-	3	-	-
EC201.6	3	3	1	0	2	-	-	-	3	3	-	3	-	2

COURSE CONTENTS

Unit-I	Set Theory and Logic	No. of Hours	COs
	Sets, Combinations of sets, Venn Diagrams, Finite and Infinite sets, Uncountable infinite sets, Principle of inclusion and exclusion, multisets. Propositions, Conditional Propositions, Logical Connectivity, Propositional calculus, Universal and Existential Quantifiers, Normal forms, methods of proofs, Mathematical Induction.	6	EC201.1
Unit-II	**Relation and Functions**	**No. of Hours**	**COs**
	Relations and their properties, Binary relations, Representing relations, Closures of relations, Equivalence relations, Partial orderings, Partitions, Hasse Diagram, Lattices, Chains and Anti-Chains, Transitive Closure and Warshall‘s Algorithm, n-ary Relations and their applications. Functions- Surjective, Injective and Bijective functions, Inverse Functions and Compositions of Functions, The Pigeonhole Principle.	6	EC201.2
Unit-III	**Graph Theory**	**No. of Hours**	**COs**
	Graphs and Graph Models, Graph terminology and Special Types of Graphs, Representing Graphs and Graph isomorphism, Connectivity, Euler and Hamilton Paths, Single source shortest path, Dijkstra's algorithm, Planar Graphs, Regular graph, Bipartite graph, Euler’s graph, Graph coloring. Case Study- Web Graph, Google map	6	EC201.3
Unit-IV	**Trees**	**No. of Hours**	**COs**
	Introduction, properties of trees, Binary search tree, Decision tree, Prefix codes and Huffman coding, cut sets, Spanning trees and Minimum Spanning tree, Kruskal’s and Prim’s algorithms, The Max flow- Min Cut Theorem (Transport network), Case Study- Game Tree, Min-Max Tree.	6	EC201.4
Unit-V	**Algebraic Structures and Coding Theory**	**No. of Hours**	**COs**
	The structure of algebra, Algebraic systems, Semi- Groups, Monoids, Groups, Homomorphism and Normal Subgroups, Congruence relations, Rings, Integral Domains and Fields, Coding theory, Polynomial Rings and polynomial Codes, Error correction and detection code. Case Study, Brief introduction to Galois theory –Field theory and Group theory.	6	EC201.5
Unit -VI	**Information Theory**	**No. of Hours**	**COs**

	Information sources and entropy, Relative entropy, Joint and conditional entropy, Mutual information, Lossless source coding with Variable code word lengths, Best prefix-free codes, Huffman codes, Lossy source coding with fixed code word lengths, Channel coding and cyclic codes.	6	EC201.6

Text Books:

1. S. K. Chakraborty, B.K. Sarkar, "Discrete Mathematics and its Applications", Oxford University Press 2011, ISBN9780198065432.
2. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", McGraw Hill 4th Edition.

Reference Books :

1. N. Biggs, "Discrete Mathematics", 3rd Edition, Oxford University Press, ISBN 0 –198507178.
2. Bernard Kolman, Robert C. Busby and Sharon Ross, "Discrete Mathematical Structures", Prentice-Hall of India /Pearson, ISBN: 0132078457, 9780132078450.
3. Edgar G. Goodaire and Michael M. Parmenter, "Discrete Mathematics with Graph Theory", Pearson Education 3rd Edition, ISBN-13978013167995.
4. Richard Johnsonbaugh, "Discrete Mathematics", Pearson Education, 7th Edition ISBN: 9332535183.

e-Resources:

https://archive.nptel.ac.in/courses/111/107/111107058/

Guidelines for Continuous Assessment:

1. Three class tests based on Units I&II, Units III &IV and Units V and VI respectively.
2. Class assignment on Unit I-VI

Electronic Devices and Circuits (EC202)

Teaching Scheme

Examination Scheme

Lectures: 3Hrs. / Week

In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks

Credits: 3

CIA: 20 Marks
Total: 100 Marks

==========

Prerequisite: Basic knowledge of Semiconductor Physics.

==========

Course Objectives:

1. To introduce semiconductor devices, FET and MOSFET, their characteristics, operation, circuits and applications.
2. To introduce concepts of positive and negative feedback in electronic circuits.
3. To analyze and interpret FET and MOSFET circuits for small signal at low and high frequencies.
4. To introduce the concept of Power amplifiers, its analysis and efficiency.
5. To simulate electronic circuits using simulation software and verify results.
6. To study the different types of voltage regulators.

Course Outcomes (COs):

After successfully completing the course students will be able to:

COs	Statement	Blooms Taxonomy	
		Level	Descriptor
EC202.1	Explain the fundamental operation and characteristics of FET	1	Remember
EC202.2	Draw DC biasing circuit and small signal model for MOSFET	3	Apply
EC202.3	Solve MOSFET AC circuit analysis related problems	3	Apply
EC202.4	Use the concept of feedback to improve stability of the circuit using FET.	3	Apply
EC202.5	Define Power amplifier circuits in different modes of operation.	2	Understand
EC202.6	Design Power supply using adjustable voltage regulator.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC202.1	3	-	2	-	-	-	-	-	-	-	-	2	1	-
EC202.2	3	3	3	-	-	-	-	-	-	-	-	2	3	1
EC202.3	3	3	3	-	-	-	-	-	-	-	-	2	3	3
EC202.4	3	2	2	-	-	-	-	-	-	-	-	2	1	3
EC202.5	3	3	3	-	-	-	-	-	-	-	-	2	3	3
EC202.6	3	3	–	–	–	–	–	–	–	–	–	2	3	3

Course Contents

Unit-I	FET	No. of Hours	COs
	BJT overview, Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage, FET Volt-Ampere characteristics, FET Configurations (CS/CD/CG) and their Comparison. Biasing of FET (Self).FET as an amplifier and its analysis (CS) and its frequency response. Small signal model, FET as High Impedance circuits.	6Hrs.	EC202.1
Unit-II	MOSFET& its DC Analysis	No. of Hours	COs
	Basics of MOS Transistor operation, Types and Construction of MOSFET, E-MOSFET characteristics & parameters, non-ideal voltage current characteristics viz. Finite output resistance, body effect, sub-threshold conduction, breakdown effects and temperature effects. Common source circuit, Load Line & Modes of operation, common MOSFET configurations: DC Analysis, constant current source biasing.	8Hrs.	EC202.1 EC202.2
Unit-III	MOSFET AC Circuit Analysis:	No. of Hours	COs
	The MOSFET CS small signal amplifier, Small signal parameters, small signal equivalent circuit, Modelling, Body effect, Analysis of CS amplifier. Introduction to BiCMOS technology. The MOSFET internal capacitances and high frequency model. Introduction to MOSFET as basic element in VLSI, V-I characteristic equation in terms of W/L ratio, MOSFET scaling and small geometry effects. MOSFET as switch, diode/active resistor, Current sink and source, current mirror, CMOS Inverter as amplifier: Active load, Current source and Push pull configurations	8Hrs.	EC202.1 EC202.2
Unit-IV	Feedback amplifiers and Oscillators	No. of Hours	COs
	Four types of amplifiers. Feedback topologies. Effect of feedback on terminal characteristics of amplifiers. Examples of voltage series and Current series FET feedback amplifiers and their analysis. Barkhausen's criterion, stability with feedback. General form of LC oscillator. FET RC Phase Shift oscillator, Wein bridge oscillator, Hartley and Colpitt's oscillators.	7Hrs.	EC202.1 EC202.2
Unit-V	Power Amplifiers	No. of Hours	COs
	Power BJTs, Power MOSFETs, Heat Sinks, Classes of Audio Power Amplifiers (Class A,B,AB,C,D), Analysis of Class A power amplifiers: Direct and transformer coupled power amplifier, Class B & AB Push-Pull and complementary-symmetry stages, Distortions in amplifiers, Concept of Total Harmonic Distortion (THD).	8Hrs.	EC202.1 EC202.2 EC202.3
Unit-VI	Voltage Regulators	No. of	COs

		Hours	
	Block diagram of an adjustable three terminal positive and negative regulators (317,337).Typical connection diagram, current boosting. Low dropout voltage regulators. Introduction to Switch Mode Power supply (SMPS), Block diagram of SMPS, Types of SMPS. IC3524 based SMPS, Comparison of Linear Power supply and SMPS.	7 Hrs.	EC202.4

Text Books:

1. Allen Mottershead, “Electronic Devices and Circuits: An Introduction, Tata McGraw Hill.
2. A. K. Maini, “All-in-One Electronic Simplified”, Khanna Publishing House.
3. Donald Neaman, “Electronic Circuit Analysis and Design”, 3rd Edition, Tata McGraw Hill.

Reference Books:

1. Anil K. Maini and Varsha Agarwal, “Electronic Devices and Circuits”, Wiley India
2. David A. Bell, “Electronic Devices and Circuits”, 5th Edition, Oxford Press
3. Phillip E. Allen, Douglas R. Holberg, “CMOS Analog Circuit Design”, Second Edition, Oxford.
4. R. L. Boylstad, L. Nashlesky, “Electronic Devices and Circuits Theory ", 9thEdition, Prentice Hall of India, 2006.

E Resources

https://inderjitsingh87.weebly.com/electronic-devices-and-circuits-1.html

Guidelines for Continuous Assessment:- Home Assignments, MCQ test

Digital Logic Design and HDL (EC203)

Teaching Scheme:
Lectures: 04 Hrs. / Week

Credits: 04

Examination Scheme:
ISE:30 Marks
ESE:50 Marks
CIA:20 Marks
Total: 100 Marks

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Prerequisite Course: Basic Electronics Engineering

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Course Objectives:

1. To introduce the methods for the simplification of logic functions.
2. To acquaint yourself with different types of combinational logic circuits using ICs.
3. To learn the concept of sequential logic circuits.
4. To learn the concept of a finite state machine.
5. To introduce the HDL concept.
6. To acquaint yourself with different types of PLDs.

Course Outcomes (COs): After successful completion of course students will be able to

COs	CO Statement	Bloom's Taxonomy	
		Level	Description
EC203.1	Recognize the number systems and identify combinational logic circuits.	1	Remember
EC203.2	Develop skill to realize different combinational circuit using ICs	2	Understand
EC203.3	Design digital sequential circuits.	3	Apply
EC203.4	Design Finite state machines using Mealy and Moore machines.	3	Apply
EC203.5	Write VHDL code for different digital circuits.	3	Apply
EC203.6	Design combinational circuit using PLDs	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC203.1	2	-	-	-	-	-	-	-	-	-	-	3	1	-
EC203.2	2	-	-	-	-	-	-	-	-	-	-	1	2	-
EC203.3	3	2	2	-	-	-	-	-	-	-	-	1	2	-
EC203.4	3	2	2	-	-	-	-	-	-	-	-	1	2	-
EC203.5	2	-	-	-	3	-	-	-	-	-	-	1	-	2

EC203.6	3	2	2	-	-	-	-	-	-	-	-	1	2	-

Course Contents:

Unit-I	**Combinational Logic Circuits**	**No. of Hours**	**COs**
	Number system and computer arithmetic (fixed and floating point), Representation of truth table, Sum of product (SOP) form, Product of sum (POS) form, Karnaugh map representation of logical functions, Simplification of logical functions using K-Map, Minimization of logical functions specified in SOP and POS form using K-map up to 4 Variables, Design examples: Half adder, Full adder, Half subtractor and Full subtractor. Code converters	08	EC203.1
Unit-II	**Combinational Logic Design using MSI Chips**	**No. of Hours**	**COs**
	Circuit design using comparator, Binary adder, BCD adder, Look ahead carry generator, Multiplexers and their use in combinational logic designs, Multiplexer trees, Priority encoder Demultiplexers and their use in combinational logic designs, Demultiplexer trees , Decoders.	07	EC203.2
Unit-III	**Sequential Logic Design**	**No. of Hours**	**COs**
	One bit memory cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation table for flip flops. Conversion of flip flops. Application of flip flops: registers, shift registers, Counters: asynchronous counter, synchronous counter, Johnson ring counter, MOD counter.	08	EC203.3
Unit-IV	**Finite State Machines**	**No. of Hours**	**COs**
	Mealy and Moore machines representation. State diagram, State table, State reduction and state assignment, Design procedure: sequence generator using shift register and sequence detector.	07	EC203.4
Unit-V	**Introduction of HDLs**	**No. of Hours**	**COs**
	Structure of VHDL Module, Package, Entity, Architecture, Configuration, data types, data objects, Modeling styles, concurrent and sequential statements, design examples.	08	EC203.5
Unit-VI	**Programmable Logic Devices**	**No. of Hours**	**COs**
	Programmable logic devices and their types: Programmable Read Only Memories, Programmable Logic Arrays, Programmable Array Logic, Complex Programmable Logic Devices, Field Programmable Gate Arrays(in details), Designing combinational and sequential circuits using PLDs.	07	EC203.6
Books:			

Text Books:

1. R.P. Jain, “Modern digital electronics” , 3rd edition , 12th reprint Tata McGraw Hill Publication,2007.
2. Thomas Floyd, “Digital Electronics”, 11th Edition.
3. M. Morris Mano, “Digital Logic and Computer Design” 4the edition,Prentice Hall of India, 2013.
4. Taub and Schilling, “Digital Principles and Applications,” TMH.

Reference Books:

1. Anand Kumar, “Fundamentals of Digital Circuits” 1 st edition, Prentice Hall of India, 2001
2. J. F. Wakerly, “Digital Design- Principles and Practices,” 3rd Edition, Pearson
3. M. M. Mano, “Digital Design,” Prentice Hall India.

e-Resources:

1. https://nptel.ac.in/courses/108/105/ 108105113/

2. https://nptel.ac.in/courses/117/106/117106086/

3. https://nptel.ac.in/courses/108/105/108105132/

Guidelines for Continuous Internal Assessment:

Home Assignments, Class Tests

Data Structure & Algorithms (EC204)

Teaching Scheme
Lectures: 03 Hrs / Week

Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite course: CFP

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Course Objectives:

1. To Learn the Fundamentals of data structures, implementation and Applications
2. To study the basics of algorithm analysis.
3. To introduce students to common programming techniques/algorithms (recursion, searching and Sorting, etc.)
4. To understand the memory requirement for various data structures.
5. To study advanced data structures such as trees and Graphs.

Course Outcomes (COs):

After successful completion of course students will be able to:

CO	Course Outcome (s) statement	Bloom's Taxonomy	
		Level	Descriptor
EC 204.1	Abstract basic program construct in C	2	Understand
EC 204.2	Analyze algorithms with respect to time and space complexity.	3	Apply
EC 204.3	Implement the concept of stacks & queues for solving a problem.	3	Apply
EC 204.4	Handle operations like insertion, deletion, searching and traversing on linked list	2	Understand
EC 204.5	Explain the use of tree and its applications.	2	Understand
EC 204.6	Analyze the real world problems using Graph Data Structure.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC 204.1	2	1	1	--	1	--	--	--	--	--	--	1	1	--
EC 204.2	1	1	2	--	2	--	--	--	--	--	--	1	3	--
EC 204.3	2	--	2	--	2	--	--	--	--	--	--	2	2	--
EC 204.4	1	1	3	--	2	--	--	--	--	--	--	2	2	--
EC 204.5	2	1	3	--	3	--	--	--	--	--	--	2	2	--

EC 204.6	2	1	3	--	3	--	--	--	--	--	--	2	2	--

Course Contents

Unit-I	**Fundamentals of C Programming**	**No. of Hours**	**COs**
	Introduction to C Programming **Functions:** Definition, Types of functions with appropriate examples, recursive functions. Macros, Comparison Macros with function. **Structures**: Definition, Self-Referential Structure, Array of structures. **Arrays:** Concept of Sequential Organization, Polynomial representation using array of structure **Pointers:** Basic concepts. Pointer declaration & initialization. Pointers and arrays, pointers and structures, pointers and strings.	07	**EC 204.1**
Unit-II	**Introduction to Algorithm & Data Structures**	**No. of Hours**	COs
	Data structures: Definition ,Types of Data Structures, Concept of Abstract Data Type **Algorithms:** Introduction to Algorithms, Analysis of Algorithms, Complexity of algorithms- Space complexity, Time complexity, Asymptotic notation- Big-O, Theta and Omega, standard measures of efficiency. **Algorithmic Strategies-** Introduction to algorithm design strategies- Divide and Conquer, and Greedy strategy **Searching Methods:** Need of searching, Sequential Search and Binary Search. **Sorting Methods**: Need of sorting, Selection sort, Bubble sort, Insertion sort and comparison of all sorting methods.	08	EC 204.2
Unit-III	**Dynamic memory allocation and Linked List**	**No. of Hours**	COs
	Introduction: Dynamic memory management. **Linked List:** Concept of Singly Linked List: Different operations such as Creation, Insertion, deletion, display, search of node in linked list. Concept of Doubly Linked List and Circular Linked List, Comparison of Linked List with Array. Polynomial addition using linked list Applications of Linked list.	**06**	EC 204.3
Unit-IV	**Stack and Queues**	**No. of Hours**	COs
	Stacks: Definition & example, representation using arrays & linked list. Concept of infix, postfix and prefix expressions, Applications of Stacks: conversion of infix to postfix expression, evaluation of postfix expression	06	EC 204.4

	Queues: Definition & example, representation of queue using array and linked list. Concept of Circular queue, Priority Queue. Applications of Queue: Job Scheduling.		
Unit-V	**Trees**	**No. of Hours**	COs
	Introduction: tree terminologies, Binary trees and its representation, Types of Binary Trees. **Binary Search Tree (BST)**: Implementation of Binary Search Tree, BST traversals – preorder, inorder & postorder, Primitive operations on BST: Create, insert, delete and search.	06	EC 204.5
Unit-VI	**Graphs**	**No. of Hours**	COs
	Graphs: Concepts and terminology, Types of graphs, representation of graph using adjacency matrix, adjacency list, Traversals: DFS & BFS. **Minimum Spanning tree**: Concept, Kruskal's, Prim's algorithm, Dijkstra's Single Source Shortest Path Algorithm	06	EC 204.6

Text Books:

1. E Balgurusamy, "Programming in ANSI C", Tata McGraw-Hill,(3rd Edition)
2. Yashavant Kanetkar, "Data Structures Through C", BPB Publication, 2nd Edition

Reference Books:

1. Seymour Lipschutz, "Data Structure with C", Schaum's Outlines, McGraw Hill Education.
2. Y. Langsam, M J Augenstein, Aaron Tenenbaum – "DS using C and C++" – Pearson Education
3. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", university press4. R. Gilberg & B.Forouzan, "Data Structures A Pseudo code Approach with C", Cengage Learning. 5.swayam.gov.in

Guidelines for Continuous Assessment: - Test on each unit will be evaluated for 10 marks and Programming assignment for 10 marks

Universal Human Values and Professional Ethics (HS205)

Teaching Scheme
Lectures: 03 Hrs./ Week
Credits: 03

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisites: Nil

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Course Objectives:

1. To help the students appreciate the essential complementarity between values and skills to ensure mutual happiness and prosperity.
2. To elaborate on 'Self exploration' as the process for Value Education
3. To facilitate the understanding of harmony at various levels starting from self and going towards family and society.
4. To elaborate on the salient aspects of harmony in nature and the entire existence
5. To explain how the Right understanding forms the basis of Universal human values and definitiveness of Ethical human conduct.
6. To provide the vision for a holistic way of living and facilitate transition from chaotic life to an orderly life.

Course Outcomes (COs): After successful completion of this course, students will be able to:

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
HS205.1	Recognize the concept of self-exploration as the process of value education	1	Remember
HS205.2	Interpret the human being as the coexistence of Self and Body.	2	Understand
HS205.3	Explain relationship between one Self and the other Self as the essential part of relationship and harmony in the family	2	Understand
HS205.4	Explain the goal of human being living in the society, the system required to achieve the human goal and the scope of this system.	2	Understand
HS205.5	Interpret the interconnectedness, harmony and mutual fulfillment inherent in the nature and the entire existence	2	Understand
HS205.6	Draw ethical conclusions in the light of Right understanding facilitating the development of holistic technologies, production systems and management models	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
HS 205.1	-	-	-	-	-	-	-	3	3	3	-	3
HS 205.2	-	-	-	-	-	-	-	3	3	3	-	3
HS 205.3	-	-	-	-	-	-	-	3	3	3	-	3
HS 205.4	-	-	-	-	-	2	1	3	3	3	-	3
HS 205.5	-	-	-	-	-	-	1	3	-	3	-	3

HS 205.6	-	-	-	-	-	2	1	3	3	3	-	3

Course Contents

Unit No.		No. of Hours	COs
Unit-I	**Introduction to Value Education**	6.	HS 205.1
	Value education and Skill education; Priority of values over skills; Implications of Value education; Self-exploration as the process for Value education; Basic human aspirations and their fulfillment; Understanding Happiness and Prosperity-Their continuity and program for fulfilment		
Unit-II	**Harmony in the Human Being**	6	HS 205.2
	Understanding Human being as the coexistence of self and the body; Discrimination between the needs of the self and the body; The body as an instrument; Harmony in the self; Harmony of the self with the body		
Unit-III	**Harmony in the Family**	6	HS 205.3
	Family as the basic unit of human interaction; Understanding relationship; Feelings in relationship; Right feeling; Role of physical facility in fulfilment of relationship; Response and reaction in behaviour; Understanding Justice		
Unit-IV	**Harmony in the Society**	6	HS 205.4
	Understanding Human Goal; Human Order; Dimensions of Human Order; Professions in a human society; World Family Order; Harmony from Family Order to World Family Order		
Unit-V	**Harmony in the Nature and Existence**	6	HS 205.5
	Nature as a collection of units; Classification of units into four orders; Interconnectedness and mutual fulfilment among the four orders; Significance of Education – Sanskar for human order; Existence as units in space; Understanding submergence; Material and consciousness units; Expression of coexistence at different levels; Role of human being in existence		
Unit-VI	**Right Understanding in Life and Profession**	6	HS 205.6
	Universal Human Values and Ethical Human Conduct; Professional Ethics in the light of right understanding; Holistic development towards Universal Human Order; Vision for Holistic technologies, Production systems and Management models; Journey towards Universal Human Order		
Text Books:			
1 R. R. Gaur, R. Sangal, G. P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books Pvt. Ltd 2 M. Govindrajan, S. Natarajan, V. S. Senthil Kumar, "Engineering Ethics (including Human Values)", Eastern Economy Edition, Prentice Hall of India, 2001			

Reference Books:

1 B. P. Banerjee, “Foundations of Ethics and Management”, Excel Books Pvt. Ltd.
2 P. L. Dhar, R. R. Gaur, “Science and Humanism”, Commonwealth Publishers
3 M. K. Gandhi, “The Story of my Experiments with Truth”, DiscoveryPublisher

e-Resources

https://fdp-si.aicte-india.org/download.php#1/
https://drive.google.com/folderview?id=1CKs7eY7AX2HABV2UEcj0B02jEbI2cPG1/

Guidelines for CIA :

1. Three class tests based on Units I&II, Units III &IV and Units V and VI respectively.
2. Group activity on Unit I, II and III.
3. Group activity on Unit IV, V and VI.
   Considering the specific nature of this course, the methodology is explorational and thus universally adaptable. In order to connect the content of this course with practice, minimum 2 group activities should be conducted with active involvement of the students. 50% of the continuous assessment should be strictly based on the participation of the students in these activities

Discrete Mathematics and Information Theory Tutorial (EC206)

Teaching Scheme — Examination Scheme
Tutorial: 1 Hr. / Week — TW: 50 Marks
Credits: 1 — Total: 50 Marks

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Prerequisite: Course on set theory and propositional logic at 12th class

Course Objectives:

1. To elaborate on set theory and propositional logic.
2. To facilitate understanding of Relations and Functions and their applications
3. To learn the principles of Graph theory and its Engineering applications
4. To learn the properties of trees and algorithms to construct the same
5. To introduce the concept of Group theory and Field theory
6. To introduce the concept of information theory and various coding techniques for the same

Course Outcomes (COs): On completion of the course, student will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC206.1	Interpret different types of sets and prepositional logic	2	Understand
EC206.2	Classify different types of relations and functions in real time applications	2	Understand
EC206.3	Summarize different Graphs, Graph models and their terminologies	2	Understand
EC206.4	Implement trees using different algorithms	3	Apply
EC206.5	Solve problems on algebraic structures using coding theories	3	Apply
EC206.6	Summarize different information sources and entropy	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC206.1	2	2	-	0	2	-	-	-	3	3	-	3	-	-
EC206.2	2	2	-	0	2	-	-	-	3	3	-	3	-	-
EC206.3	3	3	1	0	2	-	-	-	3	3	-	3	-	2
EC206.4	3	3	1	0	2	-	-	-	3	3	-	3	-	2
EC206.5	3	3	1	0	2	-	-	-	3	3	-	3	-	-
EC206.6	3	3	1	0	2	-	-	-	3	3	-	3	-	2

List of Tutorials

Minimum 8 Tutorials should be conducted from the following list. There should be at least 1 Tutorial from each unit of the syllabus.

Sr. No.	Title	CO
1	Exercise on conditional connectivity	EC206.1
2	Proof through mathematical induction	EC206.1
3	Application of Binary relation	EC206.2
4	Exercise on Pigeonhole principle	EC206.2
5	Exercise on Dijkstra's algorithm	EC206.3
6	Web graph and google map	EC206.3
7	Exercise on Kruskal's and Prim's algorithms	EC206.4
8	Case study on game tree	EC206.4
9	Exercise on Polynomial Rings and polynomial Codes	EC206.5
10	Case study on Error correction and detection	EC206.5
11	Exercise on Huffman code	EC206.6
12	Exercise on channel coding and cyclic code	EC206.6

Text Books :

1. S. K. Chakraborty, B.K. Sarkar, "Discrete Mathematics and its Applications", Oxford University Press 2011, ISBN9780198065432.
2. C. L. Liu and D. P. Mohapatra, "Elements of Discrete Mathematics", McGraw Hill 4th Edition.

Reference Books :

1. N. Biggs, "Discrete Mathematics", 3rd Edition, Oxford University Press, ISBN 0 – 198507178.
2. Bernard Kolman, Robert C. Busby and Sharon Ross, "Discrete Mathematical Structures", Prentice-Hall of India /Pearson, ISBN: 0132078457, 9780132078450.

e-Resources:

https://archive.nptel.ac.in/courses/111/107/111107058/

Electronic Devices and Circuits Laboratory (EC207)

Teaching Scheme	Examination Scheme
Practical: 2 Hrs. / Week	PR: 50 Marks
Credits: 1	Total: 50 Marks

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Prerequisite Course: Basic knowledge of Semiconductor Physics.

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Course Objectives:

1 To introduce semiconductor devices FET and MOSFET, their characteristics, operations, circuits and applications.
2 To introduce concepts of both positive and negative feedback in electronic circuits.
3 To analyze and interpret FET and MOSFET circuits for small signal at low and high frequencies.
4 To introduce the concept of Power amplifiers, analysis and efficiency.
5 To simulate electronics circuits using computer simulation software and verify desired results.
6 To study the different types of voltage regulators.

Course Outcomes (COs):

After successfully completing the course students will be able to:

COs	Statement	Blooms Taxonomy	
		Level	Descriptor
EC207.1	Explain basics ,operation and characteristics of FET and MOSFET	2	Understand
EC207.2	Analyze DC biasing circuit and Small signal model for Transistor.	4	Analyze
EC207.3	Apply concept of feedback to improve stability of circuits.	3	Apply
EC207.4	Understand the basic concepts of Power amplifiers.	2	Understand
EC207.5	Design Power supply using adjustable voltage regulator.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC207.1	**3**	-	-	-	-	-	-	2	2	-	-	3	1	-
EC207.2	**3**	-	-	-	3	-	-	2	2	-	-	3	2	2
EC207.3	**3**	-	-	-	3	-	-	2	2	-	-	3	2	3
EC207.4	**3**	-	-	-	3	-	-	2	2	-	-	3	2	3

EC207.5	3	-	-	-	3	-	-	2	2	-	-	3	2	3

Course Contents

Sr. No	List of Practical	
1	Design a single stage FET Amplifier in CS configuration and verify DC operating point.	EC207.1
2	Build and test single stage CS amplifier using FET. Calculate R_i, R_o and Av.	EC207.1, EC207.2
3	Simulate frequency response of single stage CS amplifier using Proteus software (use same circuit) and find the bandwidth.	EC207.1
4	Simulate Voltage-Series feedback amplifier using Proteus software and calculate R_{if}, R_{of}, A_{vf} and Bandwidth.	EC207.1, EC207.2
	or	
5	Simulate current series feedback amplifier using Proteus software and find R_{if}, R_{of}, G_{mf} and Bandwidth.	EC207.3
6	Simulate LC oscillator using FET.	EC207.1, EC207.2
7	Simulate MOSFET/ CMOS Inverter using Proteus software.	EC207.1, EC207.2
8	To find the efficiency of Class B and Class AB power amplifier.	EC207.4
9	Design and implement an adjustable voltage regulator using IC 317.	EC207.5

Digital Logic Design and HDL (EC208)

Teaching Scheme:
Practical: 02 Hrs. / Week
Credits: 01

Examination Scheme:
PR: 50 Marks,
Total: 50 Marks

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Prerequisite Course: Basic Knowledge of Logic Gates

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Course Objectives:

1. Acquaint yourself with different combinational logic circuits.
2. Acquaint different Sequential logic circuits.
3. Introduce HDL concept

Course Outcomes (COs): After successful completion of course students will be able to:

COs	Statements	Bloom's Taxonomy	
		Level	Description
EC208.1	Document laboratory report on results.	2	Understand
EC208.2	Design and Implement digital circuits.	3	Apply
EC208.3	Write a VHDL code	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC208.1	1	-	-	-	-	-	-	-	-	2	-	-	-	-
EC208.2	2	2	2	-	-	-	-	-	-	-	-	3	2	-
EC208.3	2	2	2	-	-	-	-	-	-	-	-	3	-	2

Course Contents:

List of Practical's (Minimum 8 Practicals to be perform)	COs
1. Design and Implement 8:1 MUX using IC-74LS153 & Verify its Truth Table.	EC208.2
2. Design and Implement full adder / subtractor function using IC- 74LS138.	EC208.2
3. Design & Implement 3-bit code converter using IC-74LS138.(Binary to Gray)	EC208.2

4. Design and Implement 4-bit Comparator.	EC208.2
5. Design and Implement MOD-N using IC-74LS90 and draw a Timing diagram.	EC208.2
6. Design and Implement MOD-N using IC-74LS93 and draw Timing diagram	EC208.2
7. Design & Implement 4-bit Up/down Counter and MOD-N Up/down Counter using IC74HC191/ IC74HC193.	EC208.2
8. Design and Implement 4-bit Ring Counter/ Twisted ring Counter using shift registers IC 74HC194/IC74LS95.	EC208.2
9. To measure various TTL and CMOS parameters.	EC208.2
10. Write, simulate and verify, VHDL Code for four bit logical and arithmetic operations for ALU.	EC208.3
11. Write, simulate and verify, VHDL Code for D / JK flip flop.	EC208.3
12. Write a Verilog code for Half Adder.	EC208.3
Note: For each experiment refer datasheets. and we can simulate experiments using Virtual Labs (Optional).	

Data Structure & Algorithms Laboratory (EC 209)

Teaching Scheme
Practical: 02 Hrs / Week
Credits: 01

Examination Scheme
Oral Exam: 50 Marks
Total: 50 Marks

Prerequisite: Basic Knowledge of C Programming

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Course Objectives:

1. To Learn the Fundamentals of data structures, implementation and Applications
2. To study the basics of analysis of algorithm.
3. To introduce students to common programming techniques/algorithms (recursion, searching and Sorting, etc.)
4. To understand the memory requirement for various data structures.

Course Outcomes (COs):

After successful completion of course students will be able to:

CO	Course Outcome (s) statement	Bloom's Taxonomy	
		Level	Descriptor
EC209.1	Apply suitable algorithm to implement applications of various data structures	3	Apply
EC209.2	Handle operations like insertion, deletion, searching, sorting and traversing on various data structures	3	Apply
EC209.3	Design & implement various linear and nonlinear data structures	4	Analyze
EC209.4	Apply an appropriate data structure and algorithm to solve a problem	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC209.1	1	3	3	2	---	----	----	----	2	----	----	----	2	----
EC209.2	2	3	3	2	2	----	----	----	2	----	----	----	2	----
EC209.3	2	3	2	3	3	----	----	----	3	----	----	----	3	----
EC209.4	2	1	2	1	2	----	----	----	1	----	----	----	1	----

List of Practical

Sr. No.	List of Practical's	
1	Implementation of Searching Algorithms	EC209.1, EC209.4
2	* Implementation of Sorting Algorithms	EC209.1, EC209.4
3	*Implementation of Singly Linked List	EC209.2
4	Array and Linked Implementation of Stack.	EC209.2
5	Conversion of Infix to Postfix.	EC209.1
6	Array and Linked Implementation of Queue.	EC209.2
7	Implementation of Doubly Linked List.	EC209.3
8	*Implement Binary Search Tree.	EC209.3
9	* Implementation of Depth First Search and Breadth First Search.	EC209.2
10	Array and Linked Implementation of Circular Queue.	EC209.2 , EC209.3
11	Addition of polynomial using array of structure	EC209.1
12	Check continuity of different types of parenthesis using stack.	EC209.1
13	Implement Prim's and Kruskal's Algorithm.	EC209.1, EC209.4
14	Implement Dijkstra's algorithm	EC209.1, EC209.4

Note: Students are required to complete at least 8 experiments. Star (*) marked experiments are compulsory.

Constitution of India – Basic features and fundamental principles (MC210)

Teaching Scheme
Practical: 2 Hrs. / Week

Examination Scheme
Credits: Non Credit

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Course Objectives

1. To study the historical background, salient features and preamble of Indian constitution
2. To study the provision of fundamental right in the Indian constitution.
3. To study the directive principle of state policy and fundamental duties.
4. To study the system of government through parliamentary and federal system,
5. To understand the formation, structure and legislative framework of central government.
6. To understand the formation, structure and legislative framework of state government.

Course Outcomes: After successful completion of course students will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
MC210.1	Describe background, salient features of constitution of India	1	Remember
MC210.2	Explain the system of government, it's structure and legislative framework also can interpret the fundamental rights and duties	2	Understand
MC210.3	Use the fundamental rights and duties in their life	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MC210.1	-	-	-	-	-	1	-	-	-	-	-	-	-	-
MC210.2	-	-	-	-	-	2	-	-	-	-	-	-	-	-
MC210.3	-	-	-	-	-	2	-	-	-	-	-	-	-	-

COURSE CONTENTS

Unit-I	Introduction to Constitution of India	No. of Hrs.	COs
	Historical background, Salient features, Preamble of constitution	07	MC210.1
Unit-II	**Fundamental Rights**	**No. of Hrs.**	**COs**

	Features of fundamental rights, Basic rights 1. Right to equality; 2. Right to freedom; 3. Right against exploitation; 4. Right to freedom of religion; 5. Cultural and educational rights; 6. Right to property; 7. Right to constitutional remedies	**05**	**MC210.3**
Unit-III	**A) Directive principle of State Policy (B) Fundamental Duties**	**No. of Hrs.**	**COs**
	Features of directive principle,Classification of directive principle, Criticism of directive principle, Utility of directive principle, Conflict between Fundamental rights and directive principle, List of fundamental duties, Features of fundamental duties, Criticism of fundamental duties, Significance of fundamental duties, Swaran Singh Committee Recommendations	**05**	**MC210.3**
Unit-IV	**System of Government**	**No. of Hrs.**	**COs**
	Parliamentary system: Features of parliamentary government, Features of presidential government, merits and demerit of Parliamentary system, Federal system: Federal features of constitution, unitary features of constitution, Centre and state relation: Legislative relation, administrative relations and financial relation, Emergency provision: National emergency, Financial emergency and criticism of emergency provision	**05**	**MC210.2**
Unit-V	**Central Government**	**No. of Hrs.**	**COs**
	President: Election of president, powers and functions of president, and Veto power of president, Vice-president: Election of vice-president, powers and functions of vice-president, Prime minister: Appointment of PM, powers and functions of PM, relationship with president, Central council of ministers: Appointment of ministers, responsibility of ministers, features of cabinet committees, functions of cabinet committees, Parliament: Organization of parliament, composition of the two houses, duration two houses, membership of parliament, session of parliament, joint sitting of two houses, budget in parliament, Supreme court (SC): Organization of supreme court, independence of supreme court, jurisdiction and powers of supreme court	**05**	**MC210.2**
Unit-VI	**State Government**	**No. of Hrs.**	**COs**
	Governor: Appointment of governor, powers and functions of governor, constitutional position, Chief minister: Appointment of CM, powers and functions of CM, relationship with governor, State council of ministers: Appointment of ministers, responsibility of ministers, cabinet, High court (HC): Organization of HC, independence of HC, jurisdiction and powers of HC, Sub-ordinate court: Structure and jurisdiction, LokAdalats, Family court, Gram Nyayalayas	**05**	**MC210.2**
Reference Book:			
1. Indian Polity for Civil Service Examination, M Laxmikanth, Mc GrawHill Education, Fifth Edition.			

2. Introduction to the Constitution of India, Durga Das Basu, LexisNexis, 22nd Edition

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

B. Tech. Electronics and Computer Engineering

2020 Pattern

Proposed Program Structure

(B. Tech. with effect from Academic Year 2020-2021)

(Revised S Y B. Tech. Sem-IV with effect from Academic Year 2021-2022)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

Vision of the Institute

To Develop World Class Professionals through Quality Education.

Mission of the Institute

To create Academic Excellence in the field of Engineering and Management through Education, Training and Research to improve quality of life of people.

Vision of the Department

To produce quality professionals in the field of Electronics and Computer Engineering with knowledge and skill sets to meet diversifying needs of industry and society.

Mission of the Department

M1- To impart the technology of Electronics and Computer Engineering through an effective teaching-learning process.
M2- To establish linkages between industry and academia for overall development of students.
M3- To promote innovative ideas in solving multi-disciplinary engineering problems having social relevance.
M4- To develop technical human resources exhibiting professional and ethical attitudes.

Program Educational Objectives (PEOs)

PEO1: Involve in design, manufacturing, integration and testing of products, software and systems in the field of Electronics & Computer engineering and allied disciplines.

PEO2: Solve engineering problems having social relevance by applying knowledge and skill sets related to Electronics and Computer engineering.

PEO3: Pursue higher Education/Research in the field of Engineering/Management or become a successful entrepreneur in the related areas.

PEO4: Work effectively as an individual and/or a team member of multi-disciplinary assignments involving people across different cultures and national boundaries.

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **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.
4. **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.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **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.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **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.

Program Specific Outcomes (PSOs)

On successful completion of the program, the graduates will be able to:

PSO1: Specify, Design, Test and Implement electronic systems related to Signal Processing, Networking, Embedded architectures and IoT using state of the art components and software.

PSO2: Provide software solutions for engineering problems by applying knowledge of Data Structures, Algorithms, Database Management, Web Technology, Big Data and Cloud Computing.

List of Abbreviations			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
BSC	Basic Science Course	OEC	Open Elective Course
CIA	Continuous Internal Assessment	OR	End-Semester Oral Examination
EFC	Engineering Foundation Course	P	Practical
ESE	End-Semester Evaluation	PCC	Professional Core Course
HSMC	Humanities/Social Sciences/Management Course	PEC	Professional Elective Course
IP	Induction Program	PR	End-Semester Practical Examination
ISE	In-Semester Evaluation	PROJ	Project
L	Lecture	T	Tutorial
MLC	Mandatory Learning Course	TW	Continuous Term Work Evaluation

S. Y. B. TECH. 2020 Pattern (Electronics and Computer Engineering) SEMESTER-III

Course			Teaching Scheme (Hours/week)				Evaluation Scheme- Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CIA				
PCC	EC201	Discrete Mathematics and Information Theory	3	-	-	3	30	50	20	-	-	-	100
PCC	EC202	Electronic Devices and Circuits	4	-	-	4	30	50	20	-	-	-	100
PCC	EC203	Digital Logic Design and HDL	4	-	-	4	30	50	20	-	-	-	100
PCC	EC204	Data Structure and Algorithms	3	-	-	3	30	50	20	-	-	-	100
HSMC	HS205	Universal Human Values & Ethics	3	-	-	3	30	50	20	-	-	-	100
LC	EC206	Discrete Mathematics and Information Theory Tutorial		1		1						50	50
LC	EC207	Electronic Devices and Circuits Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC208	Digital Logic Design and HDL Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC209	Data Structure and Algorithms Laboratory	-	-	2	1	-	-	-	50	-	-	50
MC	MC210	Mandatory Course-III Constitution of India – Basic features and fundamental principles	2	-	-	No	-	-	-	-	-	-	-
		Total	**19**	**1**	**6**	**21**	**150**	**250**	**100**	**50**	**100**	**50**	**700**

SEMESTER-IV

Course			Teaching Scheme (Hours/week)				Evaluation Scheme- Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	ISE	ESE	CIA				
BSC	BS202	Engineering Mathematics - III	3	1	-	4	30	50	20	-	-	-	100
PCC	EC212	Principles of Communication	3	-	-	3	30	50	20	-	-	-	100
PCC	EC213	Signals & Systems	3	-	-	3	30	50	20	-	-	-	100
PCC	EC214	Computer Organization & Microcontroller	3	-	-	3	30	50	20	-	-	-	100
PCC	EC215	Theory of Computations	3	-	-	3	30	50	20	-	-	-	100
LC	EC216	Principle of Communication Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC217	Python Laboratory	-	-	2	1	-	-	-		50		50
PROJ	EC218	Mini Project/Choice Based Subject (OOP)	1	-	2	2	-	-	-	50	-	-	50
PROJ	EC219	Electronics and Computer workshop	-	-	2	1	-	-	-	-	-	50	50
MC	MC220	Mandatory Course-IV Innovation - Project based – Sc., Tech, Social, Design & Innovation	2	-	-	No	-	-	-	-	-	-	-
		Total	**18**	**1**	**08**	**21**	**150**	**250**	**100**	**50**	**100**	**50**	**700**

Total Credits: 42 **Total Marks: 1400**

Engineering Mathematics III(BS202)

Teaching Scheme
Lectures: 03 Hrs. / Week
Tutorials: 01 Hrs./ Week

Credits: 04

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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COURSE OBJECTIVES

1 To make students familiarize with concepts and techniques of vector calculus, probability and random processes.

2 The intent is to furnish them with the techniques to understand engineering mathematics and its applications that would develop logical thinking power, useful in their disciplines.

COURSE OUTCOMES

The Students are able to

1. Describe and recall the basics of vector algebra, apply it to calculate directional derivative, divergence and curl of vector function.
2. understand the concept vector integration, analyze and apply it to solve engineering problems using Green's theorem, Stoke's theorem, Gauss's Divergence theorem.

3 analyzedata, find mean, correlation, regression and **Test** hypothesis with suitable method.

4 characterize probability model and function of discrete random variables based on one and two random variables**.**

5 characterize probability model and function of continuous random variables based on one and two random variables.

6 apply integral transform technique to solve equations involved in engineering applications.

CO's	Course Outcomes Statements	Bloom's Taxonomy	
		Level	Descriptor
BS202.1	Describe the basics of vector algebra, apply it to calculate directional derivative, divergence and curl of vector function	3	Apply
BS202.2	Understand the concept, vector integration, apply it to solve engineering problems using Green's theorem, Stoke's theorem, Gauss's theorem	3	Apply
BS202.3	Analyze data, find mean, correlation, regression and Test hypothesis with suitable method.	4	Analyze
BS202.4	Characterize probability model and function of discrete random variables based on one and two random variables.	4	Analyze
BS202.5	Characterize probability model and function of continuous random variables based on one and two random variables.	4	Analyze
BS202.6	Apply integral transform technique to solve equations involved in engineering applications	3	Understand/ Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
BS202.1	3	2	-	-	-	-	-	1	1	1	-	-
BS202.2	3	2	-	-	-	-	-	1	1	1	-	-

BS202.3	2	3	-	-	1	-	-	1	1	1	-	-
BS202.4	3	2	-	-	-	-	-	1	1	1	-	-
BS202.5	2	2	-	-	-	-	-	1	1	1	-	-
BS202.6	3	3	-	-	-	-	-	1	1	1	-	-

COURSE CONTENTS

Unit-I	**VECTOR DIFFERENTIATION**	**No.of Hours**	**COs**
	Scalar and vector point function, Derivative of a vector point function, Gradient of scalar function ∅, Directional derivative, Divergence and Curl of vector point function, Solenoidal and irrotational vector field and scalar potential, vector identities.	06	1
Unit-II	**VECTOR INTEGRATION**	**No.of Hours**	**COs**
	Line integral, Green's theorem, Work done, Conservative field, surface integral, Stokes theorem, volume integral, Gauss Divergence theorem.	06	2
Unit-III	**BASIC STATISTICS**	**No. of Hours**	**COs**
	Measures of Central tendency, Moments, Skewness and Kurtosis, Correlation and regression	06	3
Unit-IV	**DISCRETE RANDOM VARIABLES**	**No. of Hours**	**Cos**
	Probability mass function and Distribution function, Mathematical Expectation, Variance & Standard Deviation, Binomial distribution, Poisson distribution, Joint distributions, Independent Random variables.	06	4
Unit-V	**CONTINUOUS RANDOM VARIABLES**	**No. of Hours**	**Cos**
	Cumulative probability function and Distribution function, Mathematical Expectation, Variance & Standard Deviation, Normal distribution, Covariance and Correlation, Joint distributions, Independent Random variables.	06	5

Unit-VI	FOURIER TRANSFORM	No. of Hours	COs
	Definition of Fourier transform, Properties of Fourier transform, Fourier Cosine transform, Fourier sine transform, Inverse Fourier transform	06	6

Text Book(s)

1. B. S. Grewal, Higher Engineering Mathematics, 42/e, Khanna Publishers, 2012, ISBN-13: 978-8174091154.
2. Scott Miller, Donald Childers, Probability and Random Processes, 2 Ed, Elsevier, 2012.
3. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House, 2014. ISBN-13: 978-1842653418.

References

1. K.A. Stroud & D. S. Booth, Advanced Engineering Mathematics, Industrial Press, 5/e, 2011, ISBN-9780831134495
2. P. C. Matthews, Vector Calculus, Springer, 2/e, 2012, ISBN-9783540761808
3. T. Veerarajan, Probability Statistics and random processes, Tata McGraw Hill, 3/e, 2008. ISBN 13: 9780070669253.
4. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, 9/e, 2013, ISBN-13: 978-0471488859.

Principles of Communication (EC212)

Teaching Scheme:
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme:
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite: Fundamentals of communication

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Course Objectives:-

1. To get acquainted with the concept of amplitude modulation & its different types.
2. To get acquainted with the concept of angular modulation && it's different types.
3. To explain different types of receivers & their performance parameters.
4. To learn various types of noises & their sources.
5. To introduce the concept of sampling theorem and pulse modulation techniques.
6. To learn various techniques for waveform coding.

Course Outcomes (COs):-
After completion of course students will be able to

COs	Statement	Bloom's Taxonomy	
		Level	**Descriptor**
EC212.1	Illustrate the amplitude modulation with various types.	2	Understand
EC212.2	Illustrate the angle modulation with various types.	2	Understand
EC212.3	Compare the performance parameters of different receivers.	4	Analyze
EC212.4	Classify the noise depending on their sources.	2	Understand
EC212.5	Demonstrate the multiplexing applications.	3	Apply
EC212.6	Summarize the waveform coding techniques & their applications.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):-

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC212.1	2	1	-	-	2	-	-	-	-	-	-	1	-	1
EC212.2	2	1	-	-	2	-	-	-	-	-	-	1	-	1
EC212.3	3	2	1	-	-	-	-	-	-	-	-	1	-	2
EC212.4	2	1	1	-	-	-	-	-	-	-	-	1	-	1
EC212.5	2	1	1	-	-	-	-	-	-	-	-	1	-	2
EC212.6	2	-	2	-	-	-	-	-	-	-	-	1	-	1

Course Contents:

Unit-I	**Amplitude Modulation**	**No. of Hours**	**COs**
	Amplitude Modulation (AM), Mathematical Expression, Modulation Index, Bandwidth of AM, Power & Power Efficiency, Double Sideband Full Carrier (DSB-FC) Modulation, Double Sideband Suppressed Carrier (DSB-SC) Modulation, Single Sideband Modulation (SSB), Vestigial Sideband Modulation (VSB), Spectrum & Bandwidth of DSB-FC, DSB-SC, SSB & VSB, Comparison & Its Applications, AM Modulator & Demodulator.	06 Hrs.	EC212.1
Unit-II	**Angle Modulation**	**No. of Hours**	**COs**
	Types of Angle Modulation, Frequency Modulation (FM), Mathematical Expression, Modulation Index, Bandwidth of FM, Power & Power Efficiency, Spectrum Analysis, Narrowband FM & Wideband FM, Phase Modulation (PM), Relation Between FM & PM, Generation Methods of FM, Direct & Indirect Methods, Armstrong's Indirect Method, Comparison Between AM, FM & PM, FM Modulator & Demodulator.	06 Hrs.	EC212.2
Unit-III	**Radio Receivers**	**No. of Hours**	**COs**
	Main Functions of Receiver, Tuned Radio Frequency (TRF) Receiver, Super Heterodyne Receiver, Automatic Gain Control (AGC), Performance Parameters: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection etc.	06 Hrs.	EC212.3
Unit-IV	**Noise**	**No. of Hours**	**COs**
	Definition of Noise, Effect of Noise, Sources of Noise, Internal & External Sources of Noise, Types of Noise, Signal to Noise Ratio(SNR), Figure of Merit, Noise Figure, Noise Temperature, Noise Bandwidth, Noise Reduction Techniques.	06 Hrs.	EC212.4
Unit-V	**Pulse Modulation & Multiplexing**	**No. of Hours**	**COs**
	Sampling Process, Sampling Rate, Sampling Theorem, Nyquist Criteria, Types of Sampling: Ideal, Natural & Flat Top, Analog Pulse Modulation: PAM, PWM & PPM, Multiplexing & Demultiplexing, Multiplexing Techniques: TDM, FDM & WDM.	06 Hrs.	EC212.5
Unit-VI	**Digital Transmission of Analog Signal**	**No. of Hours**	**COs**

	Introduction to Digital Communication System, bit rate, baud rate, PCM Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and Companding, Delta Modulation(DM), Adaptive Delta Modulation(ADM), Data formats (NRZ, RZ, POLAR RZ, BIPOLAR (AMI), MANCHESTER), Digital Modulation Techniques: ASK, FSK, PSK.	06 Hrs.	EC212.6

Books:

Text Books:

1. Taub, Schilling and Saha, "Principles of Communication Systems", McGraw-Hill, 4th Edition.
2. B. P. Lathi, Zhi Ding, "Modern Analog and Digital Communication System", Oxford University Press, 4th Edition.
3. George Kennedy, "Electronic Communications", McGraw Hill Kennedy.

Reference Books:

1. Bernard Sklar and Prabitra Kumar Ray, "Digital Communications Fundamentals and Applications", Pearson Education 2nd Edition.
2. Wayne Tomasi, "Electronic Communications System", Pearson Education, 5th Edition.
3. A.B Carlson, P B Crully and J C Rutledge, "Communication Systems", Tata McGraw Hill Publication, 5th Edition.
4. Simon Haykin, "Communication Systems", John Wiley & Sons, 4th Edition.

MOOC / NPTEL Course:

1. NPTEL Course "Principles of Communication Systems-I".
2. https://nptel.ac.in/courses/108/104/108104091/

Continuous Internal Assessment:

1. Unit test
2. Poster Making
3. Case study of any communication system.

Signals and Systems (EC213)

Teaching Scheme
Lectures: 3 Hrs. / Week

Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite Course: Basic knowledge of Transform Theory

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Course Objectives:

1. To understand the mathematical description of continuous and discrete time signals and systems.
2. To analyze Linear Time Invariant (LTI) systems in the time domain.
3. To study the signal and system using the tool Laplace Transform.
4. To study the signal and system using the tool Z Transform.
5. Analyze spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.
6. To study correlation and its properties.

Course Outcomes (COs):

After completion of this subject student should be able to:

Course Code	Course outcome	Bloom's Taxonomy	
		Level	Descriptor
EC213.1	List the formulas and standard signals representation for system analysis	1	Remember
EC213.2	Interpret the Significance of convolution and system Interconnection	2	Understand
EC213.3	Classify the knowledge to convert continuous time signal into Laplace Domain	3	Apply
EC213.4	Classify the knowledge to convert discrete time signal into Z domain	3	Apply
EC213.5	Analyze system behavior using Fourier analysis tool.	4	Analyze
EC213.6	Interpret correlation and its properties, Distribution functions	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC213.1	3	2	2	-	-	-	-	-	-	-	-	-	3	-
EC213.2	3	2	2	-	-	-	-	-	-	-	-	-	2	-
EC213.3	3	2	2	-	-	-	-	-	-	-	-	-	3	-
EC213.4	3	2	2	-	-	-	-	-	-	-	-	-	3	-
EC213.5	3	2	2	-	-	-	-	-	-	-	-	-	2	-
EC213.6	3	2	2	-	-	-	-	-	-	-	-	-	2	-

Course Contents

Unit-I	Introduction to Signals and Systems	No. of Hours	CO 1
	Introduction and Classification of signals: Definition of signal and system, communication and control systems as examples, Continuous time and discrete time signal, Classification of signals, Elementary signals, different signal Operations Systems: Definition, Classification: linear and nonlinear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.	6 Hrs.	EC213.1

Unit-II	Time domain representation of LTI System	No. of Hours	CO 2
	System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral, Computation of convolution sum. Properties of convolution. System interconnection, system properties in terms of impulse response, step response.	6 Hrs.	EC213.2
Unit-III	System analysis using Laplace Transform	No. of Hours	CO 3
	Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform, ROC, Laplace transform of standard periodic and aperiodic functions, Inverse Laplace transform based on partial fraction expansion, Transfer function, concept of Poles and Zeros, stability considerations in S domain, Electrical Network using Laplace Transform approach.	6 Hrs.	EC213.3
Unit-IV	Z-Transform	No. of Hours	CO 4
	Introduction, Definition, Standard properties, ZT of standard sequences and their inverses, Solution of difference equations, Applications of ZT.	6 Hrs.	EC213.4
Unit-V	Fourier Series and Fourier Transform	No. of Hours	CO 5
	Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, orthogonality, basis functions, Amplitude and phase response, FS representation of CT signals using trigonometric and exponential Fourier series. Applications of Fourier series, Fourier Transform (FT) representation of aperiodic CT signals, Dirichlet condition for existence of Fourier transform, evaluation of magnitude and phase response, FT of standard CT signals, FT of standard periodic CT signals, Interplay between time and frequency domain, Fourier Transform for periodic signals, Introduction to Discrete Time Fourier Transform.	6 Hrs.	EC213.5
Unit-VI	Correlation and Distribution function	No. of Hours	CO 6
	Correlogram, Introduction to Correlation : Autocorrelation, Cross correlation for Continuous and discrete signals and their properties, Power spectral Density and its properties. Distribution Function : Normal, Gaussian, Rayleigh.	6 Hrs.	EC213.6

Text Books:

1. Simon Haykins and Barry Van Veen, “Signals and Systems”, John Wiley and sons.
2. B. P. Lathi, “Linear Systems and Signals”, OXFORD University Press.

Reference Books:

1. Alan V. Oppenheim, Alan S. Willsky with IAN T. Young, “Signals and Systems”, Prentice-Hall.
2. S. S. Soliman & M.D. Srinath, “Continuous and Discrete Signals and Systems”, Prentice- Hall, 1990.
3. Shaila Dinkar Apte “Signals and Systems: Principles and Applications”, Cambridge University Press.
4. M.J. Roberts “Signal and Systems”, Tata McGraw Hill 2007.

Online resource : https://onlinecourses.nptel.ac.in/noc21_ee28/preview

Guidelines for Continuous Assessment:-

Assignments and Tests

Computer Organization & Microcontroller (EC214)

Teaching Scheme	**Examination Scheme**
Lectures: 03 Hrs. / Week	In-Sem Exam: 30 Marks
	End Sem Exam: 50 Marks
	CIA: 20 Marks
Credits: 03	Total: 100 Marks

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Prerequisite course: DSA

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Course Objectives:

1. Students will gain knowledge on architecture, accessing data and instruction from memory for processing.
2. Ability to do programs with instruction set and control the external devices through I/O interface
3. Generate a system model for real world problems with data acquisition, processing and decision making with aid of micro controllers and advanced processors.

Course Outcomes (COs):

After completion of course students will be able to

Course Outcomes	Course outcome	Blooms Taxonomy	
		Level	Descriptor
EC214.1	Explain the fundamental principles of computer.	2	Understand
EC214.2	Generalize the functionality of memories in microprocessor.	2	Understand
EC214.3	Illustrate the features of 8086 microprocessor.	2	Understand
EC214.4	Explain instruction set in microcontroller.	2	Understand
EC214.5	Execute basic Assembly Language Programs (ALP).	3	Apply
EC214.6	Execute programs for Timers and Interrupts.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC214.1	3	---	1	---	1	---	---	---	---	---	---	2	1	---
EC214.2	2	---	1	---	2	---	---	---	---	---	---	1	1	---
EC214.3	1	---	2	1	1	---	---	---	---	---	---	1	2	---
EC214.4	1	---	1	1	3	---	---	---	---	---	---	2	3	---
EC214.5	2	---	1	1	3	---	---	---	---	---	---	1	2	---
EC214.6	2	1	1	1	2	---	---	---	---	---	---	1	2	---

Course Contents

Unit-I	**Computer Evolution**	No. of Hours	CO .1
	Evolution (a brief history) of computers, Designing for Performance, Evolution of Intel processor architecture- 4 bit to 64-bit. Computer Components, Computer Function, Interconnection structure, The Arithmetic and Logic Unit, addition and subtraction of signed numbers, Booth's algorithm.	06	**EC214.1**
Unit-II	**Computer Memory System**	No. of Hours	CO 2
	Cache Memory: Cache memory principles, Elements of cache design- cache address, size, mapping functions, replacement algorithms, write policy, line size, number of caches, one level and two-level cache. Internal Memory:	06	**EC214.2**

	Semiconductor main memory, advanced DRAM organization. External Memory: Hard Disk organization		
Unit-III	**Introduction to 8086**	No. of Hours	CO 3
	Introduction of 8085, 8086 architecture- functional diagram, Register organization, memory segmentation, programming model, Memory addresses, physical memory organization, I/O instructions, DMA functions, DMA Controller.	06	**EC214.3**
Unit-IV	**Introduction to Microcontroller**	No. of Hours	CO 4
	Need of Microcontrollers, Difference between Microprocessors and Microcontrollers, Criteria for Choosing a Microcontroller, Salient Features of 8051, 8051 Family, Architecture of 8051, pin description of 8051, I/O ports, Memory organization.	07	**EC214.4**
Unit-V	**Instruction sets in Microcontroller**	No. of Hours	CO 5
	Registers, addressing modes and instruction set of 8051, Structure of Assembly Language Programming, Introduction to simulation of 8051, Simple programs with 8051.	07	**EC214.5**
Unit-VI	**Timers and Interrupts in Microcontroller**	No. of Hours	CO 6
	Timer and Programming with Timer, interrupts and programming external hardware interrupts, Programming for serial communication interrupts, Programming for counters.	07	**EC214.6**

Books:

Text Books:

1. Barry B. Bray , The Intel Microprocessor 8086/8088, 80186,80286, 80386 and 80486 Architecture, programming and interfacing, PHI, 8th Edition, 2009.
2. Miles Murdocca and Vincent Heuring, “Computer Architecture and Organization- an integrated approach”, Wiley India Pvt. Ltd, 2nd Edition

3. The 8051 Microcontroller and Embedded Systems Using Assembly and C,2nd Edition, M. Ali Mazidi, Janice Gillispie Mazidi, 2005.
4. Kenneth J. Ayala. The 8051 microcontroller, 3rd edition, Cengage learning, 2010.

5. Microprocessor Architecture, Programming, and Applications with the 8085. Ramesh S. Gaonkar, 2013, 6th Edition, Penram International Publishing.

6. Microprocessor 8085: Architecture, Programming, and Interfacing, PHI Learning, Wadhwa Ajay, ISBN: 9788120340138, 9788120340138.

7. W. Stallings, Computer organization and architecture, Prentice-Hall, 8th edition, 2013.

Reference Books:

1. W. Stallings, “Computer Organization and Architecture: Designing for performance”, Pearson Education/ Prentice Hall of India, 2003 7th Edition.
2. The 8051 microcontrollers, architecture and programming and applications-K.Uma Rao, Andhe Pallavi., Pearson, 2009.
3. Microcontrollers and application, Ajay. V. Deshmukh, TMGH, 2005.
4. David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface 5th edition, Morgan Kaufmann, 2013.
5. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer organization, Mc Graw Hill, Fifth edition, Reprint 2011.

e-Resources:

1. NPTEL Course “Computer Organization”
https://nptel.ac.in/courses/106/106/106106092/
2. NPTEL Course “Computer Architecture & Organization”
https://nptel.ac.in/courses/106/105/106105163/

Guidelines for Continuous Internal Assessment: -

Programming Assignment based on theory/program will be evaluated for 10 marks.

MCQ based Test will be evaluated on each unit for 10 marks.

Theory of Computations (EC215)

Teaching Scheme
Lectures: 3 Hrs. / Week

Credits: 3

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course: Engineering Mathematics

Course Objectives:

1. To introduce the students to basics of Theory of Computation
2. To study abstract computing models to provide a formal connection between algorithmic problem solving and the theory of languages
3. To understand Grammar, Pushdown Automata and Turing Machine for language processing and algorithm design
4. To learn about the theory of computability and complexity for algorithm design

Course Outcomes (COs): After successful completion of the course, student will be able to

COs	Course Outcome Statement	Bloom's Taxonomy	
		Level	Descriptor
EC215.1	Understand formal language, translation logic, essentials of translation, alphabets, language representation and apply it to design Finite Automata and its variants	2	Understand
EC215.2	Construct regular expression to present regular language and understand pumping lemma for RE	3	Apply
EC215.3	Design Context Free Grammars and learn to simplify the grammar.	3	Apply
EC215.4	Construct Push down Automaton model for the Context Free Language.	4	Analyse
EC215.5	Devise Turing Machine for the different requirements outlined by theoretical computer science	3	Apply
EC215.6	Analyze different classes of problems, and study concepts of NP completeness.	4	Analyse

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC215.1	1	2	1	-	2	-	-	-	-	-	-	-	1	-
EC215.2	-	-	-	-	3	-	-	-	-	-	-	-	3	-
EC215.3	-	3	3	-	3	-	-	-	-	-	-	-	1	-
EC215.4	-	-	-	-	3	-	-	-	-	-	-	-	3	-
EC215.5	-	-	-	-	3	-	-	-	-	-	-	-	3	-
EC215.6	-	2	3	-	-	-	-	-	-	-	-	-	1	-

COURSE CONTENT

Unit-I	Formal Language Theory and Finite Automata	No. of Hours	COs
	Review of Mathematical Theory: Sets, Functions, Logical statements, Proofs, relations, languages, Mathematical induction, strong principle, Recursive definitions, Finite Automata (FA): An informal picture of FA, Finite State Machine (FSM), Language accepted by FA, Definition of Regular Language. FA with output: Moore and Mealy machines -Definition, models, inter-conversion.	6	EC215.1
Unit-II	Regular Expressions (RE)		
	Introduction, Operators of RE, Precedence of operators, Algebraic laws for RE, Language to Regular Expressions, Equivalence of two REs. Conversions: RE to NFA, DFA, DFA to RE using Arden's theorem, Pumping Lemma for Regular languages, Closure and Decision properties of Regular languages. Myhill-Nerode theorem	7	EC215.2
Unit-III	Context Free Grammar (CFG) and Context Free Language(CFL)		
	Basic Elements of Grammar, Formal Definition of Context Free Grammar, Sentential form, Derivation and Derivation Tree/ Parse Tree, Context Free Language (CFL), Ambiguous Grammar, writing grammar for language. Simplification of CFG: Eliminating Є-productions, unit productions, useless production, and useless symbols. Normal Forms: Chomsky Normal Form, Greibach Normal Form, Pumping Lemma for CFG, Closure properties of CFL, Decision properties of CFL, Chomsky Hierarchy, Cock-Younger-Kasami Algorithm.	5	EC215.3
Unit-IV	Pushdown Automata (PDA)		
	Introduction, Formal definition of PDA, Equivalence of Acceptance by Final State and Empty stack, Non-deterministic PDA (NPDA), PDA and Context Free Language, Equivalence of PDA and CFG, PDA vs CFLs. Deterministic CFLs.	7	EC215.4
Unit-V	Turing Machines (TM)		
	Turing Machine Model, Formal definition of Turing Machines, Language Acceptability by Turing Machines, Design of TM, Description of TM, Techniques for TM Construction, Computing function with Turing Machine, Variants of Turing Machines, Halting Problem of TM, Halting vs Looping, A Turing-unrecognizable language, Reducibility, Recursion Theorem. The Model of Linear Bounded Automata	7	EC215.5
Unit-VI	Computability and Complexity Theory		
	Computability Theory: Decidable Problems and Un-decidable Problems, Church-Turing Thesis. Reducibility: Undecidable Problems that is recursively enumerable, A Simple Un-decidable problem. Complexity Classes: Time and Space Measures, The Class P, Examples of problems in P, The Class NP, Examples of problems in NP, P Problem Versus NP Problem, NP-completeness and NP-hard Problems.	5	EC215.6

Text Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman, “Introduction to Automata Theory Languages and Computation”, Addison-Wesley,ISBN 0-201-44124-1
2. Daniel Cohen, “Introduction to Computer Theory”, Wiley & Sons, ISBN 97881265133454

Reference Books:

1. Sanjeev Arora and Boaz Barak, “Computational Complexity: A Modern Approach”, Cambridge University Press, ISBN: 0521424267 97805214242643
2. John Martin, “Introduction to Languages and The Theory of Computation”, 2nd Edition, McGrawHill Education, ISBN-13: 978-1-25-900558-9, ISBN-10: 1-25-900558-5
3. J.Carroll & D Long, “Theory of Finite Automata”, Prentice Hall, ISBN 0-13-913708-45
4. Kavi Mahesh, “Theory of Computation: A Problem-Solving Approach”, Wiley India, ISBN1081265331106
5. Michael Sipser, “Introduction to the Theory of Computation”, Cengage Learning, ISBN- 13: 97811331878137
6. Vivek Kulkarni, “Theory of Computation”, Oxford University Press, ISBN 0-19-808458

Online Resources :

1. https://nptel.ac.in/courses/106/104/106104148/
2. https://nptel.ac.in/courses/106/104/106104028/

CIA Activity

Sr. No	Title	Marks	Schedule	COs
1	MCQ Test Unit 1	10	After completion of unit I	EC215.1
2	MCQ Test Unit 2	10	After completion of unit II	EC215.2
3	MCQ Test Unit 3	10	After completion of unit III	EC215.3
4	MCQ Test Unit 4	10	After completion of unit IV	EC215.4
5	MCQ Test Unit 5	10	After completion of unit V	EC215.5
6	MCQ Test Unit 6	10	After completion of unit VI	EC215.6
7	Case Study	20	Semester start to INSEM	
8	Case study	20	INSEM to semester end	

Principle of Communication Laboratory (EC216)

Teaching Scheme:
Practical: 02Hrs. / Week
Credits: 01

Examination Scheme:
Practical: 50 Marks
Total: 50 Marks

Prerequisite Course: Basics of communication

Course Objectives:-

1. To explain the communication system & various blocks.
2. To introduce the concept of amplitude & frequency modulation.
3. To observe the different stages in analog to digital conversion.
4. To write the programs for AM & FM modulations.
5. To introduce the concept of sampling theorem and pulse modulation techniques.
6. To learn various techniques for waveform coding.

Course Outcomes (COs):-
After completion of course students will be able to

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
EC216.1	Describe the communication systems & functioning of their components.	2	Understand
EC216.2	Illustrate the amplitude modulation with its waveforms.	2	Understand
EC216.3	Illustrate the frequency modulation with its waveforms.	2	Understand
EC216.4	Show the transmission & reception of signal with the help of digital modulation technique.	3	Apply
EC216.5	Demonstrate the analog to digital conversion.	2	Understand
EC216.6	Summarize the waveform coding techniques.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):-

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC216.1	2	-	1	-	-	-	-	2	2	2	-	1	-	1
EC216.2	3	1	2	-	2	-	-	2	2	2	-	1	-	2
EC216.3	3	1	2	-	2	-	-	2	2	2	-	1	-	2
EC216.4	2	1	-	-	-	-	-	2	2	2	-	1	-	2
EC216.5	2	1	2	-	-	-	-	2	2	2	-	1	-	1
EC216.6	2	1	-	-	-	-	-	2	2	2	-	1	-	1

Students shall perform at least 8 experiments.
Practical Course Contents

Sr. No.	Title of Practical	COs

1	Survey of different communication systems & the role of different components in the communication systems.	EC216.1
2	AM generation (DSB-FC): calculation of modulation index by graphical method, power of AM wave for different modulating signal and observer spectrum.	EC216.2
3	Frequency modulator & demodulator, Calculation of modulation index & BW of FM.	EC216.3
4	Verification of sampling theorem, PAM techniques (flat top & natural sampling), reconstruction of original signal, observing aliasing effect in frequency domain.	EC216.5
5	Perform the Pulse Code Modulation [PCM] & observe the output waveforms at different stages.	EC216.5
6	Generation and detection of DM waveforms.	EC216.5
7	To generate the various line codes (NRZ, RZ, POLAR RZ, BIPOLAR (AMI), MANCHESTER) & their spectral analysis.	EC216.6
8	Write a code & simulate to generate amplitude modulation [AM] waveform for given modulation index, signal frequency & carrier frequency.	EC216.2
9	Write a code & simulate to generate frequency modulation [FM] waveform for given modulation index, signal frequency & carrier frequency.	EC216.3
10	Perform the Frequency Shift Keying [FSK] & observe the output waveforms at modulator & demodulator.	EC216.4

Books:-

Text Books:

1. Taub, Schilling and Saha, “Principles of Communication Systems”, McGraw-Hill, 4th Edition.
2. B. P. Lathi, Zhi Ding, “Modern Analog and Digital Communication System”, Oxford University Press, 4th Edition.
3. George Kennedy, “Electronic Communications”, McGraw Hill Kennedy.

Reference Books:

4. Bernard Sklar and Prabitra Kumar Ray, “Digital Communications Fundamentals and Applications”, Pearson Education 2nd Edition.
5. Wayne Tomasi, “Electronic Communications System”, Pearson Education, 5th Edition.
6. A.B Carlson, P B Crully and J C Rutledge, “Communication Systems”, Tata McGraw Hill Publication, 5th Edition.
7. Simon Haykin, “Communication Systems”, John Wiley & Sons, 4th Edition.

MOOC / NPTEL Course:

1. NPTEL Course “Principles of Communication Systems-I”.
2. https://nptel.ac.in/courses/108/104/108104091/

Python Laboratory (EC217)

Teaching Scheme
Practical: 02 Hrs / Week
Credits: 01

Examination Scheme
Practical Exam: 50 Marks
Total: 50 Marks

Prerequisite: Basics of Mathematics
Course Objective:

1. To learn the object-oriented programming concepts using Python
2. To understand the core syntax and semantics of Python programming language
3.To learn GUI Programming in Python
4.To acquaint with the use and benefits of files handling in Python

Course Outcomes:
After successful completion of course students will be able to:

	Course Outcome (s) statement	Bloom's Taxonomy	
		Level	Descriptor
EC217.1	Interpret advanced data types and functions in python	2	Understand
EC217.2	Develop Python applications using functions, Classes and objects	3	Apply
EC217.3	Implement Python applications using object-oriented concepts	3	Apply
EC217.4	Develop Python applications using files, modules, packages and GUI Programming	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC217.1	2	--	1	--	1	--	--	1	--	--	--	2	3	--
EC217.2	1	2	2	--	3	--	--	1	--	--	--	1	1	--
EC217.3	1	2	2	--	2	--	--	1	--	--	--	2	2	--
EC217.4	1	2	3	--	2	--	--	1	--	--	--	1	2	--

General Guidelines
Every student should implement 8 practical's in this laboratory which will cover topics of all units mentioned in the syllabus.

Practical Course Contents

Sr. No.	List of Practical's	CO
1	Write python programs to understand expressions, variables and basic math operations	EC217.1
2	Write python programs to understand list, tuples, dictionaries, arrays etc.	EC217.1
3	Write Python program to implement range, set and different string Functions (len, count, lower, sorted etc)	EC217.1

4	Write python programs to understand Classes and Objects	EC217.2
5	Write python programs to understand Different types of Inheritance	EC217.3
6	Write python programs to understand Constructors, Inner class and Static method	EC217.2
7	Write python programs to understand Polymorphism	EC217.3
8	Write Python program to append data to existing file and then display the entire file	EC217.4
9	Write Python program to count number of lines, words and characters in a file.	EC217.4
10	Write Python program to display file available in current directory	EC217.4
11	Write python programs to understand User-defined modules/packages and import them in a program	EC217.4
12	Creating GUI with python containing widgets such as labels, textbox, radio, checkboxes and custom dialog boxes.	EC217.4

Books:

Text Books:

1. Dr. R. Nageswara Rao, “Core Python Programming”, Dreamtech Press

2.Anurag Gupta, G. P. Biswas, “Python Programming”, McGraw-Hill

Reference Books:

1.David Beazley, Brian K. Jones, “Python Cookbook: Recipes for Mastering Python 3”, O'Reilly Media

2.Martin C. Brown, “Python: The Complete Reference”, McGraw Hill Education

3.Jeeva Jose, P. Sojan Lal, “Introduction to Computing & Problem Solving with Python”, Khanna Computer Book Store

e-Resources:

1) https://docs.scipy.org/doc/numpy/user/quickstart.html

2) https://matplotlib.org/tutorials/

3)https://www.python.org/

4) https://nptel.ac.in/courses/106/106/106106182/

Choice Based Subject (OOP) (EC218)

Teaching Scheme

Lectures: 01 Hrs. / Week
Practical: 02 Hrs / Week
Credits: 02

Examination Scheme

Oral Exam: 50 Marks
Total: 50 Marks

Prerequisite: C programming

Course Objectives:

1. To learn the object oriented programming concepts
2. To make the students familiar with programs in Java for problem solving
3. To study various java programming concept like Interface, exception handling, packages etc.

Course Outcomes (COs):

After successful completion of course students will be able to:

CO	Course Outcome (s) statement	Bloom's Taxonomy	
		Level	Descriptor
EC218.1	Recognize features of OOP, its benefits & applications	1	Remember
EC218.2	Implement the concepts of classes, Objects and Package in Java.	3	Apply
EC218.3	Design Java Applications using Inheritance, Interface and Exception Handling	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
EC218.1	2	--	1	--	--	--	--	--	--	--	--	2	3	--
EC218.2	1	2	2	--	2	--	--	--	--	--	--	2	2	--
EC218.3	2	2	2	--	3	--	--	--	--	--	--	2	2	--

Course Contents

Unit-I	Introduction to Object Oriented Programming	No. of Hours	COs
	Principles of OOP: Need of Object-Oriented Programming (OOP), Object Oriented Programming Paradigm, Basic Concepts of Object-Oriented Programming, Benefits and applications of OOP, Basic Constructs: Evolution of Java, features of java, Java Environment, Constants, variables and data types, Simple Java Program, Control statements- Decision making & branching, Decision making & looping.	04 Hrs.	EC218.1

Unit-II	Classes, Object and Packages	No. of Hours	COs
	Class fundamentals, creating Objects, Methods, Constructor, Static members and methods, Passing and returning Objects, this keyword, garbage collection, Method Overloading Packages in java, creating user defined packages, access specifiers.	04 Hrs	EC218.2
Unit-III	Inheritance, Interfaces and Exception Handling	No. of Hours	COs
	Types of Inheritance, super keyword, Object class, Method Overriding, abstract class and abstract method, final keyword Implementing interfaces, extending interfaces Error vs Exception, try, catch, finally, throw, throws, creating own exception	04 Hrs	EC218.3
Books:			
Text Books:			
1. Sachin Malhotra and Saurabh Chaudhary, "Programming in Java", Oxford University Press 2. Herbert Schildt, "Java: The Complete Reference", McGraw Hill, (7th Edition).			
Reference Books:			
T. Budd, "Understanding OOP with Java", Pearson Education. E. Balagurusamy, "Programming with Java A Primer", Tata McGraw Hill, (3rd Edition) Deitel, H.M. & Deitel, "Java: How to Program", Prentice Hall (8th Ed.).			
e-Resources: 1. https://nptel.ac.in/courses/106/105/106105151/			

General Guidelines

- Implement any 8 Programs
- Experiment should be evaluated on a weekly basis.

Practical Course Contents

Sr. No.	List of Practical's	CO
1	Write a program in Java on branching and looping	EC218.1
2	Write a program in Java to create class with members and methods, accept and display details for single object	EC218.2
3	Write a program in Java on passing object as argument and returning object	EC218.2
4	Write a program in Java on constructor and constructor overloading	EC218.2
5	Write a program in Java to implement a Calculator with operations add, subtract, multiply, divide	EC218.1
6	Write a Program in Java on method overloading using Java	EC218.2
7	Write a program in Java to sort i) List of integers ii) List of names	EC218.2

8	Write a Program in java on interface demonstrating concept of multiple inheritance	EC218.3
9	Write a java program which use try and catch for exception handling	EC218.3
10	Write a Program in java on single and multilevel inheritance (Use super keyword)	EC218.2
11	Write a program in Java on abstract class	EC218.3
12	Write a Java program which imports user defined package and uses members of the classes contained in the package	EC218.2

Electronics and Computer Workshop (EC219)

Teaching Scheme
Practical: 02 Hrs./ Week
Credits: 01

Examination Scheme
TW: 50 Marks
Total: 50 Marks

Prerequisite Course: Basics of Electrical and Electronics Engineering

Course Objectives:

1. To create awareness about basic components used in electronics devices.
2. To study the instruments and equipment.
3. To create awareness about different hardware and software components of computers.

Course Outcomes (COs): After successful completion of the course, student will be able to

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
EC219.1	Acquire a basic knowledge about resistor, capacitor and inductor.	2	Understand
EC219.2	Acquire a basic knowledge of operating Multi-meter, CRO, Power supply, Function generator.	2	Understand
EC219.3	Identify the components of computer	2	Understand
EC219.4	Install the operating systems	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC219.1	3	-	-	-	2	-	-	-	-	-	-	-	1	-
EC219.2	3	-	-	-	2	-	-	-	-	-	-	-	2	-
EC219.3	3	-	-	-	-	-	-	-	-	-	-	-	2	-
EC219.4	3	-	-	-	3	-	-	-	-	-	-	-	2	-

Course Contents

Experiment No.	**Title**	COs
1.	Study of basic electronics components.	EC219.1
2.	Demonstration of front and rear panel electronics instruments (Power supply, function generator, etc)	EC219.2
3.	Study of electronics measuring instruments (True RMS, Multi-meter, CRO, DSO etc.)	EC219.2
4.	Study of computer hardware	EC219.3
5.	Installation of Windows operating system	EC219.4
6.	Installation of Linux operating system	EC219.4
7.	Installation of application and system softwares	EC219.4
8.	Study of Computer networking components	EC219.4

Important guidelines

1. All experiments are compulsory

2. Students should prepare the brief document elaborating aim, objectives, apparatus, equipment, theory, block diagram, conclusion etc. whichever is applicable.
3. Assessment of each experiment is strictly as per rubric defined and communicated with the students in the start of semester.
4. Timely submission of experiment write-up is highly recommended

Text Books:
1. Alan Clements “Principles of Computer Hardware” 4th edition ISBN: 199273138
Reference Books:
1. Thomas C Hayes, Paul Horowitz “The Art of Electronics : A Hands-on Lab Course” Cambridge university Press.
Online Resources:
1. https://www.sans.org/media/security-training/os_install2.pdf 2. https://www.egyankosh.ac.in/bitstream/123456789/9569/1/Unit-1.pdf 3. http://www.electronicsandyou.com/basic-electronic-components-types-functions-symbols.html 4. https://www.electronicshub.org/basic-electronic-components/ 5. https://docs.oracle.com/cd/E19121-01/sf.x2100m2/819-6592-13/Chap1.html

Mandatory Course IV(MC220)

Innovation - Project based – Science and Technology, Social, Design & Innovation

Teaching Scheme	**Examination Scheme**
Lectures: 2 Hrs. / Week	
Credits: 0	Total: 0 Marks

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Many students, when they enter engineering, are full of enthusiasm to understand new areas, to build systems and to experiment and play with them. This enthusiasm is to be tapped and to direct it to exploration and sustained pursuit by the student, which may result in development of a working system, a prototype, or a device or material, etc. They are expected to come up with novel and useful ideas on social problems. Students may be encouraged to take up projects which are aimed at providing solutions to societal problems, reduce drudgery and improving efficiency in rural work, green technologies, utilization of rural and urban waste, sanitation and public health, utilizing non-conventional energy sources, technologies for the benefit of the differently abled people and technologies ready to be implemented in the Institute.

Two types of activities may be undertaken under this

(a) Exposure to social problems (which are amenable to technological solutions)

(b) Design & Innovation (to address above problems)

After this student be encouraged to undertake technology projects of social relevance

Course Objectives

1. To develop strategic thinking to solve social problems in innovative manner.
2. Understand the role of innovation and technical change in enterprise and national level economic performance
3. Understand the technological, human, economic, organizational, social and other dimensions of innovation
4. Understand the effective management of technological innovation requires the integration of people, processes and technology
5. Recognize opportunities for the commercialization of innovation
6. Understand the attributes of innovations

Course Outcomes (CO): After successfully completing the course students will be able to

CO	Course Outcome Statements	Bloom's Taxonomy	
		Level	Descriptor
MC220.1	Understand need of innovation and social problems	2	Understand
MC220. 2	Understand opportunity recognition and ideation management to solve the social problems	2	Understand

MC220.3	Understand the technological, human, economic, organizational, social and other dimensions of innovation	2	Understand
MC220.4	Understand the effective management of technological innovation requires the integration of people, processes and technology	2	Understand
MC220.5	Recognize opportunities for the commercialization of innovation	1	Remember
MC220.6	Understand the attributes of innovations	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MC220.1	-	-	-	-	-	1	-	-	-	-	-	-	2	-
MC220.2	-	-	-	-	-	3	-	-	-	-	1	-	3	-
MC220.3	-	-	-	-	-	3	-	-	-	-	1	-	-	-
MC220.4	-	-	-	-	-	2	2	-	-	-	1	-	-	-
MC220.5	-	-	-	-	-	1	2	1	-	-	-	1	-	-
MC220.6	-	-	-	-	-	2	-	-	-	-	-	2	-	-

Course Contents

Unit-I	**Introduction to innovation**	No. of Hours	COs
	Understand the concept of innovation, Know the difference between innovation and invention, Understand the reasons for innovation, The Innovation Matrix or 4 types of innovation	4Hrs.	MC220.1
Unit-II	**Process of Innovation**		
	Know what the process of innovation entails, Know the steps involved in creative problem solving, know how to build organizations for executing innovation, Evaluation of innovation	4Hrs.	MC220.2
Unit-III	**Idea generation**		
	Understand the discovery process for opportunities, Identify the people to be involved in the idea generation process, Know the methods for discovering opportunities	4Hrs.	MC220.3
Unit-IV	**Developing innovative culture**		

	Know the organizational features that facilitate innovation, how organizations can learn from new information, know how to manage available resources for innovation, A case study on product development in an open innovation environment.	4Hrs.	MC220.4
Unit-V	**Leveraging on user innovation**		
	Know how to identify lead users, Strategies of leveraging on user innovation, how to create new products based on user innovations	4Hrs.	MC220.5
Unit-VI	**Innovation attributes and their adoption rate**		
	Know the attributes of innovations, Know the rate of innovation diffusion, Know the variables determining the rate of adoption of an innovation, know how to protect their innovations	4Hrs.	MC220.6

Reference Books

1. Saini, H. S., Singh, R. K., Reddy, K. Satish ," Innovations in Electronics and Communication Engineering" Publisher *Springer*.
2. Shrenik Suresh Sarade, "Electronics Engineering Innovation-I: Electronics Project Designing for Engineering" LAP LAMBERT Academic Publishing
3. Dr R V Mahendra Gowda, "Innovation in Engineering Education"
4. NPTEL- Innovation, Business Models and Entrepreneurship

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

B. Tech. Electronics and Computer Engineering

2020 Pattern

Proposed Program Structure

(B. Tech. with effect from Academic Year 2020-2021)

(T Y B. Tech. Sem-V with effect from Academic Year 2022-2023)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

DECLARATION

We, the Board of Studies in Electronics and Computer Engineering, hereby declare that, We have designed the Curriculum up to T. Y. B. Tech. Semester-V of 2020 Pattern w.e.f A.Y 2022-2023 as per the guidelines. This document also contains the proposed structure Electronics and Computer Engineering. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information of all the concerned stakeholders.

Recommended by

(Dr. B. S. Agarkar)
Chairman
BoS Electronics and Computer Engineering

Approved by

(Dr. A. G. Thakur)
Chairman
Academic Council
SRES Sanjivani College of Engineering, Kopargaon

Vision of the Institute

To Develop World Class Professionals through Quality Education.

Mission of the Institute

To create Academic Excellence in the field of Engineering and Management through Education, Training and Research to improve quality of life of people.

Vision of the Department

To produce quality professionals in the field of Electronics and Computer Engineering with knowledge and skill sets to meet diversifying needs of industry and society.

Mission of the Department

M1- To impart the technology of Electronics and Computer Engineering through an effective teaching-learning process.
M2- To establish linkages between industry and academia for overall development of students.
M3- To promote innovative ideas in solving multi-disciplinary engineering problems having social relevance.
M4- To develop technical human resources exhibiting professional and ethical attitudes.

Program Educational Objectives (PEOs)

PEO1: Involve in design, manufacturing, integration and testing of products, software and systems in the field of Electronics & Computer engineering and allied disciplines.

PEO2: Solve engineering problems having social relevance by applying knowledge and skill sets related to Electronics and Computer engineering.

PEO3: Pursue higher Education/Research in the field of Engineering/Management or become a successful entrepreneur in the related areas.

PEO4: Work effectively as an individual and/or a team member of multi-disciplinary assignments involving people across different cultures and national boundaries.

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **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.

4. **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.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **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.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **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.

Program Specific Outcomes (PSOs)

On successful completion of the program, the graduates will be able to:

PSO1: Specify, Design, Test and Implement electronic systems related to Signal Processing, Networking, Embedded architectures and IoT using state of the art components and software.

PSO2: Provide software solutions for engineering problems by applying knowledge of Data Structures, Algorithms, Database Management, Web Technology, Big Data and Cloud Computing.

List of Abbreviations			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
BSC	Basic Science Course	OEC	Open Elective Course
CIA	Continuous Internal Assessment	OR	End-Semester Oral Examination
EFC	Engineering Foundation Course	P	Practical
ESE	End-Semester Evaluation	PCC	Professional Core Course
HSMC	Humanities/Social Sciences/Management Course	PEC	Professional Elective Course
IP	Induction Program	PR	End-Semester Practical Examination
ISE	In-Semester Evaluation	PROJ	Project
L	Lecture	T	Tutorial
MLC	Mandatory Learning Course	TW	Continuous Term Work Evaluation

T. Y. B. TECH. 2020 Pattern (Electronics and Computer Engineering) SEMESTER-V

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	CIA	ISE	ESE				
PCC	EC301	Control Systems	3	1	-	4	20	30	50	-	-	-	100
PCC	EC302	Analog Circuits and Systems	3	-	-	3	20	30	50	-	-	-	100
PCC	EC303	DBMS and SQL	3	-	-	3	20	30	50	-	-	-	100
PCC	EC304	Software Engineering, Modeling and Design	4	-	-	4	20	30	50	-	-	-	100
PEC	EC305	Refer List of PEC1	3	-	-	3	20	30	50	-	-	-	100
LC	EC306	Analog Circuits and Systems Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC307	DBMS and SQL Laboratory	-	-	2	1	-	-	-	50	-	-	50
LC	EC308	Software Engineering, Modeling and Design Laboratory	-	-	2	1	-	-	-	50	-	-	50
PROJ	EC309	Mini Project / Skill Based Credit Course	1	-	-	1	50	-	-	-	-	-	50
MC	MC310	Mandatory Course-V: Sanjivani ECE Talks	1	-	-	No	-	-	-	-	-	-	-
		Total	18	1	6	21	150	150	250	100	50	-	700

SEMESTER-VI

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	CIA	ISE	ESE				
PCC	EC311	Advanced Microcontroller and Embedded Systems	4	-	-	4	20	30	50	-	-	-	100
PCC	EC312	System Programming and Operating System	3	-	-	3	20	30	50	-	-	-	100
PCC	EC313	Digital Signal Processing	3	-	-	3	20	30	50	-	-	-	100
PEC	EC314	Refer List of PEC2	3	-	-	3	20	30	50	-	-	-	100
HSMC	HS315	Corporate Readiness	2	-	-	2	50	-	-	-	-	-	50
PROJ	PR316	IPR & EDP	2	-	-	2	20	-	30	-	-	-	50
LC	EC317	Advanced Microcontroller and Embedded Systems Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC318	System Programming and Operating System Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC319	PEC2 Laboratory	-	-	2	1	-	-	-	50	-	-	50
LC	EC320	Creational Activity	-	-	2	1	-	-	-	-	-	50	50
MC	MC321	Mandatory Course-VI:	1	-	-	No	-	-	-	-	-	-	-
		Total	18	-	08	21	150	120	230	50	100	50	700

Professional Elective Course 1 (PEC1):		Professional Elective Course 2 (PEC2):	
EC305A	Electromagnetics	EC314A	Autonomous Vehicles
EC305B	Network Theory and Analysis	EC314B	Power Electronics and Drives
EC305C	Web Technology	EC314C	Software Testing and Quality Assurance

Total Credits: 42 **Total Marks: 1400**

Control Systems (EC301)

Teaching Scheme
Lectures: 03 Hrs. / Week
Tutorial: 01 Hr. / Week

Credits: 04

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite: Mathematical background of differential equations, Laplace transforms and Matrix theory

Course Objectives:

1. To learn mathematical modelling of different kinds of physical systems.
2. To study response of first order and second order systems in the time domain.
3. To introduce the concept of system stability and different criteria for determining the same.
4. To learn various frequency response plots and correlate between time domain and frequency domain specifications.
5. To introduce the principles of state space analysis in modelling physical systems.
6. To study various modes of control actions and their applications.

Course Outcomes (COs):

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

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC301.1	Model different electrical, mechanical systems using block diagrams and SFG techniques.	2	Understand
EC301.2	Compute different time domain specifications of first and second order systems.	3	Apply
EC301.3	Determine the stability of closed loop control systems using RH criterion and root locus.	3	Apply
EC301.4	Draw the frequency response plots of control systems.	3	Apply
EC301.5	Outline the concepts of state space analysis in system modelling.	3	Apply
EC301.6	Summarize the operation of different modes of controllers and their applications to understand.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC301.1	3	2	-	-	2	-	-	-	-	-	-	-	1	-
EC301.2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
EC301.3	3	2	-	-	-	-	-	-	-	-	-	-	1	-
EC301.4	3	2	-	-	-	-	-	-	-	-	-	-	1	-
EC301.5	3	2	-	-	2	-	-	-	-	-	-	-	1	-
EC301.6	1	1	-	-	2	-	-	-	-	-	-	-	1	-

Course Contents

Unit No.		No. of Hours	COs
Unit-I	**Introduction to Control Systems**	06 Hrs.	EC301.1
	Basic elements of a control system; Open loop and Closed loop systems; Transfer function; Modelling of electrical systems and translational & rotational mechanical systems; Block diagram reduction; Signal flow graph		
Unit-II	**Time Domain Analysis**	06 Hrs.	EC301.2
	Standard input signals; Transient analysis of First order and Second order systems; Steady state error and error constants; Time domain specifications for second order system		
Unit-III	**Stability Analysis**	06 Hrs.	EC301.3
	Concept of stability; Routh-Hurwitz criterion; Relative stability; Root locus technique; Construction of root locus; Application of root locus; Concept of dominant poles; Stability of higher order systems		
Unit-IV	**Frequency Domain Analysis**	06 Hrs.	EC301.4
	Correlation between time domain and frequency domain analysis; Polar Plots; Bode Plots; Determination of frequency domain specifications and stability analysis; Nyquist stability criterion		
Unit-V	**State Space Analysis**	06 Hrs.	EC301.5
	Concept of state and state space; Advantages of state space analysis over classical techniques; Transfer function from state model; State model of physical systems; Phase variable forms; Solution of homogeneous state equations; State transition matrix and its properties; Computation of state transition matrix; Concepts of controllability and observability.		
Unit-VI	**Controller Principles**	06 Hrs.	EC301.6
	Introduction to P, PI,PD and PID controller and their characteristics; Tuning of controllers; Zeigler-Nichols method; Introduction to programmable logic controllers and ladder logic		

Text Books:

1. I. J. Nagrath, M. Gopal, “Control System Engineering”, New Age International Publishers, 5th Edition, 2009.
2. Farid Golnaraghi, Benjamin C Kuo, “Automatic Control Systems”, 9th Edition, John Wiley and Sons

Reference Books:

1. Curtis D. Johnson, “Process Control Instrumentation Technology”, Eighth Edition, PHI Pvt. Ltd., New Delhi, 2011
2. Richard C. Drof , Robert N. Bishop, “Modern Control Systems”, Addison Wesley Publishing Company, 2001

3. B. C. Kuo, “Digital Control Systems”, Oxford University Press, 2012
4. Schaum’s Outline Series, “Feedback Control Systems” Tata McGraw-Hill, 2007.
5. John J. D’Azzo, Constantine H. Houpis, “Linear Control System Analysis and Design”, Tata McGraw-Hill, Inc., 1995.

e-Resources

1. https://nptel.ac.in/courses/107/106/107106081/

CIA:

20 marks based on tutorials performance.
If any change in CIA conduction, will be communicated well in advance

List of Tutorials

Sr. No.	Tutorial Title	COs
1.	Determination of transfer function using block diagram reduction	EC301.1
2.	Determination of transfer function using signal flow graph	EC301.1
3.	Calculation of time domain specifications of a second order system.	EC301.2
4.	Stability analysis using Routh – Hurwitz criterion.	EC301.3
5.	Construction of root locus.	EC301.3
6.	Construction of Bode plot.	EC301.4
7.	Development of state space model of physical system	EC301.5
8.	Simulation of a PID controller action in Simulink.	EC301.6

Analog Circuits and Systems (EC302)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course: Basics of Op-amp, Signals and Systems

Course Objectives:

1. To have idea of Analog Signal Processing.
2. To introduce various diode applications.
3. To study linear and non-linear applications of Op-Amp.
4. Knowledge of Converters using Op-amp
5. To understand functionalities of PLL and its use in various applications in communication and control systems.
6. Usefulness of filters in various fields.

Course Outcomes (COs): After successful completion of this course students will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC302.1	Describe the Analog Signal Processing Techniques	2	Understand
EC302.2	Solve the different diode made circuits	3	Apply
EC302.3	Determine linear & non- linear Applications of Op-amp and its usefulness.	3	Apply
EC302.4	Explain V to I, I to V, V to F, F to V, ADC and DAC.	2	Understand
EC302.5	Explain the functionalities of PLL to Frequency synthesizer, FM and AM demodulators	2	Understand
EC302.6	Modify knowledge of Op-amp in Analog Filter design.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC302.1	3	1	-	-	-	-	-	-	-	-	-	2	2	-
EC302.2	2	2	1	-	-	-	-	-	-	-		2	2	-
EC302.3	3	2	3	-	-	-	-	-	-	-	-	2	3	-
EC302.4	3	2	2	-	-	-	-	-	-	-	-	2	2	-
EC302.5	2	2	-	-	-	-	-	-	-	-	-	2	1	1
EC302.6	2	2	-	-	-	-	-	-	-	-	-	2	1	-

Course Contents

Unit-I	**Analog Signal Processing**	No. of Hours	COs
	Role of Analog Signal Processing in Electronic Products, Analog Signal Processing using One Port Networks, Passive Two Ports, Active Devices for Analog Signal Processing Systems, Voltage series and voltage shunt feedback amplifier, feedback effect on Ri, Ro, bandwidth and voltage gain.	06 Hrs.	EC302.1
Unit-II	**Diode circuits**	No. of Hours	COs
	Ideal Diode, Modelling the diode forward and reverse charactertics, Clipper circuits (Positive and Negative), Clamping circuits(Positive and Negative) , Rectifiers, Zener diode as voltage Regulator, Load regulation, Line regulation,Numericals	06 Hrs.	EC302.2
Unit-III	**Linear Applications & Non-linear Applications of OP-AMP**	No. of Hours	COs
	Ideal integrator, practical integrator with frequency response, Ideal differentiator, practical differentiator with frequency response, Instrumentation amplifier, Applications of Integrator, Differentiator and Instrumentation Amplifier. Comparator, applications of comparator, Schmitt trigger, Square wave generator, Need of precision rectifier, Half wave, Full wave precision rectifiers.	08 Hrs.	EC302.3
Unit-IV	**Converters using OP-AMP**	No.of Hours	COs
	I-V and V-I converter, current amplifier , DAC: Binary Weighted and R/2R Ladder type DAC, characteristics, specifications, advantages and disadvantages of each type of DAC. ADC: types of ADC, characteristics, specifications, advantages and disadvantages of each type of ADC, Flash type ADC, Applications of Converter	07 Hrs.	EC302.4
Unit-V	**Phase Locked Loop & Oscillators**	No.of Hours	COs
	Block diagram of PLL, characteristics/parameters of PLL and different applications of PLL, Oscillators principle, design of R-C phase shift, wein bridge, voltage controlled oscillators.	06 Hrs.	EC302.5
Unit-VI	**Active filters**	No.of Hours	COs
	Need of Active filter over passive filter ,Design and frequency scaling of First order and second order Active LP, HP, BP , wide and narrow band BR Butterworth filters and notch filter, All pass filters, Applications of filter.	07 Hrs.	EC302.6

Text Books:

1. Ramakant A. Gaikwad, “Op Amps and Linear Integrated Circuits”, Pearson Education 2000.
2. Salivahanan and Kanchana Bhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill, India 2008.

Reference Books:

1. George Clayton and Steve Winder, “Operational Amplifiers”, 5th Edition Newnes..
2. Gray, Hurst, Lewise, Meyer, “Analysis & Design of Analog Integrated Circuits”, Wiley Publications on Education.
3. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, McGraw Hill Education .
4. A.S. Sedra and K.C.Smith,”Microelectronic Circuits”, Saunder's College Publishing, 1991

Online Resources :
Analog Circuits and Systems through SPICE Simulation - Course (nptel.ac.in)

Guidelines for Continuous Internal Assessment:-

1. Circuit Simulation based on UNIT I,II and III.
2. Circuit Simulation based on UNIT IV,V and VI.

DBMS and SQL (EC303)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite course: FDS

Course Objectives:

1. To study the fundamental concepts of database management.
2. To introduce different database design approach covering conceptual and logical design.
3. To learn the basic issues of transaction processing and concurrency control.
4. To study various Database Architectures and Applications.
5. To learn a powerful, flexible and scalable general-purpose distributed database.

Course Outcomes (COs): On completion of the course, student will be able to–

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC303.1	Construct ER model for given requirements and convert the same into database tables.	2	Understand
EC303.2	Illustrate basic program constructs in SQL and PL/SQL.	2	Understand
EC303.3	Implement database design using normalization.	3	Apply
EC303.4	Implement the isolation property, including locking, time stamping based on concurrency control.	3	Apply
EC303.5	Explain different database architecture and use of appropriate architecture in real time environment.	2	Understand
EC303.6	Select appropriate NoSQL databases for real time applications.	4	Analyze

Mapping of Course Outcomes to Program Outcomes(POs)& Program Specific Outcomes PSOs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC303.1	3	---	2	---	1	---	---	---	---	---	---	1	---	2
EC303.2	2	1	3	1	1	---	---	---	---	---	---	2	---	2
EC303.3	1	1	2	1	1	---	---	---	---	---	---	1	---	2
EC303.4	2	---	2	1	1	---	---	---	---	---	---	1	---	3
EC303.5	2	---	2	---	3	---	---	---	---	---	---	3	---	3
EC303.6	2	---	1	1	3	---	---	---	---	---	---	3	---	2

Course Contents

Unit-I	**Introduction to DBMS**	No.of Hours	COs
	Introduction to Database Management Systems, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models, Database users, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process.	06	EC303.1
Unit-II	**SQL & Queries introduction**	No.of Hours	COs
	SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes SQL DML Queries: SELECT Query and clauses, Set Operations, Predicates and Joins.	07	EC303.2
Unit-III	**Database Modification and Relational Database**	No.of Hours	COs
	Database Modification using SQL Insert, Update and Delete Queries. PL/SQL: concept of Stored Procedures & Functions. Cursors, Triggers, Assertions, roles and privileges, Embedded SQL, Dynamic SQL. Relational Model: Basic concepts, Attributes and Domains, Relational Integrity: Domain, Referential Integrities, Database Design: Normalization, Atomic Domains and Normal Form.	07	EC303.3
Unit-IV	**Database Transactions and Query Processing**	No.of Hours	COs
	Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Concurrency Control: Need, Locking Methods, Deadlocks, Time-stamping Methods, Recovery methods: Shadow-Paging and Log-Based Recovery, Checkpoints.	06	EC303.4
Unit-V	**Database System Architectures**	No.of Hours	COs
	Introduction to Database Architectures: Multi-user DBMS Architectures, Case study- Oracle Architecture. Parallel Databases: Speedup and Scale up, Distributed Databases: Architecture of Distributed Databases Design.	06	EC303.5
Unit-VI	**NoSQL Database**	No.of Hours	COs
	Introduction to NoSQL Database, Types and examples of NoSQL Database, Structured verses unstructured data, Distributed Database Model, Comparative study of SQL and NoSQL, Mongodb-Database.	06	EC303.6

Text Books:

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers

2. Connally T, Begg C., "Database Systems", Pearson Education

3. R. P. Mahapatra and Govind Verma, “Database Management Systems”, Khanna Publishing House

Reference Books:

1. Raghurama Krishan, “Database Management Systems”, McGrawHill

2. S.K.Singh, “Database Systems : Concepts, Design and Application”, Pearson, Education

3. Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled”, Addison Wesley

4. Kristina Chodorow, Michael Dirolf, “MangoDB: The Definitive Guide”, O’Reilly Publications

e-Resources:

1. https://nptel.ac.in/courses/106/105/106105175/

Guidelines for Continuous Internal Assessment: -

Programming Assignment will be evaluated for 20 marks.

Software Engineering Modeling & Design (EC304)

Teaching Scheme
Lectures: 04 Hrs. / Week

Credits: 04

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite : CFP

Course Objectives :

1. To learn and understand the principles of Software Engineering.
2. To be acquainted with methods of capturing, specifying, visualizing and analyzing s/w requirements.
3. To apply Project Planning and Management to S/W project development.
4. To apply design principles to Software Engineering.
5. To understand and apply Object Oriented concepts for OO based models/applications.
6. To choose and use modern design tools for project development and implementation.

Course Outcomes (COs): After successful completion of the course, student will be able to

CO	CO Statements	Bloom's Taxonomy	
		Level	Descriptor
EC304.1	Identify process models for developing a software project.	2	Understand
EC304.2	Prepare Software Requirement Specification document from the problem statement of the given application.	3	Apply
EC304.3	Present the project planning and Management to S/W project development.	3	Apply
EC304.4	Summarize various design techniques of software application.	2	Understand
EC304.5	Illustrate Object Oriented Design methodology for S/W project development.	4	Analyze
EC304.6	Demonstrate the use of appropriate modern tools for software modeling ..	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC304.1	2	2	-	1	2	-	2	-	-	-	-	1	1	-
EC304.2	2	1	3	3	-	3	2	-	3	3	-	3	1	-
EC304.3	2	2	3	-	-	-	2	-	3	-	3	2	1	1
EC304.4	2	2	2	1	-	-	2	-	-	-	-	-	1	1
EC304.5	2	2	2	-	-	-	-	-	-	-	-	-	1	-
EC304.6	2	-	-	1	3	-	-	-	-	-	-	-	1	-

Course Contents

Unit-I	**Introduction to Software Engineering**	No.of Hours	COs

	Nature of Software, Software Engineering, The Software Process, Software Myths, A Generic Process Model Vs Prescriptive Process Models: The waterfall Model, Incremental Process Models, Concurrent Models, The Unified Process , Agility Principles, Extreme Programming(XP), SCRUM.	8	EC304.1
Unit-II	**Requirement Engineering**	No.of Hours	COs
	Requirement Engineering, Collaborative Requirements Gathering, Quality Function Deployment, Elicitation Work Product, Developing use cases, Building the requirement model, Validating requirements, Analysis: Scenario Based Modeling, UML Models, Class-Based Modelling, Requirements Modeling Strategies: Flow oriented modelling, SRS plan, Case study	8	EC304.2
Unit-III	**Project Planning and Management**	No.of Hours	COs
	The Management Spectrum, Software Scope, Problem Decomposition, Process Decomposition, Process and project metrics, Size-Oriented Metrics, Function-Oriented Metrics, Software Process Reconciling LOC and FP metrics, Object- Oriented Metrics, Integrating metrics within the software project Estimation, Decomposition, Process based Estimation, Estimation with use cases Empirical Estimation Models, The Structure of Estimation Models, The COCOMO II Model, Scheduling: Tracking the Scheduling, Project Plan, Application	8	EC304.3
Unit-IV	**Introduction to Software Design**	No.of Hours	COs
	Introduction to Software Design, design methods: procedural/structural and object oriented, Requirement Vs Analysis, Vs Architecture Vs Design Vs Development 4+1 Architecture, case study of transferring requirement to design, UP,COMET use case based software life cycle, Introduction to UML-Basic building blocks, Reusability, Use case Modeling, Use case template.	8	EC304.4
Unit-V	**Static Modeling**	No. of Hours	COs
	Analysis Vs Design, Class diagram-Analysis-Object & Classes finding analysis & Design-Design classes, refining analysis relationships, Inheritance & Polymorphism, Object diagram, Component diagram-Interfaces & Components, deployment diagram, Package diagram	8	EC304.5
Unit-VI	**Dynamic Modeling**	No. of Hours	COs
	Interaction & Interaction overview diagram, Sequence diagram, Timing diagram, Communication diagram, Advanced state machine diagram, Activity diagram	8	EC304.6

Text Books:

1. Roger S Pressman “Software Engineering: A Practitioner’s Approach” 7th Edition McGraw Hill ISBN : 0073375977
2. Ian Sommerville “Software Engineering” 9th edition Pearson Education SBN-13:978-0-13-703515-1, ISBN-10:0-13-703515-2
3. Gardy Booch, James Rambaugh, Ivar Jacobson “ The unified modeling language user guide” Pearson Education, 2nd edition 2008, ISBN 0-321-24562-8

Reference Books:

1. Pankaj Jalote " An Integrated Approach to Software Engineering" 3rd Edition Narosa Publication ISBN:81-7319-702-4
2. Rajib Mall " Fundamentals of Software Engineering " 3rd Edition
3. Jim Arlow,Ila Neustadt "UML2 and the unified process-practical object oriented analysis and design" Addison Wesley, Second Edition, ISBN 978-0201770605

e- Resources:
https://www.onlinecourses.nptel.ac.in/noc22_cs106
https://www.coursera.org/learn/introduction-to-software-engineering

Guidelines for CIA:

1. Registration of all students will be done.
2. CIA Marks will be given based on NPTEL Software Engineering Course assignments score.
3. Best Six assignments score will be considered and scale down to 20 marks.

Electromagnetics (EC305A)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite course : Co-ordinate Geometry (Cartesian, Cylindrical and Spherical), Vector Calculus

Course Objectives:

1. To study Basic concepts of Electrostatic Laws and Theorems.
2. To study concepts of Magnetostatic Laws and Theorems.
3. To analyze time varying electric and magnetic fields.
4. To understand transmission line fundamentals and apply them to the basic problem.
5. To analyze and understand the Uniform plane wave propagation in various media
6. To Understand the fundamentals of Antenna and its parameters

Course Outcomes (COs): After successfully completing the course students will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC305A.1	Apply the principles of electrostatics to the problems related to electric field (E and D) and boundary conditions	3	Apply
EC305A.2	Apply the principles of Magnetostatics to the problems related to magnetic field (H and B) and boundary conditions	3	Apply
EC305A.3	Interpret the electromagnetic problem and solve using Maxwell's equations.	4	Analyze
EC305A.4	Formulate the wave equation and solve it for uniform plane wave	2	Understand
EC305A.5	Analyze the transmission line problem and use the Smith chart for impedance calculations.	4	Analyze
EC305A.6	Analyze the given antenna and its various parameters	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC305A.1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
EC305A.2	3	2	-	-	-	-	-	-	-	-	-	-	3	-
EC305A.3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
EC305A.4	2	2	3	-	-	-	-	-	-	-	-	-	3	-
EC305A.5	3	3	2	-	-	-	-	-	-	-	-	-	2	-
EC305A.6	2	3	3	-	-	-	-	-	-	-	-	-	-	2

Course Contents

Unit-I	**Electrostatics**	No. of Hours	COs
	Coulomb‘s Law, Electric field intensity (**E**), Field due to discrete and continuous charges, Gauss‘s law and applications. divergence, divergence theorem, Electric potential, Relationship between **E** & V, Current and current Density, continuity equation , Boundary conditions, Poisson’s and Laplace's equation.	06Hrs.	EC305A.1
Unit-II	**Magnetostatics**	No. of Hours	COs
	Biot-Savart’s law, Ampere’s Circuital law and its applications, magnetic flux density(B), Magnetic Scalar and vectors potentials, Magnetic boundary conditions. Maxwell equations for static EM fields.	06Hrs.	EC305A.2
Unit-III	**Time Varying Fields and Maxwell’s equations**	No. of Hours	COs
	Faraday’s law, Translational and motional emf, Displacement current, Maxwell’s equations in point form and integral form for dynamic field, Power and Poynting theorem.	06 Hrs.	EC305A.3
Unit-IV	**Uniform Plane Waves**	No. of Hours	COs
	Maxwell‘s equation using phasor notations, Electromagnetic wave equations (Helmholtz equation), Polarization: Linear, circular & Elliptical polarization, depth of penetration, skin effect, Reflection of plane waves :Normal incidence, oblique incidence.	07 Hrs.	EC305A.4
Unit-V	**Transmission Lines**	No. of Hours	COs
	Line parameters, A line of cascaded T sections, general solution, physical significance of the equations, the infinite line, wavelength, velocity of propagation, the distortion less line, Reflection on a line not terminated in Z0, reflection coefficient, open and short circuited lines, reflection factor and reflection loss, standing waves , nodes, standing wave ratio, Input impedance of dissipation less line, Input impedance of open and short-circuited lines, stub matching, Problems solving using Smith chart.	08 Hrs.	EC305A.5
Unit-VI	**Antenna Fundamentals**	No. of Hours	COs
	Friis Transmission equation, Types of Antenna, Radiation Mechanism. Antenna Parameters : Radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half power beam width, bandwidth, antenna polarization, input impedance, antenna radiation efficiency, effective length, effective area, reciprocity, EMI/EMC interference test.	06 Hrs.	EC305A.6

Text Books:

1. Mathew N. O. Sadiku, ‗Principles of Electromagnetics', 4th Edition ,Oxford University Press Inc, 2009.
2. William H. Hayt and John A. Buck, ‗Engineering Electromagnetics', Tata McGraw Hill, 8th Revised edition, 2011.
3. C. A. Balanis, "Antenna Theory - Analysis and Design", John Wiley.

Reference Books:

1. Kraus and Fleish, ‗Electromagnetics with Applications', McGraw Hill International Editions, 5th edition, 2010.
2. Jordan and Balmain, —Electromagnetic Waves and Radiating Systems‖, PHI, 1964
3. K. D. Prasad, "Antenna & Wave Propagation", Satya Prakashan, New Delhi
4. John D Kraus, " Antenna& Wave Propagation", 4th Edition, McGraw Hill, 2010

Online Resources :

1. https://easyengineering.net/electromagnetic-theory-handwritten/
2. https://electricalstudyhub.blogspot.com/2017/05/electromagnetic-field-theory-notes-pdf.html
3. https://www.newtondesk.com/electromagnetic-theory-handwritten-study-notes/

CIA :

Test will be conducted on the each unit. 2 Assignment (Unit 1,2,3 Assignment 1 and Unit 4,5,6 Assignment 2)

Network Theory And Analysis (EC305B)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite course: Principles of Physics, Basics of Electricity and Magnetism

Course Objectives:

1. To learn the basics of Network Theory.
2. To know analytical qualities of Network Theory by application of various theorems.
3. To understand the behavior of Networks by analyzing the transient response.
4. To gain knowledge of Network theory for analysis of 2-port networks.
5. To study and understand concept of AC Power analysis.
6. To study filters and understand concept of Resonance.

Course Outcomes (COs): After successful completion of the course, student will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC305B.1	Know the basics of Electric Network.	1	Remember
EC305B.2	Comprehend the various network theorems and their usefulness.	2	Understand
EC305B.3	Observe and discuss transient response upto second order circuit.	3	Apply
EC305B.4	Explain Two Port Network Parameters.	2	Understand
EC305B.5	Calculate AC Power for Reactive Circuits.	3	Apply
EC305B.6	Compare Resonance circuits and Filters circuits	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC305B.1	3	1	-	-	-	-	-	-	-	-	-	2	3	-
EC305B.2	3	2	1	-	-	-	-	-	-	-	-	2	3	-
EC305B.3	3	3	2	-	-	-	-	-	-	-	-	3	2	-
EC305B.4	3	3	3	-	-	-	-	-	-	-	-	3	3	-
EC305B.5	3	2	2	-	-	-	-	-	-	-	-	2	3	-
EC305B.6	3	2	2	-	-	-	-	-	-	-	-	2	2	-

Course Contents

Unit-I	**Basics of Network**	No. of Hours	COs

	Introduction to circuit variables and circuit elements, Review of Kirchhoff's Laws, Mesh and Nodal analysis, Independent and dependent Sources, Star, Delta connections, Star to Delta and Delta to Star conversion.	6 Hrs.	EC305B.1
Unit-II	**Network Theorems**		COs
	Superposition, Thevenin's, Norton's, Maximum Power Transfer Theorem, Reciprocity theorem, Millman's theorems.	6 Hrs.	EC305B.2
Unit-III	**Sinusoidal steady state analysis**		COs
	Representation of sine function as rotating phasor, steady state response using phasor, DC transients. Classical solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants steady state and transient state response.	6 Hrs.	EC305B.3
Unit-IV	**Two Port Network and Network Functions**		COs
	Terminal pairs, relationship of two port variables, Z, Y, transmission parameters and hybrid parameters, interconnections of two port networks. Network Functions for one port and two port, Series and parallel connections of two port networks, Reciprocal and Symmetrical two port network.	6 Hrs.	EC305B.4
Unit-V	**AC Power Analysis**		COs
	AC Power Analysis: Instantaneous and Average power, Maximum average power transfer, RMS value, Complex Power, Apparent power and Power factor, Conservation of AC Power .	6 Hrs.	EC305B.5
Unit-VI	**Resonance and Filter circuits**		COs
	Series and parallel resonance of RLC circuits: bandwidth, Q factor, centre frequency and Selectivity. Filter fundamentals, Constant K -LPF, HPF, BPF and BSF, m derived LPF and HPF.	6 Hrs.	EC305B.6

Text Books:

1. M. E. Van Valkenburg,"Network Analysis", Prentice Hall, 3rd edition.
2. D. Roy Choudhury,"Networks And Systems" New Age International Publications, 2nd edition
3. Ravish R Singh, "Network Analysis and synthesis", McGraw Hill education (India) Pvt. Ltd., 3rd edition 2015
4. Dorf & Svoboda, Introduction to Electric Circuits (9th edition), John Wiley, 2013. ISBN 1118477502, ISBN 9781118477502

Reference Books:

1. Alexander and Sadiku,"Electric Circuits", second edition, 2004.
2. K.V.V. Murthy and M.S.Kamath,"Basic Circuit Analysis", first edition (reprinted with corrections), Jaico Publishing.
3. William H. Hayt, Jack E. Kemmerly, "Engineering Circuit Analysis", McGraw Hill International, 5th edition.
4 Franklin F. Kuo, "Network Analysis and Synthesis ", John Wiley.

5 Agarwal, Anant, and Jeffrey H. Lang. “Foundation of Analog and Digital Electronic circuits”. San Mateo, CA: Morgan Kaufmann Publishers, Elsevier, July 2005. ISBN: 9781558607354.

Online Resource :
Network Analysis - Course (nptel.ac.in)

CIA :
Test will be conducted on the each unit. 2 Assignment (Unit 1,2,3 Assignment 1 and Unit 4,5,6 Assignment 2)

Web Technology (EC305C)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
InSem Exam: 30 Marks
End Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite: Programming Fundamentals

Course Objectives:

1. To learn the principles and methodologies of web based applications development process.
2. To understand current client side web technologies
3. To understand current server side web technologies.
4. To understand current client side and server side frameworks.
5. To understand web services and content management.
6. To learn XML concept and its usage.

Course Outcomes (COs): After successful completion of the course, student will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC305C.1	Design dynamic and interactive web-pages using HTML5 in a simplified way.	3	Apply
EC305C.2	Design web based application using suitable client side technologies	3	Apply
EC305C.3	Implement interactivity with jQuery..	3	Apply
EC305C.4	Design web based application using suitable server side technologies	2	Understand
EC305C.5	Design dynamic and interactive web-pages using PHP in a simplified way	3	Apply
EC305C.6	Design web based application using Content Management, frameworks	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC305C.1	3	--	3	--	2	--	--	--	--	--	--	1	2	--
EC305C.2	2	--	2	--	3	--	--	--	--	--	--	2	2	--
EC305C.3	2	--	1	--	2	--	--	--	--	--	--	3	3	--
EC305C.4	2	--	3	--	1	--	--	--	--	--	--	2	2	--
EC305C.5	1	--	2	--	3	--	--	--	--	--	--	1	3	--
EC305C.6	1	--	2	--	3	--	--	--	--	--	--	2	2	--

Course Content

Unit-I	Introduction to Web Technologies	No. of Hours	COs
	Internet, WWW, Webpage, Website, Types of Web, Applications, Web Application Architecture, Web Servers, Roles and responsibilities of Web Developer, Challenges in Web App Development. **HTML**: Structure of Web Page, Text Formatting tags, Image, tables, links, frames, forms and HTML 5.	06 Hrs.	EC305C.1
Unit-II	**Client Side Technologies**		
	CSS: Need of CSS, Types of CSS, CSS Selectors, CSS for basic HTML tags, responsive CSS framework: Bulma. **XML**: Introduction to XML, XML key component, Transforming XML into XSLT, DTD: Schema, elements, attributes, Introduction to JSON. **Java Script**: JS in an HTML	06 Hrs.	EC305C.2

	(Embedded, External), Data types, Control Structures, Arrays, Functions and Scopes, Objects in JS.		
Unit-III	**Client Side Technologies and Frameworks**		
	DOM: DOM levels, DOM Objects and their properties and methods, Manipulating DOM. **JQuery**: Introduction to JQuery, Loading JQuery, Selecting elements, changing styles, creating elements, appending elements, removing elements, handling events. Bootstrap framework.	06 Hrs.	EC305C.3
Unit-IV	**Server side Technologies**		
	Introduction to CGI, **Servlet**: introduction, life cycle of servlet, servlet directory structure, servlet example, form handling, cookies and session tracking. **JSP :** life cycle, JSP tags, built in objects, Directives, File uploading and page redirecting. Database connectivity using servlet and JSP.	06 Hrs.	EC305C.4
Unit-V	**Introduction to PHP**		
	PHP : Introduction to PHP, Features, sample code, PHP script working, PHP syntax, conditions & Loops, Functions, String manipulation, Arrays & Functions, Form handling, Cookies & Sessions, using PostgreSQL/MySQL with PHP.	06 Hrs.	EC305C.5
Unit-VI	**Frameworks**		
	MVC, AngularJS: Overview, directives, expression, controllers, filters, tables, modules, forms, includes, views, scopes, services, dependency injection, custom directives, Internationalization **Java Struts**: Overview, architecture, configuration, sample code. Web Hosting example. **CMS**: Joomla/wordpress	06 Hrs	EC305C.6

Text Books:

1. Kogent Learning Solutions Inc,Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, XML and AJAX, Blackbook, Dreamtech Press.
2. Raymond Camden, Andy Matthews, jQuery Mobile Web Development Essentials, Packet Publishing, Second Edition
3. Achyut Godbole & Atul Kahate, "Web Technologies: TCP/IP to Internet Application Architectures", McGraw Hill Education publications

Reference Books:

1. Ivan Bayross,"Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML and PHP, BPB Publications,4th Edition.
2. Sandeep Panda, "Angular JS: Novice To Ninja", SPD, First Edition
3. Robin Nixon, "Learning PHP, Mysql and Javascript with JQuery, CSS & HTML5", O'REILLY.
4. Rajkamal," Internet and Web Technologies", McGraw Hill Education publications.

CIA :

10 Marks based on Students' performance in class tests and remaining 10 marks on class assignments /Quiz. These evaluation components should be carried out on completion of each unit and average should be taken.

Analog Circuits and Systems Laboratory (EC306)

Teaching Scheme
Practical : 02 Hrs. / Week
Credits: 01

Examination Scheme
PR : 50 Marks
Total: 50 Marks

Course Objectives :

1. To have idea of different applications of Diode.
2. To analyze and identify linear and non-linear applications of Op-Amp.
3. Knowledge of Converters using Op-amp.
4. To learn functionalities of PLL .

Course Outcomes (COs): After successful completion of this course students will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC306.1	To gain knowledge of various diode circuits	2	Understand
EC306.2	Implement various Applications of Op-amp	3	Apply
EC306.3	Implement hardwired circuit to test performance and application for what it is being designed.	4	Analyze
EC306.4	Implement circuit using software tool to test performance and application for what it is being designed.	4	Analyze

Mapping of Course Outcomes to Program Outcomes(POs)& Program Specific Outcomes PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC306.1	2	-	-	3	1	-	-	-	1	2	-	2	1	-
EC306.2	2	2	2	3	1	-	-	-	1	2	-	2	1	-
EC306.3	2	2	2	3	1	-	-	-	1	2	-	2	1	-
EC306.4	2	2	2	3	3	-	-	-	1	2	-	2	1	-

Students shall perform at least 8 experiments

Practical Course Contents

Sr. No.	List of Practical	COs
1	Design, build and test diode clipper circuits	EC306.1 , EC306.3
2	Design, build and test diode half wave and full wave rectifiers	EC306.1 , EC306.3
3	Design, build and test Power supply	EC306.1 , EC306.3
4	Design, build and test integrator and differentiator for given frequency .	EC306.2 , EC306.3
5	Design, build and test precision half wave rectifier.	EC306.2 , EC306.3
6	Design, build and test Schmitt trigger and plot transfer characteristics.	EC306.2 , EC306.3
7	Design, build and test PLL.	EC306.2 , EC306.3
8	Design and implement 2 bit R-2R ladder DAC & Flash type ADC.	EC306.2 , EC306.3
9	Design, build and test square wave generator.	EC306.2 , EC306.3
10	Design and implement V-I converter.	EC306.2 , EC306.3
11	Design and implement active filters	EC306.2 , EC306.3
12	*Simulation on any one application of Op-amp	EC306.4
13	*Simulation on any one application of Diode	EC306.4

* Experiments are compulsory

DBMS and SQL Laboratory (EC307)

Teaching Scheme
Practical : 02 Hrs. / Week
Credits: 01

Examination Scheme
OR: 50 Marks
Total: 50 Marks

Course Objectives:

1. To study the fundamental concepts of database management.
2. To learn the basic issues of transaction processing and concurrency control.
3. To learn a powerful, flexible and scalable general-purpose distributed database.

Course Outcomes (COs): On completion of the course, student will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC307.1	Construct ER model for given requirements and convert the same into database tables.	2	Understand

EC307.2	Illustrate basic program constructs in SQL and PL/SQL.	2	Understand
EC307.3	Implement database design using normalization.	3	Apply

Mapping of Course Outcomes to Program Outcomes(POs)&Program Specific Outcomes PSOs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC307.1	--	--	--	--	3	--	--	--	--	--	--	3	3	--
EC307.2	--	--	--	--	3	--	--	--	--	--	--	3	2	--
EC307.3	--	--	--	--	3	--	--	--	--	--	--	3	2	--

List of Practicals

- Minimum 08 experiments to be performed.
- Experiments can be performed using any software‘s like MySQL, PhPMyadmin, etc.

Sr. No.	List of Practical	COs
1	Draw E-R diagram for a given scenario (eg. bank, college etc.)	EC303.1, EC303.2
2	Write relational algebra queries for a given set of relations.	EC303.1, EC303.2
3	Perform the following: Viewing all databases, Creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table.	EC303.2, EC303.3
4	Perform the following: a. Altering a Table, Dropping/Truncating/Renaming Tables, Backing up / Restoring a Database.	EC303.1, EC303.3
5	For a given set of relation schemes, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause).	EC303.2, EC303.3
6	For a given set of relation tables perform the following a. Creating Views (with and without check option), Dropping views, Selecting from a view.	EC303.3
7	Write a PL/SQL program using looping statements to insert ten rows into a database table.	EC303.1, EC303.2
8	Given the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID) write a cursor to select the five highest paid employees from the table.	EC303.2, EC303.3
9	Illustrate how you can embed SQL in a high-level host language such as C/Java And demonstrates how a banking debit transaction to be done.	EC303.3
10	Given an integer i, write a SQL procedure to insert the tuple (i, 'xxx') into a given relation.	EC303.2, EC303.3
11	Unnamed PL/SQL code block: Use of Control structure and Exception handling is mandatory. Write a PL/SQL block of code for the following requirements:- Schema: 1. Borrower (Rollno, Name, DateofIssue, NameofBook, Status) 2. Fine(Roll_no,Date,Amt) ● Accept roll_no & name of book from user. ● Check the number of days (from date of issue), if days are between 15 to 30 then fine amount will be Rs 5 per day. ● If no. of days>30, per day fine will be Rs 50 per day & for days less than 30, Rs. 5 per day. ● After submitting the book, status will change from I to R. ● If condition of fine is true, then details will be stored into fine table.	EC303.3

12	Cursors: (All types: Implicit, Explicit, Cursor using Looping statements, Parameterized Cursor) ● Write a PL/SQL block of code using parameterized Cursor, that will merge the data available in the newly created table N_RollCall with the data available in the table O_RollCall. If the data in the first table already exist in the second table then that data should be skipped. ● Frame the separate problem statement for writing PL/SQL block to implement all types of Cursors inline with above statement. The problem statement should clearly state the requirements.	EC303.3
13	Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUD operations, Execution).	EC303.1, EC303.3

Software Engineering, Modeling and Design Laboratory(EC308)

Teaching Scheme
Practical : 02 Hrs. / Week
Credits: 01

Examination Scheme
OR: 50 Marks
Total: 50 Marks

Prerequisite : CFP

Course Objectives :

1. To prepare a project plan .
2. To write s/w requirements specification documents.
3. To choose and use modern design tools for project development and implementation.

Course Outcomes (COs): After successful completion of the course, student will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC308.1	Use project planning and Management techniques to S/W project development	3	Apply
EC308.2	Prepare software requirement specification document for designing software application.	4	Analyze
EC308.3	Develop a model of an application using UML as a fundamental tool.	6	Create

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC308.1	2	2	2	-	3	3	3	3	3	3	3	3	1	1
EC308.2	2	3	3	3	3	-	3	-	2	3	2	1	1	1
EC308.3	3	2	2	1	3	-	-	-	2	3	-	-	1	1

Practical Course Contents

Choose any one project and do the following exercises for that project

a. Student result management System.
b. Library management system.
c. Inventory control system.
d. Accounting system.
e. Fast food billing system.
f. Bank loan system.
g. Blood bank system.
h. Railway reservation system.
i. Automatic teller machine.
j. Video library management system.
k. Hotel management system.
l. E-ticket management system.
m. Online Share trading system.
n. Resource management system.
o. Court case management system.
p. Course management system (CMS).
q. Easy leave management system.
r. E-Bidding management system.
s. Electronic Cash Counter system

Sr. No	Title of Practical	CO
1.	**Problem Analysis and Project Planning** -Thorough study of the problem–Identify Project scope, Objectives and Infrastructure.	EC308.1

2.	**Software Requirement Analysis** –Describe the individual Phases/modules of the project and Identify deliverables. Identify functional and non-functional requirements.	EC308.2
3	Draw a use case diagram.	EC308.3
4	Draw activity diagrams of all use cases.	EC308.3
5	Draw a state chart diagram of all use cases.	EC308.3
6	Draw a sequence diagram of all use cases.	EC308.3
7	Draw collaboration diagrams of all use cases.	EC308.3
8	Assign objects in sequence diagrams to classes and make class diagrams.	EC308.3

Text Books:

1. Roger S Pressman “Software Engineering: A Practitioner’s Approach” 7th Edition Mcgraw hill ISBN : 0073375977
2. Ian Sommerville ``Software Engineering” 9th edition Pearson Education ISBN-13:978-0-13-703515-1, ISBN-10:0-13-703515-2
3. Gardy Booch, James Rambaugh, Ivar Jacobson “ The unified modeling language user guide” Pearson Education, 2nd edition 2008, ISBN 0-321-24562-8

Reference Books:

1 Pankaj Jalote “ An Integrated Approach to Software Engineering” 3rd Edition Narosa Publication ISBN:81-7319-702-4

2 Rajib Mall “ Fundamentals of Software Engineering “ 3rd Edition

3 Jim Arlow,Ila Neustadt “UML2 and the unified process-practical object oriented analysis and design” Addison Wesley, Second Edition, ISBN 978-0201770605

e- Resources:

https://staruml.io/

https://ibm-rational-rose-enterprise-edition.software.informer.com/8.1/

Mini Project / Skill Based Credit Course (EC309)

Teaching Scheme:
Lectures: 01 Hr. / Week
Credits: 01

Examination Scheme:
CIA: 50 Marks
Total: 50 Marks

Prerequisite: Preliminary knowledge of Computer Fundamentals.

Course Objectives:

1. To learn report writing, word processing and Presentation tools.
2. To learn data processing tools.

Course Outcomes (COs):
After successful completion, of course students will be able to:

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC309.1	Use word processing and Presentation tools for report writing.	3	Apply
EC309.2	Demonstrate fundamentals of Data Processing tools	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC309.1	3	-	1	-	2	3	1	2	3	3	1	1	-	-
EC309.2	3	-	1	-	2	3	1	2	3	3	1	1	-	-

Course Contents

Unit-I	**Word Processing and Presentation Tools**	No. of Hours	COs

	Word Processing Tools: Introduction to Word Processing, formatting, header, footer, equation editor, tables, shapes, chart, fonts, colours, effect, columns, watermark. **Presentation Tools:** Introduction to Presentation tools, shapes, header and footer, design, animation, slide show.	07 Hrs.	EC309.1
Unit-II	**Data Processing Tools**	No. of Hours	COs
	Data Processing Tools: Introduction to sheets, conditional formatting, sorting and filters, functions, charts, formulas, data tools: mail merging	06 Hrs	EC309.2

Text Books:

1. Microsoft Excel 2016 2013 2010 2007 Tips Tricks and Shortcuts (Color Version): Learn Formulas, Functions and Formatting in 20 Mini-Lessons "Amelia Griggs", Easy Learning.
2. Microsoft Word 2022: The Most Updated Crash Course from Beginner to Advanced , " James Holler"

e-Resources:

1. https:// www.w3schools.com
2. https://www.coursera.org/learn/microsoft-powerpoint-work-smarter
3. https://www.coursera.org/specializations/everyday-excel

CIA :

- 15 Marks based on solving problem using excel for the given problem.
- 15 marks based on report writing and Presentation for the given topic.
- 20 marks on class Quiz/MCQ Test.

If required necessary changes in the CIA components can be made by respective course teacher

Mandatory Course-V (MC310)

Sanjivani ECE Talks

Teaching Scheme
Lectures: 01 Hr. / Week
Credits: No Credit

Examination Scheme
Not Applicable

Course Objectives:

1. To get exposure for students to diverse areas other than their own field of study.
2. To become a good citizen & Engineer through Professional Practices.
3. To Know the importance of a healthy mind & Body.
4. To Motivate students for participation in competition.

Course Outcomes: After successful completion of this course Students will be able to:

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
MC310.1	Know the diverse areas other than their own field of study .	1	Remember
MC310.2	Identify the professional practices & Ethics to be followed by good citizens & Engineers.	2	Understand
MC310.3	Practice the tricks & procedures to keep a healthy mind & body.	3	Apply
MC310.4	Analyze themselves to be capable of Research, Innovation & Entrepreneurship & financial needs.	4	Analyze

MC310.5	Appears for various job offering competitions & placement opportunities	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MC310.1	-	-	-	-	-	3	2	-	1	1	3	3	-	-
MC310.2	-	-	-	-	-	2	2	3	-	1	2	2	-	-
MC310.3	-	-	-	-	-	3	2	3	2	1	3	2	-	-
MC310.4	-	-	-	-	-	3	-	-	1	-	2	3	-	-
MC310.5	-	-	-	-	-	3	2	1	-	3	-	3	-	-

About the Course:

The objective is for students to get exposure to a diversity of areas other than their own field of study, but in a less formal and more engaging setup. These areas could be from science, engineering, social sciences, arts or even politics. Although practice is important and lectures are already part of every academic curriculum, engineering students usually get exposure to only a small set of areas which are part of their curriculum.

To be good citizens and human beings, as well as to be better engineers or scientists, they should be exposed to other diverse areas. For this purpose, renowned experts and practitioners from other areas of science, engineering, social sciences or arts should be invited to colleges to give lectures specially

targeted at engineering students to help open up their minds. These lectures should not be of the kind one gets in classrooms, but more like invited talks or tutorials at research conferences, or lectures based on personal experiences of these renowned experts and practitioners.

One of the models for these could be the lectures of, say, the famous physicist Richard Feynman. Some of the TED Talks can also serve as models for this. These lectures should serve as kinds of bridges between theory and practice of activities in areas other than their own. They should be motivational, in the sense that they should help students willingly and happily take up activities in at least one or two of the diverse areas. They should help in producing more rounded human beings who can interact fruitfully with other kinds of people, not just with other engineers of their own branches. In addition, the students should

feel the thrill of meeting people who have not only excelled in their fields, but have motivated others to do so. Even the more articulate politicians could be invited to present their view of the world to students, according to their different ideologies. But if this last part is done, it must be ensured that all major distinct ideologies are represented, so that students get to know very different viewpoints directly from their committed supporters. Since students are going to be citizens and voters, they should know more about political viewpoints that they can get from popular news channels or from social media.

Session: For arranging sessions, topics could be selected from following domains, but **not restricted to**

- SCIENCE
- ENVIRONMENT AND SUSTAINABILITY · BEHAVIORAL AND INTERPERSONAL SKILLS
- BANKING · FINANCE
- ART FORM · SOCIAL SCIENCE
- TECHNICAL TOPICS · DISASTER MANAGEMENT
- ROAD SAFETY · WOMEN'S EMPOWERMENT
- ENTREPRENEURSHIP · HEALTH
- MOTIVATIONAL THOUGHTS · ENGINEER AND SOCIETY

- ETHICS · TEAM WORK
- POLITICS

Execution guidelines:

 Depending on expert lecture title, course objectives and course outcomes will be framed.

 Depending on feedback and short quiz given by the students at the end of session, the attainment of corresponding outcomes will be done.

 The faculty been assigned with the load of this subject will consolidate individual attainment for calculation of final course attainment.

 The same faculty will also be responsible for smooth conduction and coordination of session which includes

1. Collecting topic choices from the faculties.
2. Identifying expert and mode of conduction.
3. Maintaining attendance, feedback, attainments and other official records.

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute affiliated to SPPU, Pune)

Department of Electronics and Computer Engineering

B Tech Honors in Embedded Systems & IoT w. e. f. Academic Year 2022-23

T. Y. B. TECH SEMESTER-V

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits		ESE	CIA	OR	PR	TW	Total
PCC	EC8101	Microcontroller and Embedded C Programming	4	-	-	4	30	50	20	-	-	-	100
		Total	**4**	**-**	**-**	**4**	**30**	**50**	**20**				**100**

T. Y. B. TECH SEMESTER-VI

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits		ESE	CIA	OR	PR	TW	Total
PCC	EC8102	Embedded system hardware and software design	4	-	-	4	30	50	20	-	-	-	100
LC	EC8103	Embedded system hardware and software design Lab	-	-	2	1	-	-	-	-	50	-	50
		Total	**4**	**-**	**2**	**5**	**30**	**50**	**20**	**-**	**50**	**-**	**150**

B Tech Honors in Software Solutions for Enterprise w. e. f. Academic Year 2022-23

T. Y. B. TECH SEMESTER-V

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits		ESE	CIA	OR	PR	TW	Total
PCC	EC8201	ABAP Workbench Fundamentals Part - I	4	-	-	4	30	50	20	-	-	-	100
LC	EC8202	ABAP Workbench Fundamentals Part - I Lab	-	-	2	1	-	-	-	-	50	-	50
		Total	**4**	**-**	**2**	**5**	**30**	**50**	**20**	**-**	**50**	**-**	**150**

T. Y. B. TECH SEMESTER-VI

Course			Teaching Scheme Hours/week				Evaluation Scheme-Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits		ESE	CIA	OR	PR	TW	Total
PCC	EC8203	ABAP Workbench Fundamentals Part - II	4	-	-	4	30	50	20	-	-	-	100
		Total	**4**	**-**	**-**	**4**	**30**	**50**	**20**				**100**

Microcontroller and Embedded C Programming (EC8101)

Teaching Scheme
Lectures: 4 Hrs. / Week

Credits: 4

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course:- Digital Electronics

Course Objectives:

1. To introduce students with the wide scope and applications of embedded systems
2. To make them capable to design and develop solutions to real world problems

Course Outcomes (COs): After successful completion of the course, student will be able to

COs	Course Outcome Statement	Bloom's Taxonomy	
		Level	Descriptor
EC8101.1	Understand different architectural features of Microcontroller and Microcontroller families.	2	Understand
EC8101.2	Elaborate capabilities of Microcontroller and different Open source embedded hardware platforms.	4	Analyze
EC8101.3	Select a Microcontroller or platform for specific applications. Write, simulate and execute programs in embedded C for specified application.	4	Analyze

EC8101.4	Interface and operate various real world devices and component through prototyping boards, Design solutions to different real world problems using embedded systems.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC8201.1	2	-	-	-	-	-	-	-	-	-	-	-	1	-
EC8201.2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
EC8201.3	2	-	-	-	3	-	-	-	-	-	-	-	1	-
EC8201.4	2	-	-	-	3	-	-	-	-	-	-	-	1	-

Course content

Unit-I	**Microcontroller architecture**	No. of Hours	COs
	Introduction to the concepts of microprocessors, microcontrollers, RISC, CISC, Harvard and Von Neumann architectures. Role of embedded systems. Selection of microcontrollers, variants of different Microcontroller family and their features. Applications of microcontrollers. Architecture of generalized Microcontroller. Working of Microcontroller, Concept and future trends in Microcontroller, Concept of IP core.	6 Hrs.	EC8101.1
Unit-II	**Open source embedded platforms and applications**	No. of Hours	EC8101.s
	Survey of different open source hardware platforms and its variants with special focus on Arduino family, Atmega 328P- features, architecture, port structure, Concept of sensors and actuators, data acquisition systems,	6 Hrs.	EC8101.2
Unit-III	**Embedded C**	No. of Hours	COs
	Introduction to simulation, debugging, and testing, programming concepts: variables, functions, conditional statements, memory map, MACROs, accessing different register, Concept of Scalability and portability. Process of Embedded C to Assembly conversion with case study. Introduction to Arduino IDE- features, IDE overview,	6 Hrs.	EC8101.3
Unit-IV	**GPIO and communication**	No. of Hours	COs
	Concept of GPIO in Atmega 328P based Arduino board, digital input and output, concept of UART & serial communication, Concept of timers, interfacing LED, LCD and keypad	6 Hrs.	EC8101.3
Unit-V	**Analog Input & output**	No. of Hours	COs
	Concept of ADC, interfacing with different sensors like LDR, temperature sensor(LM35), Ultrasonic Sensor, IR sensor, concept of PWM, DC motor interface using PWM, Servo motor interfacing	6 Hrs.	EC8101.4
Unit-VI	**Case study of different Microcontroller based application**	No. of	COs

		Hours	
	Home automation, farm automation, room temperature controller etc.	6 Hrs.	EC8101.4

Text Books:

1. David E. Simon, "An Embedded Software Primer", Addison Wesley; 2nd edition, ISBN: 978-02-016-1569-2
2. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", Tata McGraw-Hill Education (India), 2011.

Reference Books:

1. Frank Vahid, Tony Givargis, "Embedded System Design: A Unified Hardware/Software Introduction", Wiley- India,(2009) ISBN:- 978-81-265-0837-2.
2. Massimo Banzi, Michael Shiloh, "Getting Started With Arduino - The Open Source Electronics Prototyping Platform", Shroff/Maker Media; 3rd edition 2014, ISBN: 978-93-511-0907-5

e-Resources:

1. https://www.arduino.cc/
2. https://www.raspberrypi.org/
3. https://www.digit.in/technology-guides/

CIA:

1. Collection of features and pin diagrams of any one of following controllers. (5 marks)

PIC microcontrollers,
AVR microcontrollers,
ARM microcontrollers,
Intel microcontrollers any other microcontroller family

2. Prepare the block diagram of any one of the following real-world control application based on microcontroller. (5 marks)

Temperature control, Weighing machine, Humidity control, Public telephone (Landline), Street-light control, Lift controller, Washing machine control,
Any other application of similar nature and magnitude

3. Collection of features and pin diagrams of any one open source hardware platforms like Arduino, Raspberry pi etc. (5 marks)

4. Writing a program and simulation for any application in 2nd activity for specified microcontroller family. (5 marks)

ABAP Workbench Fundamentals Part - I (EC8201)

Teaching Scheme
Lectures: 04 Hrs./ Week

Credits: 04

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite: - Knowledge of Business processes

Course Objectives:

1. To learn architecture of SAP system.
2. To study navigation of AS ABAP systems with SAP GUI for windows
3. To learn AS ABAP and AS JAVA system architecture
4. To study of the structure of the ABAP Repository
5. To learn the purpose and benefits of data models
6. To study request ordered from database

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

CO	CO Statement	Bloom's Descriptor	
		Level	Descriptor
EC8201.1	Describe the architecture of SAP system	2	Understand
EC8201.2	Access AS ABAP systems using GUI for JAVA and HTML	2	Understand
EC8201.3	Identify the processes of an AS ABAP system	1	Remember
EC8201.4	Describe the structure of the ABAP repository	2	Understand
EC8201.5	Explain the purpose and benefits of data models	2	Understand

EC8201.6	Perform calculations on the database	3	Apply

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC8201.1	2	-	-	-	-	-	-	-	-	-	-	-
EC8201.2	2	-	-	-	2	-	-	-	-	-	-	-
EC8201.3	2	-	-	-	-	-	-	-	-	-	-	-
EC8201.4	2	-	-	-	-	-	-	-	-	-	-	-
EC8201.5	2	-	-	-	2	-	-	-	-	-	-	-
EC8201.6	2	-	-	-	2	-	-	-	-	-	-	-

Course Contents

Unit-I	**SAP system and portfolio Overview**	No. of Hours	Cos
	The key capabilities of SAP NetWeaver, Application Server (AS), SAP business All-in-One, SAP Business solutions, components of the SAP applications portfolio, Architecture of SAP Business Suite, SAP product Life cycle Management, Industry Applications, SAP Business Suite powered by SAP HANA, SAP applications and components, Overview of SAP S/4 HANA	06	EC8201.1
Unit-II	**SAP Navigation and Open SQL**	No. of Hours	Cos
	User Interfaces in the SAP Environment, Access technologies, variants of SAP GUI, Transaction in AS ABAP, User interface personalization, ABAP Open SQL, Database update with ABAP Open SQL, Database change Bundling	06	EC8201.2
Unit-III	**Communication and Integration Technologies**	No. of Hours	Cos
	Types of SAP NetWeaver AS, AS ABAP & AS Java System Architecture AS ABAP Processes, ASAP Dispatcher, Process Flow for Request, Flow of a Database Query, Database and ABAP Transaction, Lock Management, Communication with Remote Function Call-Based, Basics of Web Services, OData in SAP Gateway	06	EC8201.3
Unit-IV	**ABAP Workbench**	No. of Hours	Cos
	Processing in ABAP Program, Introducing the ABAP Workbench, Organizing ABAP Development Project, Development ABAP Program, Finalizing ABAP Development Project, Defining Elementary Data Object, Using Basic ABAP Statements, Analyzing Program with the ABAP Debugger.	06	EC8201.4
Unit-V	**Modularization Techniques in ABAP**	No. of Hours	Cos

	Modularization, Defining and Calling Subroutines, Calling Function Modular, Creating Function Modular, Describing Business Application Programming Interface (BAPIs), Calling Method of Global Classes, Creating Global Classes and Static Methods, Using Local Classes.	06	EC8201.5
Unit-VI	**Data Modeling, Data Retrieval & Classic ABAP Report**	No. of Hours	Cos
	Data Model, Retrieving Single Database Records, Retrieving Multiple Database Records, Authorization Checks, ABAP Lists, Selection Screens, Calling Program Synchronously, ABAP Runtime and Memory Management, Processing and Aggregating Datasets	06	EC8201.6

Text Books:

1. Kogent Learning Solutions Inc., "SAP ABAP/4 (Covers SAP ECC 6.0) Black Book", Dreamtech Press, 2009th edition, ISBN : 978-8177224290.
2. Sudipta Malakar "SAP/ ABAP/ HANA Programming", BPB Publication, ISBN :978-9387284289.

Reference Books:

1. Paweł Grześkowiak, "Mastering SAP ABAP: A complete guide to developing fast, durable, and maintainable ABAP programs in SAP", Packt Publishing Limited, ISBN:978-1787288942.

e- Resources:

1. https://www.sap.com/india/
2. https://www.udemy.com/course/sap-abap-programming-for-beginners/

Continuous Internal Assessment:-

1. MCQ Test on Each Unit
2. Assignment on each Unit
3. Prepare Reports using SAP platform

ABAP Workbench Fundamentals Part - I Laboratory (EC8202)

Teaching Scheme
Practical: 2Hrs/Week
Credits: 01

Examination Scheme
PR: 50 Marks

Prerequisite: - Knowledge of Business Processes

Course Objectives:

1. To learn architecture of SAP system.
2. To study navigation of AS ABAP systems with SAP GUI for windows
3. To learn AS ABAP and AS JAVA system architecture
4. To study of the structure of the ABAP Repository
5. To learn the purpose and benefits of data models
6. To study request ordered from database

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

Course Outcomes	Statement	Bloom's Descriptor	
		Level	Descriptor
EC8202.1	Describe the architecture of SAP system	2	Understand

EC8202.2	Access AS ABAP systems using GUI for JAVA and HTML	2	Understand
EC8202.3	Identify the processes of an AS ABAP system	1	Remember
EC8202.4	Describe the structure of the ABAP repository	2	Understand
EC8202.5	Explain the purpose and benefits of data models	2	Understand
EC8202.6	Perform calculations on the database	3	Apply

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC8202.1	2	-	-	-	-	-	-	-	-	-	-	-
EC8202.2	2	-	-	-		-	-	-	-	-	-	-
EC8202.3	2	-	-	-	-	-	-	-	-	-	-	-
EC8202.4	2	-	-	-	-	-	-	-	-	-	-	-
EC8202.5	2	-	-	-	-	-	-	-	-	-	-	-
EC8202.6	2	-	-	-	-	-	-	-	-	-	-	-

Practical Course Contents (Minimum 08 Experiments) :

Sr. No.	Title of Practical	COs
1	Write a program to print “Hello” word in ABAP	EC8202.1
2	Write a program to perform arithmetic operations in ABAP	EC8202.1
3	Write a program to perform logical operations in ABAP	EC8202.1
4	To study Overview of SAP Interface and Navigation	EC8202.1
5	Write a program using conditional statements in ABAP	EC8202.2
6	Write a program for listing of the materials in ABAP	EC8202.2
7	Write a program to create a table in ABAP	EC8202.2
8	Write a program to extract the list of electronics material from the table	EC8202.2
9	To study internal tables in ABAP	EC8202.3
10	To study ABAP workbench	EC8202.3

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

B. Tech. Electronics and Computer Engineering

2020 Pattern

Proposed Program Structure

(B. Tech. with effect from Academic Year 2020-2021)

(T Y B. Tech. Sem-VI with effect from Academic Year 2022-2023)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

DECLARATION

We, the Board of Studies in Electronics and Computer Engineering, hereby declare that, We have designed the Curriculum up to T. Y. B. Tech. Semester-VI of 2020 Pattern w.e.f A.Y 2022-2023 as per the guidelines. This document also contains the proposed structure Electronics and Computer Engineering. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information of all the concerned stakeholders.

Recommended by

(Dr. B. S. Agarkar)
Chairman
BoS Electronics and Computer Engineering

Approved by

(Dr. A. G. Thakur)
Chairman
Academic Council
SRES Sanjivani College of Engineering, Kopargaon

Vision of the Institute

To Develop World Class Professionals through Quality Education.

Mission of the Institute

To create Academic Excellence in the field of Engineering and Management through Education, Training and Research to improve quality of life of people.

Vision of the Department

To produce quality professionals in the field of Electronics and Computer Engineering with knowledge and skill sets to meet diversifying needs of industry and society.

Mission of the Department

M1- To impart the technology of Electronics and Computer Engineering through an effective teaching-learning process.
M2- To establish linkages between industry and academia for overall development of students.
M3- To promote innovative ideas in solving multi-disciplinary engineering problems having social relevance.
M4- To develop technical human resources exhibiting professional and ethical attitudes.

Program Educational Objectives (PEOs)

PEO1: Involve in design, manufacturing, integration and testing of products, software and systems in the field of Electronics & Computer engineering and allied disciplines.

PEO2: Solve engineering problems having social relevance by applying knowledge and skill sets related to Electronics and Computer engineering.

PEO3: Pursue higher Education/Research in the field of Engineering/Management or become a successful entrepreneur in the related areas.

PEO4: Work effectively as an individual and/or a team member of multi-disciplinary assignments involving people across different cultures and national boundaries.

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **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.

4. **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.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **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.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **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.

Program Specific Outcomes (PSOs)

On successful completion of the program, the graduates will be able to:

PSO1: Specify, Design, Test and Implement electronic systems related to Signal Processing, Networking, Embedded architectures and IoT using state of the art components and software.

PSO2: Provide software solutions for engineering problems by applying knowledge of Data Structures, Algorithms, Database Management, Web Technology, Big Data and Cloud Computing.

List of Abbreviations			
Abbreviation	Full Form	Abbreviation	Full Form
BSC	Basic Science Course	OEC	Open Elective Course
CIA	Continuous Internal Assessment	OR	End-Semester Oral Examination
EFC	Engineering Foundation Course	P	Practical
ESE	End-Semester Evaluation	PCC	Professional Core Course
HSMC	Humanities/Social Sciences/Management Course	PEC	Professional Elective Course
IP	Induction Program	PR	End-Semester Practical Examination
ISE	In-Semester Evaluation	PROJ	Project
L	Lecture	T	Tutorial
MLC	Mandatory Learning Course	TW	Continuous Term Work Evaluation

T. Y. B. TECH. 2020 Pattern (Electronics and Computer Engineering) SEMESTER-V

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	CIA	ISE	ESE				
PCC	EC301	Control Systems	3	1	-	4	20	30	50	-	-	-	100
PCC	EC302	Analog Circuits and Systems	3	-	-	3	20	30	50	-	-	-	100
PCC	EC303	DBMS and SQL	3	-	-	3	20	30	50	-	-	-	100
PCC	EC304	Software Engineering, Modeling and Design	4	-	-	4	20	30	50	-	-	-	100
PEC	EC305	Refer List of PEC1	3	-	-	3	20	30	50	-	-	-	100
LC	EC306	Analog Circuits and Systems Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC307	DBMS and SQL Laboratory	-	-	2	1	-	-	-	50	-	-	50
LC	EC308	Software Engineering, Modeling and Design Laboratory	-	-	2	1	-	-	-	50	-	-	50
PROJ	EC309	Mini Project / Skill Based Credit Course	1	-	-	1	50	-		-	-	-	50
MC	MC310	Mandatory Course-V: Sanjivani ECE Talks	1	-	-	Non Credit	-	-	-	-	-	-	Pass/ Fail
		Total	18	1	6	21	150	150	250	100	50	-	700

SEMESTER-VI

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory			OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	CIA	ISE	ESE				
PCC	EC311	Advanced Microcontroller and Embedded Systems	4	-	-	4	20	30	50	-	-	-	100
PCC	EC312	System Programming and Operating System	3	-	-	3	20	30	50	-	-	-	100
PCC	EC313	Digital Signal Processing	3	-	-	3	20	30	50	-	-	-	100
PEC	EC314	Refer List of PEC2	3	-	-	3	20	30	50	-	-	-	100
HSMC	HS315	Corporate Readiness	2	-	-	2	50	-	-	-	-	-	50
PROJ	PR316	IPR & EDP	2	-	-	2	20	-	30	-	-	-	50
LC	EC317	Advanced Microcontroller and Embedded Systems Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC318	System Programming and Operating System Laboratory	-	-	2	1	-	-	-	-	50	-	50
LC	EC319	PEC2 Laboratory	-	-	2	1	-	-	-	50	-	-	50
LC	EC320	Creational Activity	-	-	2	1	-	-	-	-	-	50	50
MC	MC321	Mandatory Course-VI:	1	-	-	Non Credit	-	-	-	-	-	-	Pass/ Fail
		Total	18	-	08	21	150	120	230	50	100	50	700

Professional Elective Course 1 (PEC1):		Professional Elective Course 2 (PEC2):	
EC305A	Electromagnetics	EC314A	Autonomous Vehicles
EC305B	Network Theory and Analysis	EC314B	Power Electronics and Drives
EC305C	Web Technology	EC314C	Software Testing and Quality Assurance

Total Credits: 42 **Total Marks: 1400**

Advanced Microcontroller and Embedded Systems (EC311)

Teaching Scheme
Lectures: 4 Hrs/Week
Credits:4

Examination Scheme
ISE:30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course: Microcontroller fundamentals and embedded C Programming.

Course Objectives:

1. To learn the different design aspects of embedded system.
2. To study the architecture of PIC microcontroller.
3. To develop skills for interfacing and programming the PIC18F with real world input and output devices.
4. To learn the architecture and features of ARM processors.
5. To become competent in programming and interfacing the advanced peripherals using ARM7 controller.
6. To understand step by step process of designing embedded systems application using waterfall model.

Course Outcomes (COs): After successful completion of the course, student will be able to

COs	CO Statement	Bloom's Taxonomy	
		Level	**Descriptor**
EC311.1	Know different design aspects of embedded system	2	Understand
EC311.2	Describe the PIC microcontroller architectures and its feature.	2	Understand
EC311.3	Interface the real world input and output devices with PIC18F microcontroller	3	Apply
EC311.4	Describe the ARM microprocessor architectures and its feature.	2	Understand
EC311.5	Interface the advanced peripherals to ARM based microcontroller	3	Apply
EC311.6	Foster step by step design process of embedded systems using waterfall model.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC311.1	2	-	-	-	-	-	-	-	-	-	-	-	1	-
EC311.2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
EC311.3	2	-	-	-	3	-	-	-	-	-	-	-	1	-
EC311.4	2	-	-	-	-	-	-	-	-	-	-	-	1	-
EC311.5	2	-	-	-	3	-	-	-	-	-	-	-	1	-
EC311.6	2	-	-	-	-	-	-	-	-	-	-	-	1	-

Course Contents

Unit-I	**Basics of Embedded Systems**	**No. of Hrs**	**Cos**
	Introduction to Embedded Systems, definition, Applications and recent trends, Architecture of embedded system, characteristics, Classification, Design Metrics, Optimization of Design metrics, Key Design challenges, Design constraints, Techno-Economical prospective of embedded system.	06	EC311.1
Unit-II	**PIC Microcontroller Architecture**	**No. of Hrs**	**Cos**
	Features, comparison & selection of PIC series as per application. PIC18FXX architecture- MCU, Program and Data memory organization, Pin out diagram, Reset operations, Oscillator options (CONFIG), BOD, power down modes & configuration bit settings,timer and its programming, Brief summary of Peripheral support, Overview of instruction set.	06	EC311.2
Unit-III	**Interfacing with PIC18F**	**No. of Hrs**	**Cos**
	Interfacing of LED, LCD (4&8 bits) and Key board, use of timers with interrupts, DC Motor speed control with CCP, UART, Sensor interfacing using ADC, RTC with I2C and EEPROM with SPI.	06	EC311.3
Unit-IV	**ARM Processors**	**No. of Hrs**	**Cos**
	ARM processors and its versions, features, suitability in embedded application, registers, CPSR, SPSR and RISC Design philosophy, ARM7 data flow model, programmer's model, Modes of Operations, ARM7 based microcontroller LPC2148: features, Architecture (block diagram and its description), Survey of CORTEX based processors, features and comparison.	06	EC311.4
Unit-V	**Interfacing with ARM7**	**No. of Hrs**	**Cos**
	Simple LPC2148 GPIO Programming examples using timers of LPC2148 to generate delay, Interfacing of LPC2148 with GLCD, GSM, GPS, built-in ADC, EEPROM using I2C protocol	06	EC311.5
Unit-VI	**Embedded System Development Cycle**	**No. of Hrs**	**Cos**
	Requirement engineering, requirement Specification, Hardware-Software Partitioning, Hardware-Software co-design, Integration, Testing, Quality Assurance, Aesthetic Design, Maintenance, and Electronics Waste Management.	06	EC311.6

Text Books:

1. Muhammad Mazidi, Rolin McKinlay and Danny Causey, “PIC Microcontroller and Embedded Systems using Assembly and C for PIC18 ”, Pearson Education, 2nd Edition.

2. Frank Vahid, Tony Givargis, “Embedded System Design: A Unified Hardware/Software Introduction”,Wiley India,(2009) ISBN:- 978-81-265-0837-2.

3. Andrew Sloss, “ARM System Developer's Guide: Designing and Optimizing System Software”, Morgan Kaufmann, 2004, ISBN: 978-15-586-0874-0.

Reference Books:

1. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, Tata McGraw-Hill Education (India),2011.
2. Dr. K.V.K.K Prasad, “Embedded Real Time Systems: Concepts, Design and Programming”, Dreamtech Press, 2003,ISBN:978-81-772-2461-0.
3.Trevor Martin, “An Engineer’s Introduction to the LPC2100 series”, Hitex(UK) Ltd.

e- Resources:

1. NPTEL Course on Embedded system design using ARM https://nptel.ac.in/courses/106/105/ 106105193/
2. COURSERA course https://www.coursera.org/specializations/real-time-embedded-systems

CIA:- CIA evaluation is strictly as per Rubrics. CIA is Project Based Learning activity.

System Programming and Operating System (EC312)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite Course : Computer Fundamentals and Programming

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Course Objectives:

1. To explore system programming concepts, like the use and implementation of assembler, and macro processor.
2. To define the concept of a compiler, loader and linker.
3. To study basic concepts of OS and implement various processes scheduling techniques
4. To demonstrate concurrency and deadlock avoidance schemes in the operating system.
5. To investigate the need for memory allocation and its methods
6. To analyze the input/output device design and file system.

Course Outcomes (COs): After successful completion of the course, students will be able to

COs	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC312.1	Summarize the knowledge of Systems Programming, assembler and macro processor	2	Understand
EC312.2	Implementing toy compiler and Loader for the given architecture.	3	Apply
EC312.3	Explain the basic concept of OS along with process management.	2	Understand
EC312.4	Apply deadlock detection methods for solving deadlocks.	3	Apply
EC312.5	Evaluate memory scheduling policies for process scheduling.	5	Evaluate
EC312.6	Elaborate and use the concept of I/O devices.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC312.1	1	2	3	-	3	-	-	-	-	-	-	-	-	1
EC312.2	1	-	-	-	3	-	-	-	-	-	-	-	-	3
EC312.3	2	3	2	-	3	-	-	-	-	-	-	-	1	2
EC312.4	2	3	2	-	3	-	-	-	-	-	-	-	-	2
EC312.5	2	3	2	-	3	-	-	-	-	-	-	-	-	2
EC312.6	2	-	-	-	3	-	-	-	-	-	-	-	-	2

Course Contents

Unit-I	**Introduction to Systems Programming**	No. of Hours	Cos
	Introduction: Components of System Software, Language Processing Activities, Fundamentals of Language Processing. Assemblers: Elements of Assembly language programming. Simple assembler scheme, Structure of an assembler, Design of single and two pass assemblers.Macro Processors: Macro Definition and call, Macro expansion, Nested Macro Calls, Advanced Macro Facilities, Design of a two-pass macro-processor.	06 .	EC312.1
Unit-II	**Compiler, Loaders and Linkers**	No. of Hours	Cos
	Compilers: Basic compilers function, Phases of compilation, memory allocation, compilation of expression, Compilation of expressions, compilation of control structures, Code of optimization.Loaders: Loader Schemes: Compile and go, General Loader Scheme, Absolute loaders, subroutine linkages, relocating loaders, direct linking loaders, Design of an absolute loader.Linkers: Relocation and linking concepts, Design of linker, self relocating programs, Static and dynamic linker	06 .	EC312.2
Unit-III	**Introduction to OS and Process management**	No. of Hours	Cos
	Introduction to OS : Architecture, Goals & Structures of O.S, Basic functions, Interaction of O. S. & hardware architecture, System calls, Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real -time O.S. Process Management: Process Concept, Process states, Process control, Threads, Scheduling: Types of scheduling: Preemptive, Non preemptive, Scheduling algorithms: FCFS, SJF, RR.	06	EC312.3
Unit-IV	**Concurrency control**	No. of Hours	Cos
	Concurrency: Interprocess communication, Mutual Exclusion, Semaphores, Classical Problems of Synchronization: Readers-Writers, Producer Consumer, and Dining Philosopher problem. Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection.	06	EC312.4
Unit-V	**Memory Management**	No. of Hours	Cos
	Basics of memory management, Swapping, Memory Allocation, Paging, Segmentation, Virtual memory, Demand Paging, Page replacement, Page replacement algorithms – Optimal FIFO, LRU, LRU approximation, Allocation of frames	06	EC312.5
Unit-VI	**Input and Output, File System**	No. of Hours	Cos

	I/O management & Disk scheduling: I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS), RAID, Disk Cache.File Management: Concepts, File Organization, File Directories, File Sharing, Record Blocking, Allocation methods, Free Space management	06	EC312.6

Text Books:

1. Dhamdhere D. M., "Systems Programming and Operating Systems", 2nd Edition, Tata McGraw-Hill Publishing ISBN: 978-00-746-3083-9
2. J. J. Donovan, "Systems Programming", 1st edition McGraw Hill, 1996, ISBN: 978-00-746-0482-3
3. Andrew S. Tanenbaum, "Modern Operating Systems", 2nd or 3rd Edition, Pearson, PHI. ISBN:- 978-01-360-0663-3

Reference Books:

1. Siberschatz A; Galvin P.B; Gagne G, "Operating System Concepts", 2003, John Wiley Publication.
2. Stalling William, "Operating Systems", Pearson Education(PHI), 5th edition.
3. Adam Hoover, "System Programming with C and UNIX", 1st edition, Pearson Education, ISBN: 978-01-360-6712-2.
4. Leland L. Beck, "System Software", 3rd edition, Pearson Editions. ISBN: 978-81-317-6460-2

e-Resources:

https://www.coursera.org/videos/system-programming/ekn8t
https://www.coursera.org/programs/faculty-development-program-v4v5h/browse?collectionId=&productId=TJvG4FKtEeyKpBLIBkHB1w&productType=s12n&query=operating+system&showMiniModal=true&source=search

Continuous Internal Assessment: - CIA evaluation is strictly as per Rubrics. CIA Activity is **Literature Survey** - In This activity students has to download different IEEE paper on one specific topic from the course and then prepare a report on that topic from IEEE papers collection and present it.

Digital Signal Processing (EC313)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ISE : 30 Marks
ESE : 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite course : Knowledge of Z-Transform, Laplace transform.

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Course Objectives:

1. To learn the basics of sampling, aliasing of discrete time signals.
2. To study different transforms for discrete time signals and systems.
3. To study implementation techniques of digital filters.
4. To learn the concept of multi rate sampling.
5. To introduce the concept of Digital Signal Processor.
6. To introduce applications of signal processing in different domains.

Course Outcomes (COs): After successful completion of the course, student will be able to

Course Outcomes	Course outcome	Bloom's Taxonomy	
		Level	Descriptor
EC313.1	Describe the elements of Digital Signal Processing.	2	Understand
EC313.2	Determine the transform techniques DTFT, DFT on discrete time signals.	3	Apply
EC313.3	Compute discrete time signals with FFT algorithms.	3	Apply
EC313.4	Select appropriate method for IIR filter for various applications.	4	Analyze
EC313.5	Select appropriate window function for FIR filter for various applications.	4	Analyze
EC313.6	Explain different Digital Signal Processing applications.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC313.1	3	2	---	---	---	---	---	---	---	---	---	---	1	---
EC313.2	3	2	2	---	2	---	---	---	---	---	---	---	2	---
EC313.3	3	2	2	---	2	---	---	---	---	---	---	1	2	---
EC313.4	3	2	2	2	2	---	---	---	---	---	---	1	2	---
EC313.5	3	2	2	2	2	---	---	---	---	---	---	1	2	---
EC313.6	2	2	2	1	---	---	---	---	---	---	---	2	2	---

Course Contents

Unit-I	Introduction to DSP	No. of Hours	COs
	Basic elements of DSP and its requirements, advantages over Analog signal processing. DT signals, need of sampling theorem in signal processing, recovery of analog signals, mapping between analog frequencies to digital frequency. concept of Basis function and orthogonality.	06 Hrs.	EC313.1
Unit-II	Discrete Fourier Transform	No. of Hours	COs
	DTFT, Properties of DTFT, Introduction of DFT, Properties of DFT, Twiddle factor and its properties, circular convolution using-concentric circle, expression, DFT-IDFT. Computation of linear convolution using circular convolution, circular convolution for avoidance of aliasing.	07 Hrs.	EC313.2
Unit-III	Fast Fourier Transform	No. of Hours	COs
	FFT, decimation in time and decimation in frequency using Radix-2 FFT algorithm, comparison of computational complexity with direct computation, Butterfly diagram, Linear filtering using overlap add and overlap save method, IDFT by FFT algorithm.	07 Hrs.	EC313.3
Unit-IV	IIR Filter Design	No. of Hours	COs
	Concept of analog filter design, Design of IIR filters from analog filters, IIR filter design by impulse invariance method, Bilinear transformation method. Frequency warping effect, Butterworth filters, design of Butterworth filter, IIR filter realization using direct form, cascade form and parallel form.	07 Hrs.	EC313.4
Unit-V	FIR Filter Design	No. of Hours	COs
	Ideal filter requirements, Gibb's phenomenon, windowing techniques, characteristics and comparison of different window functions, Design of linear phase FIR filter using windows and frequency sampling method. FIR filters realization using direct form.	06 Hrs.	EC313.5
Unit-VI	Multi rate DSP and Applications of DSP	No. of Hours	COs

	Concept of Multirate DSP, Sampling rate conversion by a non-integer factor, concept of decimation and interpolation, Design of two stage sampling rate converter, General Architecture of DSP, DSP processor TMS320C67XX/MSP430(Features and Architecture). Application of DSP in different domain (speech Processing, Image processing, biomedical field and Radar signal processing).	06 Hrs.	EC313.6

Books:

Text Books:

1. John G. Proakis, Dimitris G. Manolakis, — Digital Signal Processing: Principles, algorithms and applications Fourth edition, Pearson Prentice Hall.
2. S. Salivahanan, C. Gananpriya — Digital Signal processing, McGraw Hill Publication
3. Sen M. Kuo Woon- Seng S. Gan - Digital Signal processing, Pearson Publication

Reference Books:

1. Ifaeachor E.C,Jervis B. W., — Digital Signal processing : Practical approach, Pearson publication
2. Li Tan, Jean Jiang, — Digital Signal Processing: Fundamentals and applications— Academic press
3. Lathi, B. P., Linear Systems and Signals, 2nd edition, Oxford University Press.
4. S. K.Mitra - Digital Signal Processing, McGraw Hill Publication.

Online Resources :

1) Digital Signal Processing and its Applications - Course (nptel.ac.in)
2) Digital Signal Processing 1: Basic Concepts and Algorithms | Coursera

Guidelines for Continuous Assessment: - MCQ Test/ Programming Assignment

Autonomous Vehicles (EC314A)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ISE : 30 Marks
ESE : 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course: A knowledge of statistics, linear algebra, calculus is necessary as well as good programming skills. A good knowledge of computer vision and machine learning is strongly recommended.

Course Objectives:
1. Introduce the fundamental aspects of Autonomous Vehicles.
2. Gain Knowledge about the Sensing Technology and Algorithms applied in Autonomous vehicles.
3. Understand the Connectivity Aspects and the issues involved in driverless cars

Course Outcomes (COs):
After successfully completing the course students will be able to:

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
EC314A.1	Describe the evolution of Automotive Electronics and the operation of ECUs.	2	Understand
EC314A.2	Compare the different type of sensing mechanisms involved in Autonomous Vehicles.	1	Remember
EC314A.3	Discuss about the use of computer vision and learning algorithms in vehicles.	1	Remember
EC314A.4	Summarize the aspects of connectivity fundamentals existing in a driverless car.	2	Understand
EC314A.5	Identify the different levels of automation involved in an Autonomous Vehicle.	3	Apply
EC314A.6	Outline the various controllers employed in vehicle actuation.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ET314A.1	3	---	---	---	---	---	---	---	---	---	---	---		---
ET314A.2	3	---	3	2	3	---	---	---	---	---	---	---		3
ET314A.3	3	---	3	2	3	---	---	---	---	---	---	---	2	3
ET314A.4	3	---	---	–	3	---	---	---	---	---	---	---	—-	---
ET314A.5	3	---	---	—---	3	---	---	---	---	---	---	---	2	---
ET314A.6	3	---			---	3	---	---	---	---	---	---	2	---

Course Contents

Unit-I	Evolution of Automotive Electronics	8 Hrs	COs
	Basic Control System Theory applied to Automobiles -Overview of the Operation of ECUs -Infotainment, Body, Chassis and Powertrain Electronics-Advanced Driver Assistance Systems-Autonomous Vehicles	Hrs.	EC314A.1

Unit-II	Sensor Technology for Autonomous Vehicles	8 Hrs	COs
	Basics of Radar Technology and Systems -Ultrasonic Sonar Systems -LIDAR Sensor Technology and Systems -Camera Technology -Night Vision Technology -Use of Sensor Data Fusion -Kalman Filters	Hrs.	EC314A.2
Unit-III	Computer Vision and Deep Learning for Autonomous Vehicles	7Hrs	COs
	Computer Vision Fundamentals -Advanced Computer Vision -Neural Networks for Image Processing-Overview of Deep Neural Networks -Convolutional Neural Networks	Hrs.	EC314A.3
Unit-IV	Connected Car Technology	8 Hrs	COs
	Connectivity Fundamentals - DSRC (Direct Short Range Communication) - Vehicle-to-Vehicle Technology and Applications -Vehicle-to-Roadside and Vehicle-to-Infrastructure Applications -Security Issues.	Hrs.	EC314A.4
Unit-V	Autonomous Vehicle Technology	7Hrs	COs
	Driver less Car Technology-Different Levels of Automation -Localization - Path Planning. Controllers to Actuate a Vehicle - PID Controllers -Model Predictive Controllers, ROS Framework	Hrs.	EC314A.5
Unit-VI	Autonomous Vehicles' Biggest Challenges	7 Hrs	COs
	Technical Issues, Security Issues, Moral and Legal Issues.	Hrs.	EC314A.6

Books:

Text Books:

1. Hong Cheng, "Autonomous Intelligent Vehicles: Theory, Algorithms and Implementation", Springer, 2011.

2. Williams. B. Ribbens: "Understanding Automotive Electronics", 7th Edition, Elsevier Inc, 2012.

Reference Books:

1. Shaoshan Liu, Liyun Li, "Creating Autonomous Vehicle Systems", Morgan and Claypool Publishers, 2017.
2. Marcus Maurer, J.ChristianGerdes, "Autonomous Driving: Technical, Legal and Social Aspects" Springer, 2016.
3. Ronald.K.Jurgen, "Autonomous Vehicles for Safer Driving", SAE International, 2013.
4. James Anderson, KalraNidhi, Karlyn Stanly, "Autonomous Vehicle Technology: A Guide for Policymakers", Rand Co, 2014.
5. Lawrence. D. Burns, ChrostopherShulgan, "Autonomy – The quest to build the driverless car and how it will reshape our world", Harper Collins Publishers, 2018

Guidelines for Continuous Assessment: -CIA evaluation is strictly as per Rubrics. CIA is Project Based Learning activity.

Power Electronics and Drives (EC314B)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ISE : 30 Marks
ESE : 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course: Semiconductor Devices basics, Electric Motors basics

Course Objectives:

1. To introduce students to different power devices to study their construction, characteristics and turning on circuits.
2. To give an exposure to students of working & analysis of controlled rectifiers for different loads. .
3. To study DC choppers, AC voltage controllers and SMPS.
4. To study Inverters and its performance parameters.
5. To determine performance of DC Drives and excitation techniques
6. To determine performance of AC Drives and excitation techniques.

Course Outcomes (COs): After successful completion of the course, student should be able to:

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC314B.1	Describe basic operation and performance of power semiconductor devices, SCR, MOSFET and IGBT.	2	Understand
EC314B.2	Explain the characteristics of half and full controlled converters.	2	Understand
EC314B.3	Select suitable power converter to control electric motors	4	Analyze
EC314B.4	Illustrate single phase and three phase inverters.	4	Analyse
EC314B.5	Determine performance of DC drives.	3	Apply
EC314B.6	Determine performance of AC drives.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC314B.1	3	----	3	1	--	--	--	--	--	--	--	--	-	–
EC314B.2	3	----	2	2	--	--	--	--	--	--	--	--	-	–
EC314B.3	3	----	2	1	--	--	--	--	--	--	--	--	-	-
EC314B.4	3	----	2	1	--	--	--	--	--	--	--	--	-	-
EC314B.5	3	----	2	2	--	--	--	--	--	--	--	--	-	-
EC314B.6	2	----	3	3	----	----	----	--	--	--	--	--	-	--

Course Contents

Unit-I	Power Devices	No. of Hrs	COs

	SCR:Construction, steady state characteristics and switching characteristics of SCR, SCR ratings: I_L,I_H,V_{BO},V_{BR},dv/dt,di/dt,surge current and rated current, Gate characteristic, Gate drive requirements, Synchronized UJT triggering circuit, Power MOSFET & IGBT: Construction ,Steady state characteristics, Gate drive circuits. Protections and thermal consideration of power devices.	6	EC314B.1
Unit-II	AC-DC Power Converter	No. of Hrs	COs
	Concept of line and natural commutation, single phase Semi and full bridge converters for R, R-L, R-L-E loads, performance parameters, Effect of free-wheeling diode, Three phase semi and full converters for R load.	6	EC314B.2
Unit-III	DC –DC converters and AC voltage Controller	No. of Hrs	COs
	Working principle of step down chopper for R-L load(highly inductive), control strategies, performance parameters, Step-up chopper, Quadrant operations of Type A, Type B Type C Type D and Type E choppers, control techniques for choppers -TRC and CLC, Detailed analysis of type A chopper, step chopper, Multiphase chopper Single-Phase full wave AC voltage controller with R load.	6	EC314B.3
Unit-IV	DC- AC Power Converters	No. of Hrs	COs
	Single phase full bridge square wave, quasi-square wave, PWM Inverters and comparison of their performance, Three phase voltage source inverter for balanced star R load.	6	EC314B.4
Unit-V	DC Drives	No. of Hrs	COs
	Converter Control of DC Drives: Analysis of series and separately excited DC motor with single phase and three phase converters operating in different modes and configurations. Chopper Control of DC Drives: Analysis of series and separately excited DC motors fed from different choppers for both time ratio control and current limit control, four quadrant control.	6	EC314B.5
Unit-VI	AC Drives	No. of Hrs	COs

	Inverter fed AC Drives: Analysis of different AC motor with single phase and three phase inverters Operations in different modes and configurations., Problems and strategies. Cyclo-converter fed AC Drives: Analysis of different AC motor with single phase and three phase cycloconverters Operations in different modes and configurations., Problems and strategies, vector Control and Rotor side Control	6	EC314B.6

Text Books:

1. M. H. Rashid, Power Electronics circuits devices and applications‖, PHI New Delhi, 3rd edition, 2004.
2. P.C. Sen., Modern Power Electronics, 2nd edition, S.Chand & Co.
3. Bimal.K. Bose, "Power Electronics and Variable frequency drives", Standard Publishers Distributors, New Delhi, 2000

Reference Books:

1. Ned Mohan, Robbins, Power electronics, 3rd edition, John Wiley and sons.
2. M. S. Jamil Asghar, Power Electronics, PHI New Delhi, 2004
3. V.R.Moorthi, Power Electronics, Oxford University Press.
4. P. S. Bimbhra, Power Electronics, Khanna Publishers, New Delhi.
5. R. Krishnan, "Electric motor drives: modeling, analysis and control, Pearson.

Online Resources:

https://archive.nptel.ac.in/courses/108/102/108102145/
https://in.coursera.org/specializations/power-electronics
https://www.udemy.com/topic/power-electronics/

Guidelines for Continuous Assessment:-

1. Test will be conducted on Uni1 & Unit2 for 10 Marks
2. Test will be conducted on Uni3 & Unit4 for 10 Marks
3. Self learning activity will be conducted in groups for design of Power supply, Fan Regulator, DC motor control, AC motor control, DC Drives, AC Drives.

Software Testing & Quality Assurance (EC314C)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ISE : 30 Marks
ESE : 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite : Software Engineering Modelling & Design

Course Objectives :

1. To understand fundamentals concepts of software testing.
2. To learn and understand Black box testing.
3. To develop a comprehensive approach towards building White box testing.
4. To understand Testing Strategies, software quality and assurance systems.
5. To learn Testing planning and Management.
6. To learn various automated testing tools.

Course Outcomes (COs): After successful completion of the course, student will be able to

Course Outcomes	Course Outcome(s)Statement	Bloom's Taxonomy	
		Level	Descriptor
EC314C.1	Categorize real world application scenarios of software testing.	4	Analyze
EC314C.2	Describe black box testing with sub types of black box testing	2	Understand
EC314C.3	Describe white box testing with sub types of white box testing	2	Understand
EC314C.4	Demonstrate different approaches of Testing Strategies, software quality and assurance systems	3	Apply
EC314C.5	Illustrate the Test planning and Management.	4	Analyse
EC314C.6	Use automated test tools for different types of application	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC314C.1	3	2	2	3	1	-	1	-	-	-	-	-	1	1
EC314C.2	2	2	2	3	2	3	2	-	3	3	2	-	1	1
EC314C.3	2	2	2	3	2	3	2	-	3	3	2	-	1	1
EC314C.4	2	-	-	3	2	-	3	-	-	-	3	-	1	1
EC314C.5	2	3	2	-	3	3	3	-	3	3	3	-	1	1
EC314C.6	3	1	-	-	3	-	0	-	2	-	-	-	1	1

Course Contents

Unit-I	Introduction to Software Testing	No.of Hours	COs

	Need of testing, Basics of Software Testing, Testing Principles, Goals, Software Testing Life Cycle, Defects, Defect management, Verification and validation, Test Plan.	6	EC314C.1
Unit-II	Black Box Testing	No.of Hours	COs
	Introduction, need of black box testing, Requirements Analysis, Testing Methods - Requirements based testing, Positive and negative testing, Boundary value analysis, Equivalence Partitioning class, Domain testing, Design of test cases, Case studies of Black- Box testing.	6	EC314C.2
Unit-III	White Box Testing	No.of Hours	COs
	Introduction, Need of white box testing, Testing types, Static testing by humans, Structural Testing – Control flow testing, Loop Testing, Design of test cases, Challenges in White box testing, Case-studies of White-Box testing.	6	EC314C.3
Unit-IV	Testing Strategies and Quality Management	No.of Hours	COs
	Unit, Integration, System, Acceptance testing, Usability testing, Regression testing, Scenario testing, Adhoc testing, Functional, Performance testing, Stress testing, Security testing, Alpha-Beta testing, Software Quality Assurance. Elements of SQA, SQA Tasks, Goals, and Metrics, Six Sigma for Software Engineering, ISO 9000 Quality Standards.	6	EC314C.4
Unit-V	Test Planning and Management	No. of Hours	COs
	Requirement Traceability matrix, essentials, Work bench, Important Features of Testing Process, Misconceptions, Principles, Test Strategy, Test Planning, Testing Process and number of defects found, Cost aspect, methods, structured approach, categories of defect, Defect/ error/ mistake in software, Developing Test Strategy and Plan, Testing process.	6	EC314C.5
Unit-VI	Automation Testing	No. of Hours	COs
	Agile Testing, Model based testing, Need for Automation, Keyword driven automation, Data driven automation, Manual testing versus Automated testing, Automated Testing Tools, Selection of tool, Introducing Selenium, Selenium's Tool Suite, Selenium-IDE, Selenium RC.	6	EC314C.6

Text Books:

1: Ron Patton," Software Testing", Pearson Educations, ISBN-978-0-672-32798-8.
2: M. G. Limaye," Software Testing Principles, Techniques and Tools", Tata McGraw Hill,ISBN-978-0070-139909 00-7013990-3
3:A.B. Mathur, "Fundamental of software Testing", Pearson. ISBN: 9788131794760

Reference Books:

1: Srinivasan Desikan, Gopalswamy Ramesh, “Software Testing principles and Practices”,Pearson. ISBN-97881-7758-1218
2: Naresh Chauhan, “Software Testing Principles and Practices ", OXFORD, ISBN-10:0198061846. ISBN-13: 9780198061847.
3: Stephen Kan, “Metrics and Models in Software Quality Engineering”, Pearson, ISBN-10:0133988082; ISBN-13: 978-0133988086
4: Rajib Mall “ Fundamentals of Software Engineering “ 4th Edition,PHI Publication

e- Resources:
https://onlinecourses.nptel.ac.in/noc23_cs38
https://coursera.org/learn/introduction-software-testing

Guidelines for Continuous Assessment:-
1. Course & Exam Registration of all students will be done.
2. CIA Marks will be given based on NPTEL Software Testing final (assignments+Exam) score.
3.Final score will be scaled down to 20 marks.

Corporate Readiness (HS315)

Teaching Scheme	**Examination Scheme**
Lectures: 2 Hrs. / Week	CIA: 50 Marks
Credits: 2	Total: 50 Marks

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Prerequisite Course: (Quantitative aptitude, Verbal and non verbal communication)

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Course Objectives:

1. To develop clarity in the exploration process of student career and to match his skills and interests with a chosen career path.
2. To develop required aptitude skills.
3. To design the functional and chronological resume.
4. To demonstrate the importance of critical thinking ability and expression in group discussions
5. To prepare students for the various professional interviews.
6. To develop different soft skills necessary to get success in their profession.

Course Outcomes (COs): After successful completion of this course students should be able to

CO1. Remember placement processes of various organizations and modern job search approach.
CO2. Understand Industry Specific skill set with a view to design an Ideal Resume.
CO3. Apply the knowledge of GD & Presentation Skill during Industry Assessments for Placement/Internship/Industry Training/Higher Studies/Competitive Exams etc.
CO4. Analyse and apply the critical thinking ability as required during Aptitude/Technical Tests.
CO5. Evaluate Technical/General Dataset to interpret insights in it.
CO6. Create an ideal personality that fits Industry requirement.

Course Contents

Unit-I	Placement Awareness	No. of Hours	COs
	Discussion over Different Companies for recruitment, their eligibility criteria and placement procedures. Revision and Assessment of Quantitative Aptitude.	02 Hrs.	CO 1
Unit-II	Resume Writing	No. of Hours	COs
	Keywords, resume examples for industry, professional font, active language, important achievements, Proofread and edit. Innovative resume building- video resume.	02 Hrs.	CO2
Unit-III	Group Discussion and Presentation skills	No. of Hours	COs
	Why GDs are implemented commonly, Aspects which make up a Group Discussion, Tips on group discussion, do's and don'ts of GD and Presentation skills.	02 Hrs.	CO3
Unit-IV	Logical Reasoning I	No. of Hours	COs
	Coding and Decoding (Visual Reasoning and series), Statement & Conclusions (Syllogisms), Relationships (Analogy), Attention to Details, Flowcharts ,Crypt arithmetic	06 Hrs.	CO4
Unit-V	Logical Reasoning II	No. of Hours	COs
	Data Interpretation, Data Sufficiency	04 Hrs.	CO5

Unit-VI	Logical Reasoning III	No. of Hours	COs
	Blood relation and dices, Clocks and Calendar, Direction sense and cubes, Logical connectives, Puzzle	06 Hrs.	CO6

Learning Resources :

Text Books: (Max. 2-3 Books with details as per given example)

1. A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Agarwal

2. Reasoning verbal and non verbal by B. S. Sijwali.

Reference Books:(Min. 04 Books with details as per given example)

1 Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical)

2 Analytical Reasoning by MK Panday

3 Logical and analytical reasoning by k. Gupta

4 Multi dimensional reasoning by Mishra & Kumar dr. Lal

E- Books : (Min.02 Books details to be specified here)

https://themech.in/quantitative-aptitude-and-logical-reasoning-books/

https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html

E-learning Resources/MOOCs/ NPTEL Course Links: (Min. 03 course links to be specified here)

1. https://www.practiceaptitudetests.com/non-verbal-reasoning-tests/

2. https://www.educationquizzes.com/11-plus/non-verbal-reasoning/

3. https://www.livecareer.com/resume/examples/web-development/e-learning-developer

Intellectual Property Rights and Entrepreneurship Development (PR316)

Teaching Scheme
Lectures: 2 Hrs. / Week

Credits: 02

Examination Scheme
ESE: 30 Marks
CIA: 20 Marks
Total: 50 Marks

Prerequisite Course: NIL

Course Objectives:

1. To introduce the basic concepts of IPR
2. To teach patent and Design as an IPR
3. To teach copy right and trademark as an IPR
4. To make aware the selection type of IPR for appropriate inventions
5. To identify the Skill sets required to be an entrepreneur
6. To understand the Role of supporting agencies and Governmental initiatives to promote Entrepreneurship

Course Outcomes (COs): After the learning this course, the learners will be able to;

CO's	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
CO1	Interpret the need and importance of intellectual property rights.	2	Understand
CO2	Elaborate the process for Patent and Design registration	2	Understand
CO3	Explain the process for copy right and trademark registration	2	Understand
CO4	Select the IPR tool for protection of invention	3	Apply
CO5	Evaluating the Entrepreneurial abilities within an Individual.	5	Evaluate
CO6	Creating a Detailed Project Report with a due consideration to various supporting agencies and Governmental initiatives to promote Entrepreneurship.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1										3		2			
CO2										3		2			
CO3										3		2			
CO4										3		2			
CO5									2	3	3	3			
CO6									2	3	3	3			

Course Contents

Unit	**Contents**	No.of Hours	COs
1	**Introduction to IPR**	6 Hrs.	
	Introduction to Concept of Property, Types of Property, General Characteristics of Property Rights, Need of Intellectual property, Introduction to Intellectual Property, Philosophy of IPR, Different forms of Intellectual Property, IPR in India : Genesis and Development, International Organizational and Treaties, WIPO and its Role, International Treaties.		1
2	**Patent and Design**	6 Hrs	CO

	Definition of Patents, Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter, Anticipation, Registration Procedure, Time Frame and Cost, Rights and Duties of Patentee, International Protection, Commercialization, Infringement, Patent Databases, IP protection of Semiconductors and Integrated Circuits, Case studies What is a Design, Difference from Patent, how can Designs be protected, Procedure for Registration, Effect of Registration and Term of Protection, Non-Patentable Subject Matter, Infringement, Patenting biotechnological invention, Case studies		2
3	**Copyrights and Trademarks**	8Hrs.	C0
	Introduction to Copyright, what is covered by Copyright, How long does copyright last, Why Protect Copyright, Registration Procedure, Term of protection, Ownership of copyright, Related Rights - Distinction between related rights and copyrights, Infringement. Difference between copyrights and other IPRs, Case studies Introduction to Trademarks, Different kinds of marks: brand names, logos, signatures, symbols, well known marks, Non-Registrable Trademarks, Registration of Trademarks, Rights of holder and assignment and licensing of marks, Infringement., Introduction to Geographical Indications.		3
4	**Trade Secrets and IP Regime**	6Hrs.	C0
	What are trade secrets; how trade secrets are to be maintained; how trade secrets are used in trade and businesses, Case studies Need of IP Valuation, IPR as an Instrument of Development, Impact of Intellectual Property System on Economic Growth, Role of Intellectual Property in Technology Transfer, Introduction to Biopiarcy and popular cases, Career opportunities in IPR.		4
5	**Title of Unit-5 Entrepreneurship: Introduction**	6 Hrs.	C0
	Concept and Definitions: Entrepreneur & Entrepreneurship, Entrepreneurship and Economic Development, A Typology of Entrepreneurs. **5.2 Entrepreneurial Competencies:** The Entrepreneur's Role, Entrepreneurial Skills: creativity, problem solving, decision making, communication, leadership quality; Self-Analysis, Culture & values, Risk-taking ability, Technology knowhow. **Factor Affecting Entrepreneurial Growth:** Economic & Non-Economic Factors, EDP Programmes. **Steps in Entrepreneurial Process:** Deciding Developing Moving Managing Recognizing.		5
6	**Title of Unit-6 DPR & Various Support Systems for Entrepreneurship**	8 Hrs	CO
	6.1 Project Report Preparation:		

	Specimen Format of Project Report; Project Planning and Scheduling using PERT / CPM; Methods of Project Appraisal – Feasibility Study both Economic and Market Preparation projected financial statement. **6.2 Role of Support Institutions and Management of Small Business:** Director of Industries, DIC, SIDO, SIDBI, Small Industries Development Corporation (SIDC), SISI, NSIC, NISBUED, State Financial Corporation (SFC) EPC, ECGC. **6.3 Various Governmental Initiatives:** Make in India Start Up India Stand Up India Digital India Skill India **6.4 Case Studies of Successful Entrepreneurs**		6

Text Books

1. Watal, Jayashree " Intellectual Property Rights in The WTO And Developing Countries ", Oxford University Press.
2. R. Anita Rao & Bhanoji Rao, Intellectual Property Rights- A Primer, Eastern Book Co.
3. Shiv Sahai Singh, The Law of Intellectual Property Right, Eastern Book Co
4. Prabuddha Ganguli Intellectual property right – Unleashing the knowledge economy, , Tate McGraw Hill Publishing company ltd.

Reference Books and Acts

1. Subbaram N.R, " Handbook of Indian Patent Law and Practice, S. Viswanathan Printers and Publishers Pvt. Ltd.,1998
2. Indian Patent Act, 1970 (With recent Amendments)
3. The Design Act 2020 (With recent Amendments)
4. The trademarks Act 1999 (With recent Amendments)
5. Copy right act 1957 ((With recent Amendments)

CIA Activity

1. Students shall file on patent/Design/Copyright/Trademark- **15 marks**
2. Online EDP certification from Infosys- **05 marks**

Advanced Microcontroller and Embedded Systems Laboratory (EC317)

Teaching Scheme
Practical: 02 Hrs./ Week
Credits: 01

Examination Scheme
PR : 50 Marks
Total : 50 Marks

Prerequisite Course: Microcontroller fundamentals, Embedded C Programming

Course Objectives:

1. To develop skills for interfacing and programming the PIC18F microcontroller with real world input and output devices.
2. To create awareness about ARM7 hardware and software platforms available for interfacing the advanced peripherals

Course Outcomes (COs): After completion of the course the students will be able to,

CO	CO Statement	Bloom's Descriptor	
		Level	Descriptor
EC317.1	Interface the real world input and output devices with PIC18F microcontroller	3	Apply
EC317.2	Interface the advanced peripherals to ARM based microcontroller	3	Apply
EC317.3	Foster ability to design and implement embedded system as per specifications and need of an application.	6	Create

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC318.1	2	–	–	–	3	–	–	–	–	–	–	–	1	–
EC318.2	2	–	–	–	3	–	–	–	–	–	–	–	1	–
EC318.3	2	–	–	–	2	–	–	–	–	–	–	–	1	–

Practical Course Contents (Minimum 08 Experiments) :

Sr. No.	Title of Practical	COs
1	Interfacing of Push buttons, LEDs, Relay & Buzzer to PIC18F microcontroller.	EC317.1
2	Interfacing of LCD with PIC18F microcontroller.	EC317.1
3	Interfacing serial port with PC using PIC18F.	EC317.1
4	Interfacing DS1307 RTC chip with PIC18F using I2C protocol.	EC317.1
5	Interfacing DC Motor with PIC18F to generate PWM signal.	EC317.1
6	Interfacing of GLCD with LPC2148 to display image on it.	EC317.2
7	Interfacing of UART with LPC2148.	EC317.2
8	Interfacing GSM with LPC2148 for sending and receiving message and voice call.	EC317.2
9	Interfacing GPS with LPC2148 for finding current location latitude and longitude values.	EC317.2
10	Interfacing of built-in ADC of LPC2148 for displaying its values.	EC317.2
11	Interfacing EEPROM to LPC2148 using I2C protocol.	EC317.2
12	Case study of designing an embedded system	EC317.3

System Programming and Operating System Laboratory (EC318)

Teaching Scheme
Practical : 2Hrs/Week
Credits: 1

Examination Scheme
PR: 50 Marks
Total: 50 Marks

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Prerequisite Course: Basic knowledge of C Language

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Course Objectives:

1. To understand the use of system programming tools for the development of programs.
2. To explore the spectrum of the operating system and its various commands.

Course Outcomes (COs): After successfully completing the course students will be able to:

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
EC318.1	To get acquainted with design of various system programming tools for the development of programs.	2	Understand
EC318.2	To Summarize the basic concept of operating system and its various commands.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC318.1	3	2	2	2	3	----	---	----	----	-----	----	…..	---	2
EC318.2	3	2	2	2	3	----	---	----	----	-----	----	…….	----	2

Sr. No.	Title of Practical	Cos
1.	Study of Basic Linux Commands and shell script.	EC318.1
2.	Write C Program to implement Lexical Analyzer for the simple arithmetic operation which creates a uniform symbol table.	EC318.1
3.	Design and implementation of a PASSI of two pass macro preprocessors for pseudo machine code.	EC318.1
4.	Design and implementation of a PASSII of two pass macro preprocessors for pseudo machine code.	EC318.1
5.	Design and implementation of a PASS I of two pass assembler for pseudo machine code.	EC318.1
6.	Design and implementation of a PASS II of two pass assembler for pseudo machine code.	EC318.1
7.	Implementation of different Job scheduling algorithms: FCFS, SJF, PS.	EC318.2
8.	Implementation of page replacement algorithm: FIFO or LRU.	EC318.2
9.	Implement Bankers Algorithm for deadlock detection and avoidance.	EC318.2

10.	Study of System calls to list files and System call to process creation	EC318.2
11.	Detail case report on Raspbian OR Android Operating System	EC318.2
12.	Performance report on any one following development tool chain 1. TASM 2. MASM 3. TURBO 4. 8051 Microcontroller 5. PIC Microcontroller	EC318.2

Guidelines for Subject Teacher:

1. From the list of practicals only 8 Experiments should be performed.
2. Equal justification should be given to both parts of System programming and Operating system.

Guidelines for Subject Students

1. Do not delete any of the system files or folders
2. Do not change the settings in the BIOS setup
3. Do not play games on the PC
4. Turn off the PC when your experiment if over

Books:

Text Books:

1. Dhamdhere D. M., "Systems Programming and Operating Systems", 2nd Edition, Tata McGraw-Hill Publishing ISBN: 978-00-746-3083-9
2. J. J. Donovan, “Systems Programming”, 1st edition McGraw Hill, 1996, ISBN: 978-00-746-0482-3
3. Andrew S. Tanenbaum, “Modern Operating Systems”, 2nd or 3rd Edition, Pearson, PHI. ISBN:-978-01-360-0663-3

Reference Books:

Siberschatz A; Galvin P.B; Gagne G, “Operating System Concepts”, 2003, John Wiley Publication.

Stalling William, "Operating Systems", Pearson Education(PHI), 5th edition.

Adam Hoover, “System Programming with C and UNIX”, 1st edition, Pearson Education, ISBN: 978-01-360-6712-2.

Leland L. Beck, “System Software”, 3rd edition, Pearson Editions. ISBN: 978-81-317-6460-2

PEC Laboratory : Autonomous Vehicle (EC319A)

Teaching Scheme

Practical: 02 Hrs./ Week
Credits: 01

Examination Scheme

OR : 50 Marks
Total : 50 Marks

Prerequisite Course: The students should be conversant with sensors, transducers, measurement techniques, batteries and IoT

Course Objectives:

1. Introduce the fundamental aspects of Autonomous Vehicles.
2. Gain Knowledge about the Sensing Technology and Algorithms applied in Autonomous vehicles.
3. Understand the Connectivity Aspects and the issues involved in driverless cars

1.**Course Outcomes:** After completion of the course the students will be able to,

Course Outcomes	Statement	Bloom's Descriptor	
		Level	Descriptor
EC319A.1	Design and implement measurements system in automobiles using various sensors and transducers.	3	Apply
EC319A.2	Develop automated systems for safety of passengers and vehicles	3	Apply
EC319A.3	Implement different standards and protocols for automobile automation.	3	Apply
EC319A.4	Identify designing required for electric vehicle charging.	3	Apply
EC319A.5	Design and develop IoT automation for vehicle manoeuvrability and accident avoidance.	3	Apply

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC319A.1	3	3	–	–	3	–	–	–	2	–	–	3	–	–
EC319A.2	3	2	–	–	3	–	–	–	2	–	–	3	–	–
EC319A.3	3	3	–	–	3	–	–	–	2	–	–	3	–	–
EC319A.4	3	3	—	—	3	–	–	–	—	–	–	3	–	–
EC319A.5	3	3	–	—	3	–	–	—	—	–	–	3	–	–

Practical Course Contents (Minimum 08 Experiments) :

Sr. No.	Title of Practical	COs
1	Study of sensor interface and DAQ in Electronic Control Unit (EC	EC319A.1
2	Study of pre-collision system in vehicle	EC319A.2
3	Study of power trains in electric vehicles	EC319A.2

4	Study and implementation of Controller Area Network (CAN) in ECU	EC319A.2
5	Design of wireless charging and Vehicle to vehicle (V2V) charging for Electric vehicles	EC319A.1
6	Study of Vehicle to pedestrians (V2P) communications for safety	EC319A.2
7	Measurement of vehicle performance parameter –Fuel Economy	EC319A.2
8	Design of Battery Equalizers for electric vehicles	EC319A.4
9	Study of specification of the electrical vehicle for driving cycle and range requirements	EC319A.2
10	Study of Indian Standards (IS) and Automotive Industry standards (AIS)	EC319A.2
	Text Books:	
	1. Hong Cheng, "Autonomous Intelligent Vehicles: Theory, Algorithms and Implementation", Springer, 2011. 2. Williams. B. Ribbens: "Understanding Automotive Electronics", 7th Edition, Elsevier Inc, 2012.	
	Reference Books:	
	1. Shaoshan Liu, Liyun Li, "Creating Autonomous Vehicle Systems", Morgan and Claypool Publishers, 2017. 2. Marcus Maurer, J.ChristianGerdes, "Autonomous Driving: Technical, Legal and Social Aspects" Springer, 2016. 3.Ronald.K.Jurgen, "Autonomous Vehicles for Safer Driving", SAE International, 2013. 4.James Anderson, KalraNidhi, Karlyn Stanly, "Autonomous Vehicle Technology: A Guide for Policymakers", Rand Co, 2014. 5. Lawrence. D. Burns, ChrostopherShulgan, "Autonomy – The quest to build the driverless car and how it will reshape our world", Harper Collins Publishers, 2018	

Students are expected to perform minimum eight experiments.

Power Electronics and Drives Laboratory (EC319B)

Teaching Scheme
Practical: 2 Hrs. / Week
Credits: 1

Examination Scheme
OR : 50 Marks
Total: 50 Marks

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Prerequisite Course: Semiconductor Devices basics, Electric Motors basics

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Course Objectives:

1. To introduce students to different power devices to study their construction, characteristics and turning on circuits.
2. To give an exposure to students of working & analysis of controlled rectifiers for different loads. .
3. To study DC choppers, AC voltage controllers and SMPS.
4. To study Inverters and its performance parameters.
5. To evaluate performance of DC and AC Drives and excitation techniques

Course Outcomes (COs): After successful completion of the course, student should be able to:

Course Outcomes	Course Outcome(s)Statement	Bloom's Taxonomy	
		Level	Descriptor
EC319B.1	Describe operation and performance of power semiconductor devices, SCR, MOSFET and IGBT.	2	Understand
EC319B.2	Explain the characteristics of a half and full controlled converter.	3	Apply
EC319B.3	Select suitable power converter to control electric motors	4	Analyze
EC319B.4	Demonstrate IGBT based single phase and three phase inverters.	3	Apply
EC319B.5	Illustrate the performance of DC & AC drives.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC319B.1	3	----	1	2	--	--	--	--	--	--	--	-	--	--
EC319B.2	3	----	1	3	3	--	--	--	--	--	--	-	--	--
EC319B.3	3	----	1	2	2	--	--	--	--	--	--	-	--	--
EC319B.4	3	----	1	2	2	--	--	--	--	--	--	--	--	--
EC319B.5	2	----	1	2	3	--	--	--	--	--	--	-	--	--

Practical Contents

Sr. No	Name of the Experiment	COs
1	Study of characteristics of SCR.	EC319B.1
2	Study of Power MOSFET characteristics	EC319B.1
3	Triggering Circuit for SCR using IC TCA 785.	EC319B.1
4	Single phase Fully/Semi controlled converter for R & RL load.	EC319B.2
5	Simulation of single phase PWM bridge inverter.	EC319B.2
6	MOSFET/IGBT based Step down DC chopper.	EC319B.3
7	Speed control of DC motor using AC to DC controlled converter.	EC319B.4

8	Simulation of power electronic conversion system (DC-AC/DC-DC), with suitable load.	EC319B.4
9	Modeling and simulation of Chopper fed DC drive	EC319B.5
10	Modeling and simulation of Cyclo-converter fed AC drive	EC319B.5

Note: Any 8 experiments to be conducted in laboratory

Text Books:

1. M. H. Rashid, Power Electronics circuits devices and applications‖, PHI New Delhi, 3rd edition, 2004.
2. P.C. Sen., Modern Power Electronics, 2nd edition, S.Chand & Co.
3. Bimal.K. Bose, "Power Electronics and Variable frequency drives", Standard Publishers Distributors, New Delhi, 2000

Reference Books:

1. Ned Mohan, Robbins, "Power electronics", 3rd edition, John Wiley and sons.
2. M. S. Jamil Asghar, "Power Electronics", PHI New Delhi, 2004
3. V.R.Moorthi, "Power Electronics", Oxford University Press.
4. P. S. Bimbhra, "Power Electronics", Khanna Publishers, New Delhi.
5. R. Krishnan, "Electric motor drives: modeling, analysis and control" Pearson.

E Resources:

https://powersimtech.com/
https://www.mathworks.com/solutions/electrification/power-electronics-simulation.html

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Software Testing & Quality Assurance Laboratory(EC319C)

Teaching Scheme
Practical: 2 Hrs. / Week
Credits: 1

Examination Scheme
OR : 50 Marks
Total: 50 Marks

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Prerequisite Course: Software Engineering and Design

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Course Objectives :

1. To design test cases for given applications.
2. To prepare a test plan for given applications.
3. To prepare a defect report of an application.
4. To use automated test tools for testing of software.

Course Outcomes (COs): After successful completion of the laboratory, student will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC319C.1	Design and run test cases for given applications.	4	Analyze
EC319C.2	Prepare test plan for an application	3	Apply
EC319C.3	Identify bugs and prepare defect reports of given applications.	4	Analyze

EC319C.4	Test software for performance measures using automated testing tools.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC319C.1	3	3	-	3	3	-	1	3	-	-	-	2	1	1
EC319C.2	2	1	-	2	2	-	1	3	3	3	2	-	1	1
EC319C.3	2	2	-	3	3	-	1	3	-	3	2	-	1	1
EC319C.4	3	-	-	-	3	-	1	3	-	-	-	-	-	-

Practical Course Contents

Sr. No	Title of Practical	COs
1.	Identify system specifications and design test cases for purchase order management system/inventory management	EC319C.1
2.	Design test cases for simple calculator application(BB Testing)	EC319C.1
3	Design test cases for railway reservation form/e-commerce (Amazon/flip Kart)login form	EC319C.1
4	Design test cases for web pages testing of any web site	EC319C.1
5	Write program and design test cases for following control & decision statements 1. for loop 2. Do while 3. if else 4. switch case	EC319C.1
6	Prepare a test plan for an identified mobile application.	EC319C.2
7	Design test plan and test cases for Notepad(MS window based)application.	EC319C.2
8	Prepare defect report after executing test cases for library management system/withdrawal of amount from ATM/any login form.	EC319C.3
9	Design and run test cases for web based applications using an automated tool-Selenium.	EC319C.1, EC319C.4

Text Books:

1: Ron Patton," Software Testing", Pearson Educations, ISBN-978-0-672-32798-8.
2: M. G. Limaye," Software Testing Principles, Techniques and Tools", Tata McGraw Hill,ISBN-978-0070-139909 00-7013990-3
3:A.B. Mathur, "Fundamental of software Testing", Pearson. ISBN: 9788131794760

Reference Books:

1: Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing principles and Practices", Pearson. ISBN-97881-7758-1218
2: Naresh Chauhan, "Software Testing Principles and Practices ", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847.
3: Stephen Kan, "Metrics and Models in Software Quality Engineering", Pearson, ISBN-10:0133988082; ISBN-13: \ \ 978-0133988086

e-Resources:
https://www.selenium.dev/
https://www.tranzact.com/

	EC 320 Creational Activities	
Teaching Scheme		**Examination Scheme**
Practical: 02 Hrs. / Week		**Termwork: 50 Marks**
Credits: 1		**Total: 50 Marks**

Prerequisite Course: —Mini Project Based Learning

Course Objectives:

1. To encourage students to be member of professional bodies/clubs/chapters.
2. To enhance mini project developed by students in the view of product development.
3. To validate and test enhanced mini project.
4. To motivate students for participation and interaction in extra-curricular or co- curricular activities.

Course Outcomes (COs): On completion of the course, student will be able to–

CO No.	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
CO1	**Understand** working of professional bodies and participate in events organized by such bodies.	2	Understand
CO2	**Analyse** implemented code and create working product.	4	Analyse
CO3	**Apply** different testing methods and tools.	3	Apply
CO4	**Apply** their knowledge to participate in extra-curricular or co-curricular activities.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	—	—	—	2	—	2	2	—	—	1	—	2
CO2	3	2	—	—	—	—	—	—	—	—	—	2	2	—
CO3	3	2	—	—	—	—	—	—	—	—	—	—	2	—
CO4	1	2	2	—	—	3	—	2	2	—	—	2	—	2

Subject Description:

- The course will acquaint students with a variety of technical activities and skills which help to develop their employability skills required for placement. The course will focus on skill and personality development of students.
- Course is divided in two categories i.e compulsory activities and elective activities organized in different buckets. From elective activities student has to select one bucket.
- Groups of students will be same as Semester-V Mini Project groups.

Guidelines

1. Membership of Professional body (ex. CSI,IEEE etc) or Member of Coding groups like geeks for geeks and participation in at least one event organized by respective body.
2. Completion of project in view of product development.
3. Testing of Mini Project performed in SEM-V (Test cases with sufficient data set).

I] Group of students have to select one Bucket from Following

Bucket 1: Certification

Standard certification like salesforce, NPTEL, Coursera, AWS, SAP, any other certification or international certification which help to develop their employability skills required for placement.

Bucket 2: Publication

Publication of paper in reputed journal in association with expert faculty. OR

Presentation and Publication in National or International conference.

Bucket 3: Achievement

State /National level winner in extra-curricular or co- curricular activities, which includes Sports, Arts, Coding or Hackathon Competition, Idea or Innovation.

Bucket 4: Product Development and Projects

End product development and Patent
OR

Winner in State or National project competition. OR

Project Presented at National Level competition.

Bucket 5: Any other domain chosen by student in consult with faculty member.

Mandatory Course VI :- Electronic Waste Management (MC321)

Teaching Scheme **Examination Scheme**

Lectures: 1 Hrs. / Week

Credits: 0

Prerequisites: Guidelines on Implementation of E-Waste (Management) Rules, 2016

Course Objectives:

1. To Introduce the concept of solid waste handling
2. To get an understanding of different solid waste collection systems.
3. To learn various waste treatment methods
4. To get an understanding of e-waste control measures
5. To highlight the e-waste hazards on global trade.
6. To get introduce various e-waste legislation

Course Outcomes (COs): After completion of course students will able to

COs	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
MC321.1	List various characteristics of solid wastes	1	Remember
MC321.2	Name different systems for collections of solid wastes	1	Remember
MC321.3	Compare among different treatment methods for waste materials	2	Understand
MC321.4	Summarize different kinds of e-wastes	2	Understand
MC321.5	Explain essential factors in global waste trade economy	2	Understand
MC321.6	List different legislation on e-waste management and handling	1	Remember

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
MC321.1	2	-	-	-	-	3	3	-	-	-	-	-	-	-
MC321.2	2	-	-	-	-	3	3	-	-	-	-	-	-	-
MC321.3	2	-	-	-	-	-	3	-	-	-	-	-	-	-
MC321.4	2	-	-	-	-	2	3	-	-	-	-	2	-	-
MC321.5	2	-	-	-	-	2	2	-	-	-	-	-	-	-
MC321.6	2	-	-	-		3	-	-	-	-	-	2	-	-

Course Contents

Unit-I	**Introduction To Solid Wastes**	No. of Hours	COs
	Definition of solid wastes, Sources, classification and characteristics of solid wastes, Municipal Solid Waste (Management and Handling) Rules,	4	MC322.1
Unit-II	**Collection Of Solid Waste:**	No. of Hours	COs
	Systems of collection of solid wastes, transfer stations, collection equipment's, route optimization techniques and numerical problems on route optimization. Processing techniques of solid wastes (principle of operation and function only).	4	MC322.2

Unit-III	**Treatment Method**	No. of Hours	COs
	Autoclave, Hydroclave, Microwave, Chemical Disinfection, Solidification and stabilization, Bio-remediation, Thermal Conversion Technologies, accumulation and storage of hazardous waste, land disposal of hazardous waste, other treatment and disposal method.Common Hazardous Waste Treatment facilities (TSDF).	4	MC322.3
Unit-IV	**E-Waste Control Measures**	No. of Hours	Cos
	Need for stringent health safeguards and environmental protection laws in India, Extended Producers Responsibility (EPR), Import of e-waste permissions, Producer-Public-Government cooperation, Administrative Controls & Engineering controls, monitoring of compliance of Rules, Effective regulatory mechanism strengthened by manpower and technical expertise, Reduction of waste at source.	4	MC322.4
Unit-V	**E-waste hazardous on Global trade**	No. of Hours	Cos
	Essential factors in global waste trade economy, Waste trading as a quint essential part of electronic recycling, Free trade agreements as a means of waste trading. Import of hazardous e-waste in India; India's stand on liberalizing import rules, E-waste economy in the organized and unorganized sector. Estimation and recycling of e-waste in metro cities of India.	4	MC322.5
Unit-VI	**E- waste legislation**	No. of Hours	
	E-waste (Management and Handling) Rules, 2011; and E-Waste (Management) Rules, 2016 - Salient Features and its likely implication. Government assistance for TSDFs. The international legislation: The Basel Convention; The Bamako Convention. The Rotterdam Convention. Waste Electrical and Electronic Equipment (WEEE) Directive in the European Union, Restrictions of Hazardous Substances (RoHS) Directive	4	MC322.6

Text Book(s)

1. George Tchobanoglous et.al., "Integrated Solid Waste Management", Mc-Graw-Hill, Inc. New York, 1993.
2. Howard S.Peavy et.al., "Environmental Engineering", Mc-Graw-Hill Book Company, New York, 1985.

References Books

1. Besselviere, E and Schwartz,"Treatment of Industrial Wastes",. McGraw Hill. 1975.
2. F Dougal and P WhiteIntegrated "Solid waste Management", John Wiley and Sons, 2001.
3 A.D. Bhide and B.B.Sudareshan, "Solid Waste management in Developingountries", NEERI, Nagpur 1983 .

Guidelines: Industrial Visit to e-waste treatment plant will be organized once in the semester and report for the same will be prepared

ABAP Workbench Fundamentals Part - II (EC8203)

Teaching Scheme
Lectures: 04 Hrs./ Week
Credits: 04

Examination Scheme
ISE : 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course: - Business Management

Course Objectives:

1. To study the ABAP dictionary.
2. To perform various operations on SAP database tables.
3. To learn SAP dictionary object and views.
4. To study screen programming and user interfaces.
5. To learn ABAP language programming.
6. To study ABAP List Viewer.

Course Outcomes (COs): After completion of the course the students will be able to,

CO	CO Statement	Bloom's Descriptor	
		Level	Descriptor
EC8203.1	Describe the ABAP dictionary	2	Understand
EC8203.2	Implement various operations on SAP database tables	3	Apply
EC8203.3	Explain the dictionary Object and different Views	2	Understand
EC8203.4	Illustrate screen programming and ABAP user interfaces	3	Apply
EC8203.5	Demonstrate the use of ABAP programming on internal tables	3	Apply
EC8203.6	Discuss ABAP List Viewer	2	Understand

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC8203.1	2	-	-	-	2	-	-	-	-	-	-	-	-	-
EC8203.2	2	-	-	-	2	-	-	-	-	-	-	-	-	-
EC8203.3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
EC8203.4	2	-	-	-	2	-	-	-	-	-	-	-	-	-
EC8203.5	2	-	-	-	2	-	-	-	-	-	-	-	-	-
EC8203.6	2	-	-	-	-	-	-	-	-	-	-	-	-	-

Course Contents

Unit-I	ABAP Dictionary	No. of Hrs	Cos
	Describing the ABAP Dictionary, Database Object, Type Definition. Creating Domain and Data Elements, Flat Structures, Creating Table Types and Deep Structure, Creating Type Groups.	06	EC8203.1
Unit-II	**SAP Database Tables**	**No. of Hrs**	**Cos**

	Creating Transparent Table, Defining Cluster Tables and Pooled Table, Creating Database Table Indexes, Setting up Table Buffering. Creating Fixed Values, Defining Foreign Keys to Perform Input Checks, Creating Text Tables.	06	EC8203.2
Unit-III	**Dictionary Object and Views**	**No. of Hrs**	**Cos**
	Differentiate Active and Inactive Dictionary Object, Dependencies with ABAP Dictionary Objects, table Conversion, Enhancing Table using Append Structures, Creating Database Views, Maintenance Views, and View Clusters. Creating Search helps, Applying Advanced Search Help Techniques, Implementing a Selection Screen, Multiple Selection Screens, Input Checks and Creating Variants.	06	EC8203.3
Unit-IV	**Screen Programming and User Interfaces**	**No. of Hrs**	**Cos**
	Dialog Programming Model, Screen Programming, Creating Screens and Screen Elements, Modifying Screens at Runtime, Designing Screen Sequence, Calling a Dialog Box Dynamically. User Interfaces, Setting a GUI Title and a GUI Status. Creating Screen Elements for Output, Input/Output Fields, Checkboxes and Radio Button Groups, Creating Pushbuttons.	06	EC8203.4
Unit-V	**ABAP Details-I**	**No. of Hrs**	**Cos**
	ABAP language foundation: using ABAP data types & data objects, predefined ABAP types, data object categorization, visibility of objects in procedural and object-oriented ABAP. Statements, Functions and Expressions for Simple Data, Internal Tables, ABAP Open SQL, Database update with ABAP Open SQL, Database change Bundling.	06	EC8203.5
Unit-VI	**ABAP Details-II**	**No. of Hrs**	**Cos**
	SAP Locking, Organization of Database Updates, LUWs across multiple programs, SAP List Viewer (ALV) creation, ALV design, ALV events and methods.	06	EC8203.6

Text Books:

1. Kogent Learning Solutions Inc., “SAP ABAP/4 (Covers SAP ECC 6.0) Black Book”, Dreamtech Press, 2009th edition, ISBN : 978-8177224290.
2. Sudipta Malakar “SAP/ABAP/ HANA Programming”, BPB Publication, ISBN :978-9387284289.

Reference Books:

1. Paweł Grześkowiak, “Mastering SAP ABAP: A complete guide to developing fast, durable, and maintainable ABAP programs in SAP”, Packt Publishing Limited, ISBN:978-1787288942.

e- Resources:

1. https://www.sap.com/india/
2. https://www.udemy.com/course/sap-abap-programming-for-beginners/

CIA:-

1. MCQ Test on Each Unit
2. Assignment on each Unit
3. Prepare Reports using SAP platform

Embedded system hardware and software design (EC8102)

Teaching Scheme	Examination Scheme
Lectures: 4 Hrs. / Week	In-Sem Exam: 30 Marks
	End-Sem Exam: 50 Marks
Credits: 4	CIA: 20 Marks
	Total: 100 Marks

Prerequisite:- Basics of Microcontroller and Embedded C Programming

Course Objectives:

1. To create awareness about different hardware platforms available for embedded system design along with list of features and selection criteria.
2. To create awareness about different software platforms available for real-time and non-real-time embedded system design along with list of features and selection criteria.

Course Outcomes (COs): After successful completion of the course, student will be able to

COs	Course Outcome Statement	Bloom's Taxonomy	
		Level	Descriptor
EC8102.1	Identify design aspects of embedded system	2	Understand
EC8102.2	Utilize capabilities of modern hardware in designing embedded systems	3	Apply
EC8102.3	Foster step by step design process of embedded systems for specified application using waterfall model.	3	Apply
EC8102.4	Explain the structure and working of real-time operating systems (RTOS).	4	Analyse
EC8102.5	Use embedded Linux for developing embedded system products	3	Apply
EC8102.6	Design embedded systems for different application by using waterfall model.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC8102.1	1	2	1	-	2	-	-	-	-	-	-	-	1	-
EC8102.2	-	-	-	-	3	-	-	-	-	-	-	-	3	-
EC8102.3	-	3	3	-	3	-	-	-	-	-	-	-	1	-
EC8102.4	-	-	-	-	3	-	-	-	-	-	-	-	3	-
EC8102.5	-	-	-	-	3	-	-	-	-	-	-	-	3	-
EC8102.6	-	2	3	-	-	-	-	-	-	-	-	-	1	-

COURSE CONTENT

Unit-I	**Basics of Embedded Systems**	No. of Hours	COs
	Introduction to Embedded Systems, Applications and recent trends, Definition, Block diagram, Embedded system Architecture, Hardware and software Architecture of embedded System, Characteristics, classification, Key Design challenges, Design Metrics, Optimization of Design metrics, Design constraints.	6	EC8102.1

	Techno-Economical prospective of embedded system,		
Unit-II	**Recent trends in Embedded System Hardware**		
	Embedded processor technology **IC technology** **Design technology** Microcontroller selection criteria, Introduction to advanced microcontroller, ARM family of microcontroller, Generalized block diagram of ARM Processor, Concept and working principle of multi core processors, SoC.	7	EC8102.2
Unit-III	**Embedded Technology and development cycle**		
	Embedded System Development Cycle: Requirement engineering, requirement Specification, Hardware-Software Partitioning, Hardware Software co-design, Integration, Testing, Quality Assurance, Maintenance, and Electronics Waste Management.	5	EC8102.3
Unit-IV	**µCOS-II Real Time Operating System**		
	Concept and necessity of RTOS, Types of RTOS, Features, Architecture, File structure of µCOS-II, Concept of Task, Clock tick, Assign static and dynamic priority to the tasks, concept and Types of kernel services:- System Services, application of multitasking, Task management Services, Time management services, Shared resources/critical section of code and related issues, Concept of deadlock, Protection mechanisms, IPC mechanisms.	7	EC8102.4
Unit-V	**Basics of Embedded Linux**		
	Use of Embedded Linux in embedded application development, Embedded Linux development setup, Development tool chain insights (GNU), Minicomp, **Different components of Embedded Linux:** Bootloader, Kernel, File System, Device Drivers, application program. Survey of different applications empowered with Embedded Linux Operating System	7	EC8102.5
Unit-VI	**Case study of Embedded System Design**		
	Mobile Phone /smart phone, Home automation, Self driving cars, Voice operated devices like Amazon Echo Dot-Alexa, Google home mini. Google Glass.	5	EC8102.6

Text Books:

1. Frank Vahid, Tony Givargis, “Embedded System Design: A Unified Hardware/Software Introduction”, Wiley-India,(2009) ISBN:- 978-81-265-0837-2.
2. Andrew Sloss, “ARM System Developer's Guide: Designing and Optimizing System Software”, Morgan Kaufmann, 2004, ISBN: 978-15-586-0874-0
3. Jean J. Labrosse, “MicroC/OS-II: The Real Time Kernel”, CRC Press; 2nd edition, 2002, ISBN: 978-15-782-0103-7
4. Christopher Hallinan, “Embedded Linux Primer: A Practical Real-World Approach”, 2nd edition, Prentice Hall; 2 edition, 2010, Pearson Open Source Software Development Series,

Reference Books:

1. David E. Simon, “An Embedded Software Primer”, Addison Wesley; 2nd edition, ISBN: 978-02-016-1569-2
2. Dr. K. V. K. K. Prasad, “Embedded Real Time Systems: Concepts, Design and Programming”, Dreamtech Press, 2003 ISBN: 978-81-772-2461-0
3. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, Tata McGraw-Hill Education (India), 2011.

Online Resources:

1. https://www.micrium.com/rtos/kernels/
2. NPTEL Course on RTOS https://nptel.ac.in/courses/106/105/106105172/
3. NPTEL Course on Embedded system design using ARM https://nptel.ac.in/courses/106/105/106105193/
4. Coursera course https://www.coursera.org/specializations/real-time-embedded-systems

CIA Activity

Sr. No	Title	Marks	Schedule	COs
1.	MCQ Test Unit 1	10	After completion of unit I	EC8102.1
2.	MCQ Test Unit 2	10	After completion of unit II	EC8102.2
3.	MCQ Test Unit 3	10	After completion of unit III	EC8102.3
4.	MCQ Test Unit 4	10	After completion of unit IV	EC8102.4
5.	MCQ Test Unit 5	10	After completion of unit V	EC8102.5
6.	MCQ Test Unit 6	10	After completion of unit VI	EC8102.6
7.	Perform survey of different processors used in recent smart phones. Prepare the detailed consolidated report.	20	Semester start to INSEM	EC8102.2
8.	Develop any application using µCOS-II OS justifying need of RTOS. OR Develop any application using Embedded Linux OS exploring capabilities of the same.	20	INSEM to semester end	EC8102.4 EC8102.4 EC8102.5 EC8102.6

Embedded system hardware and software design Laboratory (EC8103)

Teaching Scheme		Examination Scheme		
Practical:	**02 Hrs./ Week**	**PR**	**:**	**50 Marks**
Credits: 01		**Total**	**:**	**50 Marks**

Prerequisite:- Basics of Microcontroller and Embedded C Programming

Course Objectives:

1. To create awareness about different hardware platforms available for embedded system design along with list of features and selection criteria.
2. To create awareness about different software platforms available for real-time and non-real-time embedded system design along with list of features and selection criteria.

Course Outcomes (COs): After successful completion of the course, student will be able to

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
EC8103.1	Acquire a basic knowledge about different hardware tools used for designing embedded system	2	Understand
EC8103.2	Acquire a basic knowledge about different software tools used for designing embedded system	2	Understand
EC8103.3	Asses embedded Operating System's behaviour and performance under different circumstances.	5	Evaluate
EC8103.4	Foster ability to design and implement embedded system as per specifications	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC8103.1	1	-	-	-	3	-	-	-	-	-	-	1	1	-
EC8103.2	1	-	-	-	3	-	-	-	-	-	-	1	1	-
EC8103.3	2	1	-	-	-	-	-	-	-	-	-	-	2	-
EC8103.4	3	2	2	1	-	-	-	-	2	-	-	-	3	-

Course Contents

Experiment. No	**Title**	COs
1.	Program Arduino Uno board to perform different operations on GPIO using Arduino IDE tool.	EC8103.1 EC8103.2
2.	Case study of Temperature control application on Arduino Uno board	EC8103.2
3.	Porting of µCOS-II on ARM7 controller.	EC8103.1 EC8103.2
4.	Implementation of multitasking with µCOS-II on ARM7 microcontroller for three tasks.	EC8103.3

5.	Porting of Embedded Linux components Bootloader, Kernel and File System on ARM 9 board.	EC8103.3
6.	Writing simple application using Embedded Linux on ARM9 board.	EC8103.4
7.	Design any one embedded system from Unit 6.	EC8103.4
8.	Implement any one embedded system from Unit 6.	EC8103.4

Important guidelines

1. All experiments are compulsory
2. Students should prepare the brief document elaborating aim, objectives, apparatus, equipment, theory, observation table, circuit diagram, block diagram, calculations, result, graph, conclusion etc. whichever is applicable.
3. Software Platform to be used:- Experiment 1 & 2 on Arduino IDE, Experiment 3 & 4 on Keil Software, Experiment 5 on Linux Platform. Experiment 7 & 8 will be proposed by student.
4. Hardware Platform to be used:- Experiment 1 & 2 on Arduino Uno Board, Experiment 3 & 4 on ARM 7 development board, Experiment 5 on ARM9 Prototyping Board. Experiment 7 & 8 will be selected by student.
5. Assessment of each experiment is strictly as per rubric defined and communicated with the students in the start of semester.
6. Timely submission of experiment write-up is highly recommended

Text Books:

1. Massimo Banzi, “Make Getting Started With Arduino” 3rd edition, 2009, Publisher O’Reilly Media, Inc. ISBN: 9780596155513
2. Jean J. Labrosse, “MicroC/OS-II: The Real Time Kernel”, CRC Press; 2nd edition, 2002, ISBN: 978-15-782-0103-7
3. Christopher Hallinan, “Embedded Linux Primer: A Practical Real-World Approach”, 2nd edition, Prentice Hall; 2 edition, 2010, Pearson Open Source Software Development Series,

Reference Books:

1. Andrew Sloss, “ARM System Developer's Guide: Designing and Optimizing System Software”, Morgan Kaufmann, 2004, ISBN: 978-15-586-0874-0
2. David E. Simon, “An Embedded Software Primer”, Addison Wesley; 2nd edition, ISBN: 978-02-016-1569-2
3. Raj Kamal, “Embedded Systems: Architecture, Programming and Design”, Tata McGraw-Hill Education (India), 2011.
4. Dr. K. V. K. K. Prasad, “Embedded Real Time Systems: Concepts, Design and Programming”, Dreamtech Press, 2003 ISBN: 978-81-772-2461-0

Online Resources:

1. https://www.micrium.com/rtos/kernels/
2. https://www.arduino.cc/
3. https://www.ti.com/lit/ds/symlink/lm35.pdf

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

B.Tech. Electronics and Computer Engineering

2020 Pattern

Proposed Program Structure

(B.Tech. with effect from Academic Year 2020-2021)

(B. Tech. Sem-VII with effect from Academic Year 2023-2024)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

DECLARATION

We, the Board of Studies in Electronics and Computer Engineering, hereby declare that, We have designed the Curriculum up to B. Tech. Semester-VII of 2020 Pattern w.e.f A.Y 2023-2024 as per the guidelines. This document also contains the proposed structure Electronics and Computer Engineering. So, we are pleased to submit and publish this FINAL copy of the curriculum for the information of all the concerned stakeholders.

Recommended by

(Dr. B. S. Agarkar)
Chairman
BoS Electronics and Computer Engineering

Approved by

(Dr. A. G. Thakur)
Chairman
Academic Council
SRES Sanjivani College of Engineering, Kopargaon

Vision of the Institute

To Develop World Class Professionals through Quality Education.

Mission of the Institute

To create Academic Excellence in the field of Engineering and Management through Education, Training and Research to improve quality of life of people.

Vision of the Department

To produce quality professionals in the field of Electronics and Computer Engineering with knowledge and skill sets to meet diversifying needs of industry and society.

Mission of the Department

M1- To impart the technology of Electronics and Computer Engineering through an effective teaching-learning process.
M2- To establish linkages between industry and academia for overall development of students.
M3- To promote innovative ideas in solving multi-disciplinary engineering problems having social relevance.
M4- To develop technical human resources exhibiting professional and ethical attitudes.

Program Educational Objectives (PEOs)

PEO1: Involve in design, manufacturing, integration and testing of products, software and systems in the field of Electronics & Computer engineering and allied disciplines.

PEO2: Solve engineering problems having social relevance by applying knowledge and skill sets related to Electronics and Computer engineering.

PEO3: Pursue higher Education/Research in the field of Engineering/Management or become a successful entrepreneur in the related areas.

PEO4: Work effectively as an individual and/or a team member of multi-disciplinary assignments involving people across different cultures and national boundaries.

Program Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **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.

4. **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.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **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.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **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.

Program Specific Outcomes (PSOs)

On successful completion of the program, the graduates will be able to:

PSO1: Specify, Design, Test and Implement electronic systems related to Signal Processing, Networking, Embedded architectures and IoT using state of the art components and software.

PSO2: Provide software solutions for engineering problems by applying knowledge of Data Structures, Algorithms, Database Management, Web Technology, Big Data and Cloud Computing.

List of Abbreviations			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
BSC	Basic Science Course	OEC	Open Elective Course
CIA	Continuous Internal Assessment	OR	End-Semester Oral Examination
EFC	Engineering Foundation Course	P	Practical
ESE	End-Semester Evaluation	PCC	Professional Core Course
HSMC	Humanities/Social Sciences/Management Course	PEC	Professional Elective Course
IP	Induction Program	PR	End-Semester Practical Examination
ISE	In-Semester Evaluation	PROJ	Project
L	Lecture	T	Tutorial
MLC	Mandatory Learning Course	TW	Continuous Term Work Evaluation

Final Year B. TECH. 2020 Pattern (Electronics and Computer Engineering)

SEMESTER-VII

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks						
							Theory						
Cat	Code	Title	L	T	P	Credits	CIA	ISE	ESE	OR	PR	TW	Total
PCC	EC401	Big Data & Cloud Computing	3	-	-	3	20	30	50	-	-	-	100
PCC	EC402	IoT & WSN	3	-	-	3	20	30	50	-	-	-	100
PCC	EC403	Computer Networks and Security	3	-	-	3	20	30	50	-			100
PEC	EC404	Refer List of PEC3	4	-	-	4	20	30	50	-	-	-	100
PEC	EC405	Refer List of PEC4	3	-	-	3	20	30	50	-	-	-	100
LC	EC406	Big Data & Cloud Computing Laboratory	-	-	2	1	-		-	50	-	-	50
LC	EC407	IoT & WSN Laboratory	-	-	2	1	-		-	-	50	-	50
LC	EC408	Computer Networks and Security Laboratory	-	-	2	1	-		-	-	50	-	50
PROJ	EC409	Project Stage-I	-	-	6	3	-		-	50	-	100	150
MC	MC410	Mandatory Course-VII :	1	-	-	Non Credit	-		-	-	-	-	Pass/ Fail
		Total	17	-	12	22	100	150	250	100	100	100	800

SEMESTER-VIII

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks					
							Theory					
Cat	Code	Title	L	T	P	Credits	CIA	ESE	OR	PR	TW	Total
OEC	EC411	OE-I:	3	-	-	3	25	75	-	-	-	100
OEC	EC412	OE-II:	3	-	-	3	25	75	-	-	-	100
OEC	EC413	OE-III :	2	-	-	2	25	75	-	-	-	100
PROJ	EC414	Industrial Internship	-	-	12	6	-	-	50	-	100	50
PROJ	EC415	Project Stage-II	-	-	4	2	-	-	50	-	-	150
		Total	8	-	16	16	75	225	100	-	100	700

Professional Elective Course 2 (PEC3):		Professional Elective Course 4 (PEC4):	
EC404A	Communication I	EC405A	Communication II
EC404B	Image Processing and Pattern Recognition	EC405B	Block Chain
EC404C	Distributed Systems	EC405C	Data Mining

Total Credits: 38 **Total Marks: 1300**

Big data and Cloud Computing(EC401)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite:

Database Management Systems and SQL(EC303),Computer Organization and Architecture(EC204)

Course Objectives:

1. To understand Big data primitives and fundamentals.
2. To understand different Big data processing techniques.
3. To get familiar with Distributed Computing with Spark.
4. To learn the fundamentals and essentials of cloud computing
5. To learn basics of virtualization and its importance
6. To get familiar with recent trends in cloud computing.

Course Outcomes (COs):

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

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC401.1	Describe Big Data primitives	2	Understand
EC401.2	Explore different Big data processing techniques with hadoop	2	Understand
EC401.3	Understand distributed computing techniques with Spark	2	Understand
EC401.4	Articulate the main concepts, key technologies and fundamentals of cloud computing	2	Understand
EC401.5	Understand cloud enabling technologies and virtualization.	2	Understand
EC401.6	Explore future trends of cloud computing.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC401.1	2	1	-	-	-	-	-	-	-	-	-	1	1	-
EC401.2	2	2	1	-	3	-	-	-	-	-	-	1	2	-
EC401.3	3	2	2	-	2	-	-	-	-	-	-	2	3	-
EC401.4	3	2	2	-	-	-	-	-	-	-	-	2	2	-
EC401.5	2	1	1	-	2	-	-	-	-	-	-	1	1	-
EC401.6	1	2	2	-	2	-	-	-	-	-	-	2	2	-

Course Contents

Unit-I	INTRODUCTION TO BIG DATA	No. of Hours	COs
	Types of Data, Defining Big Data, Big Data examples, Comparison of Big Data and Small Data,Need of Big Data, 5 V's of Big data, Big data challenges and solutions, Characteristics of Big Data, Advantages of Big Data, Different Job Roles working with Big Data	06 Hrs.	EC401.1
Unit-II	**BIG DATA PROCESSING WITH HADOOP**	**No. of Hours**	**COs**
	Introduction to Google file system, Hadoop Architecture, HDFS, MapReduce paradigm, Introduction to Apache Pig, Apache Hive and Apache Sqoop , Textual ETL processing.	06 Hrs.	EC401.2
Unit-III	**BIG DATA WITH APACHE SPARK**	**No. of Hours**	**COs**
	Apache Spark Evolution, Ecosystem of Spark,Architecture of Spark, Spark RDD, Features of Spark, Spark Streaming, Spark SQL,Distributed computing with Spark, Spark SQL architecture.	06 Hrs.	EC401.3
Unit-IV	**FUNDAMENTALS OF CLOUD COMPUTING**	**No. of Hours**	**COs**
	Overview, Layers and Types of Cloud , Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing ,Risks and Challenges, Cloud Characteristics, Cloud Infrastructure Management, Infrastructure as a Service	06 Hrs.	EC401.4
Unit-V	**VIRTUALIZATION AND CLOUD PLATFORMS**	**No. of Hours**	**COs**
	Using Virtualization Technology, Load Balancing and Virtualization, Understating Hypervisors, Exploring SaaS, PaaS,IaaS. Introduction to Popular cloud platforms: Amazon web services ,Google Cloud and Microsoft Azure	06 Hrs.	EC401.5
Unit-VI	**EMERGING TRENDS IN CLOUD COMPUTING**	**No. of Hours**	**COs**
	Multi-Cloud Vs Omni-Cloud, Kubernetes, Cloud AI, Intelligent SaaS, Containerization using Docker: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow	06 Hrs.	EC401.6

Text Books:

1.Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", The McGraw-Hill.
2.Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson
3.Seema Acharya & Subhashini Chellappan,Big Data & Analytics,Wiley Publications

Reference Books:

1.Big Data, Black Book, DT Editorial services, 2015 edition
2.Judith Hurwitz, Alan Nugent, Big Data For Dummies, Wiley India,
3.KailashJayaswal, Jagannath Kallakurchi, Donald J. Houde, Cloud Computing Black Book , Dreamtech
4. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson

e-Resources:

1. NPTEL Course on “Cloud Computing”, by Prof. Soumya Kanti Ghosh, IIT Kharagpur
Link of the Course: https://nptel.ac.in/courses/106105167
2. NPTEL Course on “Big Data Computing” by Prof. Rajiv Misra,IIT Patna
Link of the Course :https://nptel.ac.in/courses/10610418
3. hadoop.apache.org/
4. spark.apache.org/

CIA:

1.Extempore: 20 Marks

Internet of Things & Wireless Sensor Networks (EC402)

Teaching Scheme
Lectures: 03 Hrs./ Week

Credits: 03

Examination Scheme
In Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite: Fundamentals of networking, microcontroller & communication

Course Objectives:
1. To study fundamental concepts of IoT.
2. To Learn different protocols used for IoT design.
3. To be acquainted with interfacing of sensors & actuators with different IoT platforms.
4. To learn real world application scenarios of IoT for the usefulness of society.
5. To understand the fundamentals of wireless sensor networks & its application.
6. To understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.

Course Outcomes (COs):
After completion of course students will be able to

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
EC402.1	Identify the components of the Internet of things.	2	Understand
EC402.2	Apply various protocols for design of IoT systems.	3	Apply
EC402.3	Compare various IoT boards, interfacing & programming for IoT.	3	Apply
EC402.4	Provide suitable solutions for domain specific applications of IoT.	3	Apply
EC402.5	Technical knowhow in building a WSN network.	2	Understand
EC402.6	Analysis of various critical parameters in deploying a WSN	4	Analysis

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs): -

COs	PO1	PO2	PO 3	PO4	PO 5	PO 6	PO7	PO8	PO 9	PO1 0	PO11	PO1 2	PSO1	PSO2
EC402.1	2	1	-	-	-	-	-	-	-	-	-	1	1	-
EC402.2	1	1	1	-	1	-	-	-	-	-	-	1	2	-
EC402.3	3	2	2	-	2	-	-	-	-	-	-	2	3	-
EC402.4	3	2	2	-	2	-	-	-	-	-	-	2	2	-
EC402.5	2	1	1	-	1	-	-	-	-	-	-	1	1	-
EC402.6	2	2	2	-	2	-	-	-	-	-	-	2	2	-

Course Contents:

Unit-I	**Fundamentals of IoT**	**No. of Hours**	**COs**
	Roles of Sensors & Actuators, Types, Working, Introduction to IoT, Characteristics of IoT, Overview of System Components of IoT, Architecture, Physical & Logical Design of IoT, IoT Enabling Technologies,IIOT, Introduction to IoT Networking: Gateways & Routing.	06 Hrs.	EC402.1
Unit-II	**IoT Protocols & Security**	**No. of Hours**	COs
	Protocols:IEEE 802.11, IEEE 802.15.4, Wireless HART, Ethernet, Z Wave, Bluetooth Low Energy, NFC, Bacnet, Zigbee Smart Energy, IPv4, IPv6, 6LoWPAN, DHCP, RPL, REST, TCP, UDP, HTTP, CoAP, XMPP, AMQP, MQTT, IoT Security & Privacy: Security Requirements, Risk Elements of IoT, Hardware & Communication security.	06 Hrs.	EC402.2
Unit-III	**Implementation of IoT**	**No. of Hours**	**COs**
	Introduction to IoT Boards, Arduino, Raspberry Pi , ESP 8266, NODE MCU, RFID, Interfacing of sensors, Programming Environment, Common Operating System.	06 Hrs.	EC402.3
Unit-IV	**Applications of IoT**	**No. of Hours**	**COs**
	Smart Cities, Greenhouse Monitoring, Smart Healthcare Monitoring, Smart Home Automation, Smart Agriculture Monitoring, Air Pollution Monitoring, Smart Industrial Automation, Smart Grid, Patients Surveillance.	06 Hrs.	EC402.4
Unit-V	**Introduction of Wireless Sensor Networks**	**No. of Hours**	**COs**
	Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.	06 Hrs.	EC402.5
Unit-VI	**Sensor Network**	**No. of Hours**	**COs**
	Introduction to ad hoc/sensor networks: Key definitions of ad hoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering, MAC Protocols, Routing Protocols.	06 Hrs.	EC402.6
Books:			
Text Books:			

Text Books:

1. S. Misra, A. Mukherjee & A. Roy, "*Introduction to IoT*" Cambridge University Press, 2020
2.S. Misra, C. Roy & A. Mukherjee, "*Introduction to Industrial Internet of Things & Industry 4.0"* CRC Press, 2020
2. Kazem Sohraby, Daniel Minoli & Taieb Znati, "*Wireless Sensor Networks Technology, Protocols & Applications*", John Wiley & Sons, 2007
3. Adrian McEwen, Hakim Cassimally, "*Designing the Internet of Things*", Wiley, 2013
4. Hakima Chaouchi, "*The Internet of Things Connecting Objects to the Web*", Wiley Publications,1st Edition,2010
5. Olivier Hersent, David Boswarthick, & Omar Elloumi , "*The Internet of Things: Key Applications & Protocols*", Wiley Publications, 1stEdition, 2011

Reference Books:

1. Holger Karl & Andreas Willig, "*Protocols & Architectures for Wireless Sensor Networks*", John Wiley & Sons, Ltd., 2005
2. Olivier Hersent, Omar Elloumi & David Boswarthick, "*The Internet of Things: Applications to the Smart Grid & Building Automation*", 2nd Edition Wiley, 2011
3.Clint Smith, Daniel Collins, "*Wireless Networks*", 3rd Edition, McGraw Hill Publications

Useful Links for IoT Applications and Use Cases:

http://52.16.186.190/resources/case-studies/
https://pressbooks.bccampus.ca/iotbook/chapter/iot-use-cases/
https://research.aimultiple.com/iot-applications/
https://www.jigsawacademy.com/101-applications-of-iot/
https://www.youtube.com/watch?v=xmt6OCBeS94
http://www.libelium.com/resources/case-studies

MOOC / NPTEL Course:

1. NPTEL Course on "Introduction to IoT", by Prof. Sudip Misra, IIT Kharagpur
Link of the Course: https://nptel.ac.in/courses/106105166
2. NPTEL Course on "Introduction to Industry 4.0 and Industrial Internet of Things", by Prof. Sudip Misra, IIT Kharagpur
Link of the Course: https://nptel.ac.in/courses/106105195

Continuous Internal Assessment:

A Project Based Learning approach will be followed for this course hence the small projects will be built by the students.

Computer Networks and Security (EC403)

Teaching Scheme
Lectures: 3 Hrs. / Week

Credits : 3

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course: Principles of Communication (EC212)

Course Objectives:

1. To understand state-of-the-art in network protocols, architectures, and applications
2. To provide students with a theoretical and practical base in computer networks issues
3. To outline the basic network configurations
4. To understand security issues involved in LAN and Internet.
5. To recognize the individual components of computer networks

Course Outcomes (COs):

After successful completion of the course students should be able to:

Cos	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC403.1	Explain fundamentals underlying principles of computer networking.	2	Understand
EC403.2	Demonstrate Data Link layer services, flow control and error control.	3	Apply
EC403.3	Demonstrate Network layer services and different routing algorithm.	3	Apply
EC403.4	Explore the transport layer services and data flow control with its characteristics	4	Analyze
EC403.5	Ensure basic knowledge of installing and configuring networking applications with network management.	2	Understand
EC403.6	Describe basic knowledge of the use of cryptography and network security.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO2
EC403.1	2	2	1	-	-	-	-	-	-	-	-	3	2	-
EC403.2	3	3	2	1	1	-	-	-	-	-	-	1	2	-
EC403.3	3	3	2	1	1	-	-	-	-	-	-	1	2	-
EC403.4	3	3	2	1	1	-	-	-	-	-	-	1	2	-
EC403.5	2	3	3	2	3	-	-	-	-	-	-	1	2	-
EC403.6	2	2	1	1	3	-	-	-	-	2	-	3	2	2

Course Contents

Unit-I	**Physical Layer**	No. of Hours	**Cos**
	Data Communications, Networks, Network types, Protocol layering, TCP / IP protocol suite, Addressing, OSI model, OSI Vs. TCP/IP, Guided and Unguided Transmission media. Switching: Circuit switched networks, Packet Switching.	6	EC403.1
Unit-II	**Data Link Layer**	No. of Hours	**Cos**
	Introduction to Data link Layer, DLC Services, DLL protocols, HDLC, PPP, Media Access Control: Random Access, Controlled Access, Channelization. Wired LAN: Ethernet Protocol, Standard Ethernet, Fast Ethernet (100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet. Wireless LAN : Introduction, IEEE 802.11 Project, Bluetooth	7	EC403.2
Unit-III	**Network Layer**	No. of Hours	**Cos**
	Introduction to Network Layer: Network-Layer Services, Network-Layer Performance, IPv4 addresses, Forwarding of IP Packets, Network Layer Protocols: Internet Protocol (IP), ICMPv4, Unicast and Multicast Routing: Introduction, Routing Algorithms, Unicast Routing Protocols, Introduction, Multicasting Basics, Intra-domain Multicast Protocols, Inter-domain Multicast Protocols, IGMP. Next Generation IP: IPv6 Addressing, Ipv6 Protocol, T ICMPv6 Protocol, Transition from IPv4 toIPv6.	6	EC403.3
Unit-IV	**Transport Layer**	No. of Hours	
	Introduction, Transport layer protocols and services, Port numbers, User Datagram Protocol (UDP), Transmission Control protocol (TCP), SCTP, Quality of services: Dataflow characteristics, Flow Control.	5	EC403.4
Unit-V	**Application Layer**	No. of Hours	**Cos**
	Introduction to Application Layer, Standard Client Server Protocols: World Wide Web and HTTP, FTP, Electronic Mail, Telenet, SSH, Domain Name System (DNS).Network Management: Introduction, SNMP.	5	EC403.5
Unit-VI	**Network Security**	No. of Hours	**Cos**
	Cryptography and Network Security: Introduction, Symmetric key ciphers and Asymmetric key Ciphers, AES, DSA & RSA Algorithms, Confidentiality, Other Aspects of Security. Internet Security: Network-Layer Security, Transport-Layer Security, Application-Layer Security, Firewalls. Virtual Private Network (VPN)	6	EC403.6
Books:			
Text Books:			

1. Behrouz A. Forouzan, “Data Communications and Networking”,MacGraw Hill, 5th edition. 2. S.Keshav,“An Engineering approach to computer Networking”, Pearson Education
Reference Books:
1. Andrew S. Tannenbaum, Computer Networks, Pearson Education, Fourth Edition,2003 2. Wayne Tomasi, Introduction to Data Communication and Networking, 1st edition, Pearson Education 3. Natalia Olifer, Victor Olifer, Computer Networks‖ Wiley Student Edition 4. James F. Kurouse & W. Rouse, —Computer Networking: A Top down Approach, 6th Edition Pearson Education
e-Resources: https://cag.gov.in/uploads/media/Network-20210426203825.ppt https://www.computernetworkingnotes.com/
Guidelines for Continuous Assessment:- Open Book Test

Communication I (EC404A)

Teaching Scheme:
Lectures: 04 Hrs. / Week
Credits: 04

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite Course: Knowledge of principles of communication (EC 212)

Course Objectives:-

1. To introduce fundamental theory of radiation and microwaves.
2. To become acquainted with antenna design.
3. To use the concept of transmission line and waveguides.
4. To analyze theory of passive and active components of microwave systems.
5. To introduce the concepts and techniques associated with wireless cellular communication systems.
6. To understand the next generation mobile communication system.

Course Outcomes (COs):-
After completion of course students will be able to:

Cos	Statement	Bloom's Taxonomy	
		Level	Descriptor

EC404A.1	Differentiate various performance parameters of radiating elements.	**2**	Understand
EC404A.2	Design antenna for given specification.	**3**	Apply
EC404A.3	Apply the knowledge of waveguide fundamentals in design of transmission lines.	**3**	Apply
EC404A.4	Analyze various passive and active microwave components.	**4**	Analyze
EC404A.5	Understand concepts of Mobile Communication	**2**	Understand
EC404A.6	Understand the next generation Mobile Communication System.	**2**	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):-

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC404A.1	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**2**	**-**
EC404A.2	**3**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**2**	**-**
EC404A.3	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**3**	**2**	**-**
EC404A.4	**2**	**2**		**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
EC404A.5	**3**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
EC404A.6	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

Course Contents:

Unit-I	**Theory of Radiation, Radiating Elements and arrays**	**No. of Hours**	**COs**
	Fundamental equations for free space propagation, Friis transmission equation, radiation mechanism, Definition of antenna, Definitions and performance parameters of antenna, Comparison of various radiating elements such as infinitesimal dipole, small dipole, finite length dipole and half wave length dipole, analytical treatment of these elements. Types of arrays, two element array, N-element array, uniform amplitude uniformly spaced linear broad side and end-fire array.	08	EC404A.1
Unit-II	**Antenna Design**	**No. of Hours**	**COs**
	Types of antennas – Point source – Dipole and slots – Loop antenna – Horn antenna – Helical Antenna – Patch – Reflector antennas –Parabolic reflector. Array of two sources – Pattern multiplication – Linear arrays – Broadside array – End fire array – Planar arrays.	08	EC404A.2

Unit-III	**Transmission lines and Waveguides**	**No. of Hours**	**COs**
	Introduction of electromagnetic spectrum, General solution for TEM, TE and TM waves. Analysis of coaxial line, Wave guide and Types of wave guide, rectangular waveguides. Analysis of rectangular cavity resonators and their applications, Strip lines: Structural details, types and applications.	08	EC404A.3
Unit-IV	**Microwave passive and active Components**	**No. of Hours**	**COs**
	Waveguide cavity resonators. Construction and Principles of E-plane Tee, H plane Tee, hybrid Tee, Faraday's rotation Principle isolator, circulator, directional couplers, Microwave tubes: Limitations of conventional tubes in the microwave frequency ranges. Working principles of Klystron amplifier, Reflex klystron oscillator, Magnetrons, Traveling wave tubes. Harmful effects of radiation. .	08	EC404A.4
Unit-V	**Fundamentals of Wireless Communication**	**No. of Hours**	**COs**
	Evolution of mobile radio communication, Examples of mobile radio system, Overview of 2G, 2.5G, 3G ,4G ,5G wireless networks, Cellular fundamentals: frequency reuse, channel assignment strategies, handoff strategies, Interference & system capacity, Trunking & grade of service, Techniques of improving coverage & capacity of cellular system	07	EC404A.5
Unit-VI	**Next Generation Mobile Systems**	**No. of Hours**	**COs**
	3G Wireless Standards: CDMA2000: Overview, Radio & Network Components, Network Structure, Packet - Data Transport Process Flow, Radio Network, CDMA Channel Allocation. TD-CDMA and TDSCDMA: Overview, Generic Architecture, Core Network, Radio Network, Interference – Mitigation Techniques, RAN Traffic Planning, Handover, Implementation 4G Wireless Standards- LTE: Network Architecture and Interfaces, FDD Air Interface and Radio Network, TD-LTE , Scheduling, Mobility Management and Power Optimization, LTE Security Introduction to 5G: Introduction, 5G network architecture, Applications, 5G enable technologies, Recent trends in Telecommunication Industries	09	EC404A.6

Books:

Text Books:

1. C.A. Balanis, —Antenna Theory - Analysis and Design", John Wiley.

2. Collin, R.E., “Foundations for Microwave Engineering”, 2nd Ed., John Wiley & Sons
3. Annapurna Das and Sisir K. Das, —Microwave Engineering", Second edition, Tata McGraw Hill.
4.Theodore Rappaport, —Wireless Communications Principles and Practice, Second Edition, Pearson Education

Reference Books:

1. K. D. Prasad, —Antenna &Wave Propagation, Satya Prakashan, New Delhi.
2. M. Kulkarni, —Microwave and Radar engineering, 3rd edition, Umesh Publication
3. Fei Hu, —Opportunities in 5G Networks : A research & development perspective, CRC Press
4. Aditya Jagannatham, Principles of Modern Wireless Communication Systems.TMH publications 2015

MOOC / NPTEL Course:
NPTEL Course "Principles of Communication Systems-I", by Prof. Aditya.K. Jagannath.
https://nptel.ac.in/courses/108/104/108104091/

Continuous Internal Assessment:
1. extempore Self Learning of topic
2. Case study of any communication system

Image Processing and Pattern Recognition(EC404B)

Teaching Scheme
Lectures: 04 Hrs. / Week
Credits:04

Evaluation Scheme
CIA: 20 Marks
ISE: 30 Marks
ESE: 50 Marks
Total: 100 Marks

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Prerequisite Course: Digital Signal Processing ( ), EM-III

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Course Objectives:
1. To learn fundamentals of Image Processing.
2. To learn image enhancement and restoration techniques.
3. To learn image compression & segmentation techniques.
4. To study the fundamentals of pattern recognition
5. To study general approaches of classifications
6. To study various Nonparametric Techniques.

Course Outcomes (COs):

After successful completion of the course, student will be able to

CO	Statement of Course Outcome	Bloom's Taxonomy	
		Level	Descriptor
EC404B.1	Explain the basics of Image Processing.	2	Understand
EC404B.2	Describe image enhancement and restoration techniques.	2	Understand
EC404B.3	Demonstrate the use of image compression & segmentation techniques.	3	Apply
EC404B.4	Explain the fundamentals of pattern recognition and its learning techniques.	2	Understand
EC404B.5	Illustrate the principles of Bayesian parameter estimation in probabilistic models	3	Apply
EC404B.6	Use of Maximum-likelihood parameter estimation in complex probabilistic models	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC404B.1	2	-	-	-	-	-	-	-	-	-	-	-	1	-
EC404B.2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
EC404B.3	2	-	-	-	3	-	-	-	-	-	-	-	1	-
EC404B.4	2	-	-	-	-	-	-	-	-	-	-	-	1	-
EC404B.5	2	-	-	-	3	-	-	-	-	-	-	-	1	-
EC404B.6	2	-	-	-	-	-	-	-	-	-	-	-	1	-

Course Content

Unit-I	Introduction to Image Processing	No.of Hours	COs
	What is Digital Image processing? Fundamental steps in Digital Image processing, Components of an Image Processing System, Image sampling and Quantization: Basic concept in Sampling and Quantization, Representing Digital Images, Spatial and Gray Level resolution. Basic relationships between pixels.	6 Hrs.	CO1
Unit-II	Image Enhancement and Restoration	No.of Hours	COs
	Image Enhancement: Introduction, Contrast Intensification, Smoothing and Image Sharpening. Restoration: Introduction, Minimum mean square error restoration, Least square error restoration, Restoration by Singular value decomposition, Maximum a Posterior estimation, Homomorphic Filtering. Blind deconvolution, Super resolution imaging.	6 Hrs.	CO2
Unit-III	Image Compression and Segmentation	No.of Hours	COs
	Compression: Introduction, Error criterion, Lossy Compression methods, Lossless compression methods. Segmentation: Introduction, Region extraction, Pixel based approach, Multi level thresholding, Local thresholding, Region based approach, Grow Cut region growing, Colour image segmentation, Applications of Digital Image Processing	6 Hrs.	CO3
Unit-IV	Introduction to Pattern Recognitions	No.of Hours	COs

	Pattern recognition System- sensing, Segmentation, feature extraction, classification, post processing. Design Cycle-Learning and Adaption. Supervised Learning, Unsupervised Learning, Reinforcement Learning,	6 Hrs	CO4
Unit-V	Bayesian Decision Theory	No.of Hours	COs
	Introduction- Bayesian Decision Theory, Minimum Error Rate Classification, Classifiers, Discriminant Functions and Decision Surfaces,The normal Density, Error Bounds for Normal Densities-Missing and Noisy Features.	6 Hrs	CO5
Unit-VI	Maximum Likelihood and Bayesian Parameters Estimations	No.of Hours	COs
	Introduction-maximum likelihood, Estimation-Bayesian Estimation, Bayesian parameter, Estimation-Sufficient Statistics-Component Analysis and Discriminants-Hidden Markov Models. Applications of pattern recognition, Applications of pattern recognitions	6 Hrs.	CO6

Text Books:

1. Rafel Gonzallez and R. Woods Digital Image Processing, 1.4th edition, 2018.
2. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2002.
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
4. William K Pratt, “Digital Image Processing”, John Wiley & Sons, 4th Edition, 2007.

Reference Books:

1. S.Theodoridis and K.Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009
2. Richard. E.G., Johnsonbaugh and Jost.S. “Pattern Recognition and Image Analysis”, Prentice Hall of India Pvt. Ltd., New Delhi, 1999.
3. Morton Nadler and Eric Smith P. “Pattern Recognition Engineering”, John Willey and Sons, New York, 1993.
4. Rober J. Schalkoff, “Pattern Recognition – Statistical, Structural and Neural Approaches”, John Wiley & Sons Inc, New York, 1992.

E-Resources:

1. **https://nptel.ac.in/courses/117105135**

2. **https://nptel.ac.in/courses/117105101**

CIA: Project Based Learning

Distributed Systems (EC404C)

Teaching Scheme:
Lectures: 04 Hrs. / Week
Credits: 04

Examination Scheme
ISE: 30 Marks
ESE: 50 Marks
CIA: 20 Marks
Total: 100 Marks

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Prerequisite Course:

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Course Objectives:-

1. To learn the principles, architectures and programming models used in distributed systems.
2. To understand the fundamentals and knowledge of the Middleware of distributed systems
3. To gain knowledge of working components and fault tolerance of distributed systems.
4. To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems.
5. To make students aware about distributed and multimedia file systems and web systems.
6. Create an awareness of Emerging trends in distributed computing.

Course Outcomes (COs):-

After completion of course students will be able to:

Cos	Statement	Bloom's Taxonomy	
		Level	Descriptor
EC404C.1	Demonstrate the core concepts of distributed systems.	2	Understand
EC404C.2	Understand the concept of middleware of distributed systems	2	Understand
EC404C.3	Understand Inter-process communication methods and analyze different coordination algorithms	3	Apply
EC404C.4	Comprehend the importance of replication to achieve fault tolerance in distributed systems.	3	Apply
EC404C.5	Analyze the design and functioning of existing distributed file systems, distributed multimedia, and distributed web-based systems	4	Analyze
EC404C.6	Understand various Recent Trends in distributed systems.	2	Understand

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):-

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC404C.1	3	2	-	-	-	-	-	-	-	-	-			-
EC404C.2	3	3	-	-	-	-	-	-	-	-	-			-
EC404C.3	3	2	2	-	-	-	-	-	-	-	-			-

EC404C.4	2	2		-	-	-	-	-	-	-	-			-
EC404C.5	3	2	-	-	-	-	-	-	-	-	-			-
EC404C.6	3	2	-	-	-	-	-	-	-	-	-			-

Course Contents:

Unit-I	**Introduction to Distributed Systems**	**No. of Hours**	**COs**
	Introduction: Network operating System VS Distributed operating systems, Characteristics, Design goals, challenges of Distributed Systems, Examples of Distributed Systems, Trends in Distributed systems: Pervasive networking and the modern Internet, Mobile and ubiquitous computing, Focus on resource sharing Distributed Computing Models: Physical, Architecture and Fundamental models	06	EC404C.1
Unit-II	**Middleware**	**No. of Hours**	**COs**
	Introduction to middleware, middleware Framework, Role of middleware, Examples of Middleware, Origins of middleware, Architecture vs Middleware, RMI, CORBA, General Approaches to adaptive software, Types of middleware-messages oriented middleware, intelligent middleware, content centric middleware, middleware protocol, middleware Services, Distributed computing Environment (DCE), middleware Issues, middleware Analyst	07 Hrs.	EC404C.2
Unit-III	**Inter-Process Communication**	**No. of Hours**	**COs**
	IPC: Introduction, Layered protocols, API for internet protocols, IPC through shared memory, external data representation and marshaling, Types of communication, inter process communication, multicast communication, message-oriented communication, MPI, network virtualization, overlay networks Coordination: Clock synchronization, logical clocks, mutual exclusion, election algorithms, Gossip based coordination	08 Hrs.	EC404C.3
Unit-IV	**Replication and Fault Tolerance**	**No. of Hours**	**COs**
	Replication: Reasons for replication, Replica management – Finding the best server location, Content replication and placement, Content distribution, Managing replicated objects Consistency protocols: Primary based protocols, replicated write protocols Fault Tolerance: Introduction to fault tolerance, Reliable client server communication, Reliable group communication, distributed commit, Recovery – Check pointing, Message logging	06 Hrs.	EC404C.4
Unit-V	**Distributed Files, Multimedia and Web Based System**	**No. of Hours**	**COs**

	Distributed Files: Introduction, File System Architecture, Sun Network File System and HDFS. Distributed Multimedia Systems: Characteristics of Multimedia Data, Quality of Service Management, Resource Management Distributed Web Based Systems: Architecture of Traditional Web-Based Systems, Apache Web Server, Web Server Clusters, Communication by Hypertext Transfer Protocol, Synchronization, Web Proxy Caching	07	EC404C.5
Unit-VI	**Recent Trends in Distributed Systems**	**No. of Hours**	**COs**
	Recent Trends: Introduction, Portable and handheld Devices, Wearable devices, Devices embedded in appliances, Parallel Virtual Machine (PVM), Jini, Service Oriented Architecture, The Future of Recent Trends. Tools for Distributed System Monitoring: Prometheus, Zabbix, Nagios	08	EC404C.6

Books:

Text Books:

1. Distributed Systems: Concepts and Design by George Coulouris, J Dollimore and Tim Kindberg, Pearson Education, ISBN: 9789332575226, 5th Edition, 2017.
2. Distributed Systems, Maarten van Steen, Andrew S. T, ThirdeditionVersion. Andrew S. Tanenbaum, Maarten van Steen, PHI ,2nd Edition, ISBN: 978-0130888938
3. Distributed Operating Systems: Concepts and Design by P. K. Sinha, PHI, ISBN: 978-0780311190

Reference Books:

1. Distributed Computing, Sunita Mahajan and Seema Shah, Oxford University
2. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, Hagit Attiya and Jennifer Welch, Wiley India
3. Tool for Distributed Systems Monitoring, Łukasz KUFEL, Foundation of Computing and Decision Sciences, Vol 41(4), 2016, e-ISSN 2300-3405, DOI:10.1515/fcdc-2016-0014

MOOC / NPTEL Course:

NPTEL course:

1. https://archive.nptel.ac.in/courses/106/106/106106168/

online study material :

1. http://home.mit.bme.hu/~meszaros/edu/oprendszerek/segedlet/elosztott/distributed-systems-survey.pdf 2. http://home.mit.bme.hu/~meszaros/edu/oprendszerek/segedlet/elosztott/DisSysUbiCompReport.html

Continuous Internal Assessment: One Case Study on each unit

Communication-II (EC405A)

Teaching Scheme:
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme:
In Sem Exam: 30 Marks
End Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite: Fundamentals of analog & digital communications

Course Objectives:

1. To be familiar with architecture and protocols used in Wireless Sensor Networks.
2. To understand the various optical fiber modes, configuration & transmission characteristics of optical fibers.
3. To learn about the various optical sources, detectors and transmission techniques.
4. To extend the fundamentals to design and analysis of fiber optic communication links.
5. To understand the basics of orbital mechanics and the look angles from ground stations to the satellite.
6. To apply subject understanding in Link Design.

Course Outcomes (COs):

After completion of course students will be able to

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
EC 405.1	Explain various concepts and terminologies used in WSN.	2	Understand
EC 405.2	Calculate the important parameters associated with optical components used in fiber optic telecommunication systems.	2	Understand
EC 405.3	Identify different optical devices with their operating principle & contrast the performance of major components in optical links.	2	Understand
EC405.4	Evaluate the performance viability of optical links using the power and rise time budget analysis & to enrich the knowledge about optical networks.	4	Analyze
EC 405.5	To provide exposure of the global satellite system and its application.	2	Understand
EC 405.6	Perform Satellite Link design for UpLink and DownLink.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO 1	PO 2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO1 0	PO11	PO12	PSO1	PSO2
EC 405.1	2	-	2	-	2	-	-	-	-	-	-	2	2	-
EC 405.2	1	1	1	-	-	-	-	-	-	-	-	1	1	-
EC 405.3	2	1	1	-	-	-	-	-	-	-	-	1	1	-
EC405.4	1	2	2	-	2	-	-	-	-	-	-	2	2	-
EC 405.5	1	1	1	-	-	-	-	-	-	-	-	1	1	-

EC 405.6	1	2	2	-	-	-	-	-	-	-	-	1	1	-

Course Contents:

Unit-I	**Wireless Sensor Networks**	**No. of Hours**	**COs**
	Sensors, Actuators, Types, Working, Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.Application of WSN: Smart Homes, Healthcare, Intelligent Transportation, Agriculture, etc. Fundamentals of RADAR.	06 Hrs.	EC 405.1
Unit-II	**Fundamentals of Optical Fibers for Telecommunication**	**No. of Hours**	**COs**
	Basic Block Diagram of Optical Fiber Communication System, Principles of Light Propagation Through a Fiber, Total Internal Reflection, Acceptance Angle, Numerical Aperture Cutoff Wavelength, Different Types of Fibers & their Characteristics: Attenuation, Material Absorption, Distortion, Scattering Losses, Fiber Bend Loss, Loss Due to Fiber Misalignment, Mode Coupling, Coupling Losses, Material Dispersion, Dispersion In Single-Mode & Multimode Fibers, Connectors & Splicers, Advantages & Disadvantages of Optical Fibers.	06 Hrs.	EC 405.2
Unit-III	**Optical Sources & Detectors**	**No. of Hours**	**COs**
	Introduction to Optical Sources: LEDs & Semiconductor LASERs: Principle of Working Absorption, Spontaneous Emission, Stimulated Emission, Concept of Population Inversion & their Characteristics, Line Coding. Introduction to Optical Detectors: PIN, Avalanche Photodiodes & Photo Transistors, Principle of Working & Characteristics.	06 Hrs.	EC 405.3
Unit-IV	**Fiber Optic Link Design & Optical Networks**	**No. of Hours**	**COs**
	Optical Power Budget, Rise Time Budget, Bit Rate for RZ & NRZ Pulse Format, Overview of WDM, WDM Components :Coupler, Optical Isolators & Circulators, Optical Add/Drop, Multiplexers & Demultiplexers, Fiber Bragg Grating, Elements of an Optical Network, Types, Long Haul System, Role of Fiber Optic Network in the 5G Networks.	06 Hrs.	EC405.4
Unit-V	**Orbital Mechanics & Launchers**	**No. of Hours**	**COs**

	History of Satellite Communication, Orbital Mechanics, Look Angle Determination, Orbital Perturbations, Orbital Determination, Launchers & Launch Vehicles, PSLV, Orbital Effects in Communication System Performance, Satellite Subsystems, Attitude and Control Systems (AOCS), Telemetry, Tracking, Command & Monitoring, Power Systems, Communication Subsystems, Satellite Antennas, Equipment Reliability & Space Qualification.	06 Hrs.	EC 405.5
Unit-VI	**Satellite Communication Link Design**	**No. of Hours**	**COs**
	Introduction, Basic Transmission Theory, System Noise Temperature & G/T Ratio, Design of Downlinks, Satellite Systems using Small Earth Stations, Uplink Design, Design of Specified C/N: Combining C/N And C/I Values In Satellite Links System Design Examples.	06 Hrs.	EC 405.6

Books:

Text Books:

Text Books:

1. Gerd Keiser, *"*Optical Fiber Communications*",* 4th Edition, Tata McGraw Hill

2. John M. Senior, *"*Optical Fiber Communications*",* 2nd Edition, PHI

3. Kazem Sohraby, Daniel Minoli & Taieb Znati, "Wireless Sensor Networks Technology Protocols & Applications", John Wiley & Sons, 2007

4. Timothy Pratt, Charles Bostian, Jeremy Allnutt, "Satellite Communications", John Wiley & Sons

Reference Books:

1. Djafar K. Mynbaev & Lowell L. Scheiner,"Fiber Optic Communications Technology", 1st Edition, Pearson Education

2. Govind P. Agrawal, "Fiber Optic Communication Systems", 3rd Edition, Wiley India

3. Dennis Roody, "Satellite Communications", McGraw Hill

4.Clint Smith, Daniel Collins, "Wireless Networks", 3rd Edition, McGraw Hill Publications

MOOC / NPTEL Course: -

1.NPTEL Course on "Advanced Optical Communication*",* by Prof R. K. Shevgaonkar, IIT Madras
Link of the Course: https://nptel.ac.in/courses/117101002

2. NPTEL Course on "Fiber Communication Technology", by Prof. Deepa Venkitesh, IIT Madras
Link of the Course: https://nptel.ac.in/courses/108106167

3. NPTEL Course on "Fiber- Optic Communication Systems & Techniques", by Dr. Pradeep Kumar K. IIT Kanpur
Link of the Course: https://nptel.ac.in/courses/108104113

4. NPTEL.Course"Remote.Sensing:Principal & Application",by Prof. Eswar Rajasekaran,IIT Bombay
Link of theCourse:https://nptel.ac.in/courses/105101206

5. NPTELCourse"Remote Sensing Essentials",by Dr.Arun.K.Saraf, IIT Roorkee
Link of the Course:https://nptel.ac.in/courses/105107201

6. NPTEL Course "Global Navigation Satellite Systems & Applications", by Dr. Arun. K. Saraf, IIT Roorkee
Link of theCourse:https://nptel.ac.in/courses/105107194

Continuous Internal Assessment: -

Case study of any communication system

Block Chain (EC 405B)

Teaching Scheme
Lectures: 3 Hrs/Week
Credits:3

Examination Scheme
In-Sem Exams: 30 Marks
End-Sem Exam:50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite: Knowledge of scripting languages

Course Objectives:

1. To describe block chain and cryptocurrencies techniques in the application development.
2. To use appropriate consensus for solving problems and programming.
3. To use Bitcoin basics and use it in Cryptocurrencies.
4. To use Ethereum Virtual Machine for solving problems and programming.
5. To select appropriate Zero Knowledge proofs and protocols in Blockchain foundations for problem solving and programming.
6. To learn the various applications of block chain.

Course Outcomes:

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

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
EC405.1	Describe block chain and cryptocurrencies techniques in the application development.	2	Understand
EC405.2	Use appropriate consensus for solving problems and programming.	3	Apply
EC405.3	Use Bitcoin basics and use it in Cryptocurrencies.	3	Apply
EC405.4	Use Ethereum Virtual Machine for solving problems and programming.	3	Apply
EC405.5	Select appropriate Zero Knowledge proofs and protocols in Blockchain foundations for problem solving and programming.	4	Analyze
EC405.6	Examine various applications of block chain in different sectors.	4	Analyze

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC405.1	2	1	2	1	-	-	-	-	-	-	-	-	-	2
EC405.2	2	3	3	2	-	-	-	-	-	-	-	-	-	2
EC405.3	2	1	2	2	-	-	-	-	-	-	-	-	-	2
EC405.4	1	1	2	2	-	-	-	-	-	-	-	-	-	2

EC405.5	2	1	2	2	-	-	-	-	-	-	-	-	-	2
EC405.6	2	2	2	2	-	-	-	-	-	-	-	-	-	2

Course Contents			
Unit-I	**INTRODUCTION TO BLOCKCHAIN AND CRYPTOGRAPHY**	**No. of Hours**	**COs**
	Introduction – basic ideas behind block chain, need, how it is changing the landscape of digitalization, Categories of blockchain public, private blockchain, permissioned ledger tokenized block chain, token less block chains side chains. Introduction to cryptographic concepts required Hashing, signature schemes, encryption schemes and elliptic curve cryptography.	**06**	**CO1**
Unit-II	**THE CONSENSUS PROBLEM**	**No. of Hours**	**COs**
	The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle- formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).	**06**	**CO2**
Unit-III	**BITCOIN**	**No. of Hours**	**COs**
	Bitcoin - Wallet - Blocks - Merkley Tree - hardness of mining -transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin.	**06**	**CO3**
Unit-IV	**ETHEREUM**	**No. of Hours**	**COs**
	Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum -Solidity - Smart Contracts - some attacks on smart contracts.	**06**	**CO4**
Unit-V	**PROTOCOLS IN BLOCKCHAIN**	**No. of Hours**	**COs**
	Zero Knowledge proofs and protocols in Blockchain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves - Zcash.	**06**	**CO5**
Unit-VI	**APPLICATIONS OF BLOCKCHAIN**	**No. of Hours**	**COs**
	Decentralized Cryptocurrency, Distributed Cloud Storage, EVoting, Insurance Claims, Cross-Border Payments, Asset Management, Smart Appliances. Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems, and others	**06**	**CO6**
Text Books:			

1. Arvind Narayanan, “Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction” Princeton University Press (July 19, 2016).

2. Don and Alex Tapscott, “Blockchain Revolution”. Portfolio Penguin 2016.

3. William Mougayar, “Business Blockchain Promise, Practice and Application of the Next Internet Technology, John Wiley & Sons 2016.

Reference Book

1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Second Edition, Packt Publishing, 2018
2. Andreas Antonopoulos, Satoshi Nakamoto, “Mastering Bitcoin”, O”Reilly, 2014.
3. Roger Wattenhofer, “The Science of the Blockchain” Create Space Independent Publishing, 2016.
4. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015 (article available for free download) { curtain raiser kind of generic article, written by seasoned experts and pioneers}.

e-Resources

NPTEL & MOOC courses titled blockchain technology
blockgeeks.comguide/what-is-block-chain-technology

1. **https://nptel.ac.in/courses/106105184**
2. **https://archive.nptel.ac.in/courses/106/105/106105235/**

Continuous Internal Assessment:

. extempore Self Learning of topic

Data Mining (EC405C)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
In-Sem Exam: 30 Marks
End-Sem Exam: 50 Marks
CIA: 20 Marks
Total: 100 Marks

Prerequisite:

Database Management Systems and SQL(EC303)

Course Objectives:

1. To learn fundamentals of Data Mining
2. To get familiar with different Data preprocessing Methods.
3. To understand various methods, techniques and algorithms in data mining
4. To learn data mining architecture, algorithms, software tools and applications.
5. To get familiar with different clustering methods
6. To introduce students to the emerging trends in Data Mining

Course Outcomes (COs):

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

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC405C.1	Describe data mining process through Knowledge Discovery in Data Mining	2	Understand
EC405C.2	Explore various Data preprocessing Methods	2	Understand
EC405C.3	Optimize the mining process by choosing best data mining technique	3	Apply
EC405C.4	Identify appropriate data mining algorithms to solve real world problems	3	Apply
EC405C.5	Identify the hidden patterns in the data	2	Understand
EC405C.6	Demonstrate emerging and enhanced data models for advanced applications.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC405C.1	1	1	-	-	-	-	-	-	-	-	-	1	1	-
EC405C.2	2	2	1	-	2	-	-	-	-	-	-	2	3	-
EC405C.3	3	2	2	-	2	-	-	-	-	-	-	2	2	-
EC405C.4	2	1	-	-	-	-	-	-	-	-	-	1	1	-
EC405C.5	2	1	1	-	2	-	-	-	-	-	-	2	1	-
EC405C.6	2	2	2	-	3	-	-	-	-	-	-	2	2	-

Course Contents

Unit-I	**Fundamentals of Data Mining**	**No. of Hours**	**COs**
	Data, Types of Data, Data Mining Functionalities ,Basic Data mining tasks, Data Mining Versus Knowledge Discovery in Databases, Architecture of data mining , Major issues in Data Mining, Data mining applications	06 Hrs.	EC405C.1
Unit-II	**Data Preprocessing**	**No. of Hours**	**COs**
	Introduction to Data Preprocessing, Data cleaning, Data integration and transformation, Data reduction, Correlation analysis, Min-max normalization, z-score normalization and decimal scaling, Data Discretization: Binning, Histogram Analysis	06 Hrs.	EC405C.2
Unit-III	**Association Rule Mining**	**No. of Hours**	**COs**
	Association Rules: Introduction, Large Item Sets, Basic Algorithms, Parallel & Distributed Algorithms, Comparing Approaches, Incremental Rules, Advanced Association Rules Techniques, Measuring the Quality of Rules.	06 Hrs.	EC405C.3
Unit-IV	**Classification**	**No. of Hours**	**COs**
	Classification and Prediction Basic concepts, Decision tree induction, Bayesian classification, Rule–based classification, Lazy learner.Enhancing Performance of classification: Cross-Validation, Sub-Sampling, and Hyper Parameter Tuning Techniques, Metrics for Evaluating Classifier Performance	06 Hrs.	EC405C.4
Unit-V	**Clustering and Applications**	**No. of Hours**	**COs**
	Cluster analysis, Types of Data in Cluster Analysis, Categorization of Major Clustering Methods– Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Outlier Analysis.	06 Hrs.	EC405C.5
Unit-VI	**Emerging Trends in Data Mining**	**No. of Hours**	**COs**
	Basic concepts in Mining data streams, Mining Time series data, Spatial Data mining, Multimedia Data mining, Text Mining, Mining the World Wide Web.	06 Hrs.	EC405C.6

Text Books:

1. Jiawei Han, Michelin Kamber, Data Mining-Concepts and techniques, Morgan Kaufmann Publishers
2.Margaret H Dunham, Data Mining Introductory and Advanced topics , Pearson Education
3. Arun K Pujari, Data Mining Techniques,University Press
4. Vikram Pudi, P. Radha Krishna, Data Mining, Oxford University Press

Reference Books:

1.Ian H Witten, Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Elsevier
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining,Pearson Education
3. Salvador García, Julián Luengo, Francisco Herrera, Data Preprocessing in Data Mining, Springer International Publishing
4. Carlo Vercellis ,Business Intelligence:Data Mining and Optimization for Decision Making, Wiley Publications

e-Resources:

1. NPTEL Course on “Data Mining”
Link of the Course: https://nptel.ac.in/courses/106105174/

CIA:

online course offered by Coursera Titled “ Data Mining for smart cities”

Computer Networks and Security Laboratory (EC406)

Teaching Scheme
Lectures: 2 Hrs. / Week
Credits : 1

Examination Scheme
PR: 50 Marks
Total: 50 Marks

Prerequisite Course: Principles of Communication (EC212)

Course Objectives:

1. To understand use of cables, connectors and tools for network design.
2. To provide students with knowledge of networking components and devices like LAN adapter, Hub, Switches, Routers etc.
3. To outline the basic network configurations.
4. To understand use of simulation software in Computer networks.
5. To make students aware of network security algorithms.

Course Outcomes (COs):

After successful completion of the course students should be able to:

Cos	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC406.1	Select proper transmission media and tools for computer networking.	2	Understand
EC406.2	Demonstrate use of networking components and devices.	3	Apply
EC406.3	Execute simulation of computer networking protocols.	3	Apply
EC406.4	Demonstrate network environment using different network utilities.	3	Apply
EC406.5	Implement different configuration of TCP/IP protocols	3	Apply
EC406.6	Develop cryptography and network security algorithm	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
EC406.1	3	1	1	-	2	-	-	-	-	-	-	3	2	-
EC406.2	3	2	2	1	2	-	-	-	-	-	-	3	2	-
EC406.3	3	3	2	1	3	-	-	-	-	-	-	3	2	-
EC406.4	3	3	2	1	2	-	-	-	-	-	-	2	2	-
EC406.5	3	3	3	1	3	-	-	-	-	-	-	2	2	-
EC406.6	3	3	2	2	3	-	-	-	-	-	-	3	2	2

Practical Course Contents

Sr. No.	Title of the Practical	Cos
1.	Familiarization with Transmission media and tools: Co-axial cable, UTP cable, Crimping tool, Connectors etc.	EC406.1
2.	Introduction and making use of networking components and devices like LAN adapter, Hub, Switches, Routers etc.	EC406.1, EC406.2
3.	Installation and introduction of simulation tools packet tracer/GNS3/ Boson NetSim.	EC406.3
4.	Simulation of various LAN topologies and their creation using network devices, cables and Computer.	EC406.3
5.	Familiarization of network environment, understanding and using network utilities : ipconfig, netstat, ping, arp, telnet, ftp, finger, traceroute.	EC406.4
6.	Configuration of TCP/IP protocols in Window/LINUX.	EC406.5
7.	Configuration of TELNET protocols on router for remote access.	EC406.5
8.	Implementation of RSA public key algorithm.	EC406.6

Books:

Text Books:

1. Behrouz A. Forouzan, “Data Communications and Networking”,MacGraw Hill, 5th edition.
2. S.Keshav,“An Engineering approach to computer Networking”, Pearson Education

Reference Books:

1. Andrew S. Tannenbaum, Computer Networks, Pearson Education, Fourth Edition,2003
2. Wayne Tomasi, Introduction to Data Communication and Networking, 1st edition, Pearson Education
3. Natalia Olifer, Victor Olifer, Computer Networksǁ Wiley Student Edition
4. James F. Kurouse & W. Rouse, Computer Networking: A Top down Approach, 6th Edition Pearson Education

e-Resources:

1. **https://cag.gov.in/uploads/media/Network-20210426203825.ppt**
2. **https://www.computernetworkingnotes.com/**

Internet of Things & Wireless Sensor Networks Laboratory (EC407)

Teaching Scheme **Examination Scheme**

Practical: 02 Hrs. / Week **PR :** 50 Marks
Credits: 01 **Total:** 50 Marks

Prerequisite: Fundamentals of networking, microcontroller & communication

Course Objectives:

1. To introduce the fundamentals of sensors & actuators along with the basic concepts of an IoT.
2. To expose students to the usage of protocol standardization for IoT with IoT edge & gateway network with communication protocols.
3. To understand the Arduino & Raspberry Pi & their application in IoT.
4. To learn real world application scenarios of IoT along with its societal & economic impact using case studies.
5. To learn basic concepts of wireless sensor networks.
6. Describe importance & use of radio communication & link management in WSN.

Course Outcomes (COs):

After completion of course students will be able to

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
EC407.1	Demonstrate & identify building blocks of Internet of things.	2	Understand
EC407.2	Comprehend the operation of IoT protocols.	2	Understand
EC407.3	Describe various IoT boards, interfacing & programming for IoT.	3	Apply
EC407.4	Provide suitable solutions for domain specific applications of IoT.	3	Apply
EC407.5	Explain various concepts & terminologies used in WSN.	2	Understand
EC407.6	Recognize the importance of localization and routing techniques used in WSN.	4	Analyze

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs): -

COs	PO1	PO 2	PO3	PO4	PO 5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC407. 1	2	1	-	-	-	-	-	-	-	-	-	1	1	-
EC407. 2	1	1	1	-	1	-	-	-	-	-	-	1	2	-
EC407. 3	3	2	2	-	2	-	-	-	-	-	-	2	3	-
EC407. 4	3	2	2	-	2	-	-	-	-	-	-	2	2	-
EC407. 5	2	1	1	-	1	-	-	-	-	-	-	1	1	-
EC407. 6	2	2	2	-	2	-	-	-	-	-	-	2	2	-

Practical Course Contents:

Perform any 08 practicals.

Sr. No.	Title of Practical	COs
1.	Demonstration & Survey of various development boards for IoT.	EC407.3
2.	Demonstration & Survey of various IoT platforms.	EC407.1
3.	Wireless communication between Arduino & PC using Bluetooth protocol.	EC407.4
4.	Interfacing of Wifi (ESP8266) Module with Arduino .	EC407.4
5.	Interfacing of LED with Arduino and program for blinking LED.	EC407.3
6.	Interfacing temperature sensor LM35 with Arduino board and program to display temperature.	EC407.4
7.	Interfacing IR sensor with Arduino board and program to turn on buzzer when intruder detected.	EC407.4
8.	Interfacing touch sensor, LDR, Gas sensor with Arduino board and program for the same.	EC407.4
9.	Interfacing of DC motor with Arduino and program for speed control of dc motor using PWM.	EC407.3
10.	Interfacing of 16x2 LCD with Arduino board for display of message or information.	EC407.3
11.	Interfacing Wifi module with Arduino.	EC407.3
12.	Interfacing Xbee module with Arduino.	EC407.3
11.	Study of Raspberry-Pi, Beagle board, Arduino, and different operating systems for RaspberryPi/Beagle board/Arduino. Understanding the process of OS installation on RaspberryPi/Beagle board/Arduino .	EC407.3
12.	Study of Connectivity & configuration of Raspberry-Pi /Beagle board circuit with basic peripherals, LEDS. Understanding GPIO & its use in programs.	EC407.4

Books:

Text Books:

Text Books:

1. Kazem Sohraby, Daniel Minoli & Taieb Znati, “Wireless Sensor Networks Technology, Protocols, and Applications”, John Wiley & Sons, 2007.
2. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, Wiley, 2014.
3. Hakima Chaouchi, “The Internet of Things Connecting Objects to the Web”, Wiley Publications,1st Edition.
4. Olivier Hersent, David Boswarthick, & Omar Elloumi , “The Internet of Things: Key Applications & Protocols”, Wiley Publications, 1stEdition.

Reference Books:

1. Holger Karl & Andreas Willig, “Protocols & Architectures for Wireless Sensor Networks”, John Wiley & Sons, Ltd., 2005.
2. Olivier Hersent, Omar Elloumi & David Boswarthick, “The Internet of Things: Applications to the Smart Grid & Building Automation”, Wiley, 2012 .
3.Clint Smith, Daniel Collins, “Wireless Networks”, 3rd Edition, McGraw Hill Publications.

Useful Links for IoT Applications and Use Cases:

http://52.16.186.190/resources/case-studies/
https://pressbooks.bccampus.ca/iotbook/chapter/iot-use-cases/
https://research.aimultiple.com/iot-applications/
https://www.jigsawacademy.com/101-applications-of-iot/
https://www.youtube.com/watch?v=xmt6OCBeS94
http://www.libelium.com/resources/case-studies

MOOC / NPTEL Course:

1. NPTEL Course on “Introduction to IoT”, by Prof. Sudip Misra, IIT Kharagpur
Link of the Course: https://nptel.ac.in/courses/106105166
2. NPTEL Course on “Introduction to Industry 4.0 and Industrial Internet of Things”, by Prof. Sudip Misra, IIT Kharagpur
Link of the Course: https://nptel.ac.in/courses/106105195

Virtual LAB Links:

Lab Name:

www.thingspeak.com/login:

Guidelines for Lab Assessment:

1.The laboratory assignments/experiments are to be submitted by students in the form of a journal.

2.Continuous assessment of laboratory work is done based on overall performance.

3.Each lab assignment/ experiment assessment will assign grade / marks based on parameters with appropriate weightage.

4.Suggested parameters for overall assessment as well as each lab assignment / experiment assessment include:

Timely completion Performance

Punctuality and neatness

Big Data and Cloud Computing Laboratory (EC408)

Teaching Scheme
Practical: 02 Hrs. / Week
Credits: 01

Examination Scheme
OR : 50 Marks
Total: 50 Marks

Prerequisite: Database Management Systems and SQL(EC303), Computer Organization and Architecture(EC204)

Course Objectives:

1. To understand key concepts of Hadoop Framework
2. To get familiar withBig Data analysis process
3. To study various platforms for cloud computing
4. To Learn Virtualization concepts in Cloud

Course Outcomes (COs):

After completion of course students will be able to

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
EC 408.1	Solve Big Data problems using different Frameworks	2	Understand
EC 408.2	Apply the Analytical concept of Big data using Hadoop MapReduce	3	Apply
EC 408.3	Develop cloud based applications	3	Apply
EC 408.4	Demonstrate the virtualization concepts in cloud environment	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs): -

COs	PO1	PO 2	PO3	PO4	PO 5	PO6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC408. 1	2	2	1	-	-	-	-	-	-	-	-	2	1	-
EC408. 2	2	2	3	1	2	-	-	-	-	-	-	1	2	-
EC408. 3	2	3	2	2	1	-	-	-	-	-	-	2	2	-
EC408. 4	3	1	2	1	1	-	-	-	-	-	-	1	2	-

Practical Course Contents:

Sr. No.	Title of Practical	COs

1.	Installation and configuration of one node Hadoop	EC408.1
2.	Create an application (Ex: Word Count) using Hadoop MapReduce.	EC408.2
3.	Installation and configuration of Apache Spark	EC408.1
4.	Read File(Ex: JSON) and write in DataFrame and vice versa using Spark Datasource API	EC408.1
5.	Installation and configuration of own Cloud	EC408.3
6.	Implementation of Virtualization in Cloud Computing using Open Source Operating System.	EC408.4
7.	Containerize Python/ Java application using Docker	EC408.3
8.	Case Study: To understand services of Microsoft Azure/ Amazon Elastic Cloud	EC408.3

Books:

Text Books:

1.Anthony T. Velte Toby J. Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, The McGraw-Hill.
2.Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology & Architecture, Pearson
3.Seema Acharya & Subhashini Chellappan,Big Data & Analytics,Wiley Publications

Reference Books:

1.Big Data, Black Book, DT Editorial services
2.Judith Hurwitz, Alan Nugent, Big Data For Dummies, Wiley India
3.KailashJayaswal, Jagannath Kallakurchi, Donald J. Houde, Cloud Computing Black Book , Dreamtech
4. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson

e-Resources:

1. NPTEL Course on “Cloud Computing”, by Prof. Soumya Kanti Ghosh, IIT Kharagpur
Link of the Course: https://nptel.ac.in/courses/106105167
2. NPTEL Course on “Big Data Computing” by Prof. Rajiv Misra,IIT Patna
Link of the Course :https://nptel.ac.in/courses/10610418
3. hadoop.apache.org/
4. spark.apache.org/

Guidelines for Lab Assessment:

1.The laboratory assignments/experiments are to be submitted by students in the form of a journal.
2.Continuous assessment of laboratory work is done based on overall performance.
3.Each lab assignment/ experiment assessment will assign grade / marks based on parameters with appropriate weightage.
4.Suggested parameters for overall assessment as well as each lab assignment / experiment assessment include:
Timely completion Performance
Punctuality and neatness

Project Stage I (EC409)

Teaching Scheme
Practical: 06 Hrs./Week
Credits: 03

Examination Scheme
OR : 50 Marks
TW: 100 Marks

Prerequisite:- Technical core knowledge and software skills.

Course Objectives:

1. To understand the Product Development Process including budgeting through Project.
2. To plan for various activities of the project and distribute the work amongst team members.
3. To inculcate electronic hardware or software implementation skills by artwork design, effective trouble-shooting practices, algorithm and model design.
4. Knowing the significance of aesthetics and ergonomics while designing electronic products and modeling.
5. To develop student's abilities to transmit technical information clearly and test the same by demonstration on the Project
6. To understand the importance of document design by compiling Technical reports on the Project work carried out.

Course Outcomes:- After completion of this course students will be able to:

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC409.1	Recognize the technical aspect and cost-estimation of the project.	1	Remember
EC409.2	Organize engineering problems based on experimental, statistical and computational methods to meet desired needs.	2	Understand
EC409.3	Design and simulate the project by using EDA tools or processes to meet desired needs within realistic constraints.	3	Apply
EC409.4	Work as a leader or productive member of a multi-disciplinary and multi-cultural team.	5	Evaluate
EC409.5	Design, simulate, and implement desired systems (hardware and software) by using modern and appropriate tools and techniques.	6	Create
EC409.6	Organize a technical report and demonstrate the project.	3	Apply

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC409.1	2	2	2	2	3	2	1	3	2	3	3	3	2	2
EC409.2	2	2	2	2	3	2	1	3	2	2	2	2	2	2
EC409.3	2	2	2	2	3	2	1	3	1	2	2	1	2	2
EC409.4	2	2	2	2	3	2	1	3	2	3	3	3	2	2
EC409.5	2	2	2	2	3	2	1	3	2	2	2	2	2	2

EC409.6	2	2	2	2	3	2	1	3	1	2	2	1	2	2

RULES AND REGULATIONS OF PROJECT:

1. Every student has to undertake project of professional nature and interest at various levels of study. The topic of the project may be related to theoretical analysis, an experimental investigation, a prototype design, new concept, analysis of data, fabrication and setup of new equipment etc. The student shall be evaluated for his/her project through the quality of work carried out, the novelty in the concept, the report submitted and presentation(s) etc.

2. The project should be undertaken preferably by a group of 3/4 students who will jointly work and implement the project in the two semesters.

3. A student has to carry out project under the guidance of a faculty from the same discipline unless specifically permitted by the Department Monitoring Committees (DMCs)* of the concerned departments in case of interdisciplinary projects or DMC* of the parent department in case of industry sponsored projects.

4. The project is divided into two stages. The first stage shall be carried out in Semester-VII while the second stage shall be carried out in Semester-VIII.

5. The quantum of work expected to be carried out by a student in each stage shall be in accordance with the division of credits given in Project Evaluation Scheme.

6. Students are expected to avoid plagiarism during the project work to secure full credits.

7. All claims should be supported by valid references in the report.

8. The decisions taken by the evaluators and examiners will be final.

9. The dissertation report (Synopsis, Project) is to be submitted in the prescribed format.

10. The Project report must be submitted by the prescribed date usually two weeks before the end of the academic session of the semester.

11. Different domains of the project: The students can choose any domain to work on as a project. The different domains are as follows;

- Block chain
- Data science
- Big data
- Machine learning
- Data analytics
- Cloud commuting
- IOT
- Artificial Intelligence
- AWS
- Quantum Computing
- Mobile Computing
- Applications of ANNs/Fuzzy/GA/Soft computing
- Virtual Reality/Augmented reality/Extended reality
- Digital trust
- 3D printing
- New energy solutions
- Computer vision and pattern recognition
- Computer security
- Distributed cloud environment
- DevOps
- Cybersecurity
- 5G and onwards networks

- Applications of microcontrollers/Embedded systems
- Communication Engineering
- Application of Networking
- Biomedical based
- Signal/Image processing
- VLSI Applications
- Robotics/Mechatronics/Process Automation
- Agricultural Engineering,etc.

12. The project stage-I and Project Stage-II reports should be submitted as per the prescribed format approved by the DMC.

Assessment of Project:-

Semester-VII Project Stage-I					
Sr. No	**Details**	**Evaluation By**	**Evaluation Type**	**Schedule**	**Marks**
1	Synopsis Approval Presentation	DMC	Approved/Not Approved	2nd Week of July	Y/N
2	Demonstration of 25% project Completion (Literature survey and block Diagram/flow chart/development of software)	Project Guide + DMC	SE1 by GA	2nd Week of August	50 Marks (30+20)
3	Demonstration of 25% to 75 % project Completion (Circuit Diagram, power Supply design, Module Design,software Simulation)	DMC	SE2 by GA	3rd Week of September	50 Marks
4	Presentation and demonstration of 100% Project Completion	Panel of Examiners comprising of guide, external examiner and chairman	ESE	2nd week of November	50 marks

DMC- Department Monitoring Committee
GA- Group Activity
SE- Shuffle Examination
ESE-End Sem Examination

Sanjivani Rural Education Society's

Sanjivani College of Engineering, Kopargaon

(An Autonomous Institute Affiliated to Savitribai Phule Pune University, Pune)

B. Tech. Electronics and Computer Engineering

2020 Pattern

Proposed Program Structure

(B. Tech. with effect from Academic Year 2020-2021)

(B. Tech. Sem-VIII with effect from Academic Year 2023-2024)

At. Sahajanandnagar, Post. Shingnapur Tal. Kopargaon Dist. Ahmednagar,

Maharashtra State, India PIN 423603

List of Abbreviations			
Abbreviation	**Full Form**	**Abbreviation**	**Full Form**
BSC	**Basic Science Course**	**OEC**	**Open Elective Course**
Cat	**Category**	**OR**	**End Semester Oral Examination**
CIA	**Continuous Internal Assessment**	**P**	**Practical**
ESE	**End-Semester Evaluation**	**PCC**	**Professional Core Course**
HSMC	**Humanities/Social Sciences/Management Course**	**PEC**	**Professional Elective Course**
IP	**Induction Program**	**PR**	**End Semester Practical Examination**
L	**Lecture**	**PROJ**	**Project**
LC	**Laboratory Course**	**T**	**Tutorial**
MLC	**Mandatory Learning Course**	**TW**	**Continuous Term Work Evaluation**

Final Year B. TECH. 2020 Pattern (Electronics and Computer Engineering)

SEMESTER-VIII

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks					
							Theory					
Cat	Code	Title	L	T	P	Credits	CIA	ESE	OR	PR	TW	Total
OEC	EC411	OE-I:	3	-	-	3	25	75	-	-	-	100
OEC	EC412	OE-II:	3	-	-	3	25	75	-	-	-	100
OEC	EC413	OE-III :	2	-	-	2	25	75	-	-	-	100
PROJ	EC414	Industrial Internship	-	-	12	6	-	-	50	-	100	150
PROJ	EC415	Project Stage-II	-	-	04	2	-		50	-		50
		Total	**8**	**-**	**16**	**16**	**75**	**225**	**100**	**-**	**100**	**500**

Total Credits: 38 **Total Marks: 1300**

		NPTEL Course Title (July to Oct 2023)
Open Elective -1	EC411A	Deep Learning - IIT Ropar
	EC411B	Ethical Hacking
	EC411C	Organizational Behavior
	EC411D	Programming In Java
Open Elective -II	EC412A	Introduction To Algorithms And Analysis
	EC412B	Modern Digital Communication Techniques
	EC412C	Natural Language Processing
	EC412D	E-Business
Open Elective -III	EC413A	Hardware Modeling Using Verilog
	EC413B	Financial Accounting
	EC413C	Project Management
	EC413D	Google Cloud Computing Foundations
	EC413E	Data Science For Engineers

(Dr. B. S. Agarkar)
HOD and Chairman BoS
ECE

(Dr. A. B. Pawar)
Dean Academics

(Dr. A. G. Thakur)
Director and Chairman
Academic Council

OPEN ELECTIVE

All the students of Final Year ECE (Academic Year 2023-2024) have to select one open elective each from a given list of Open Elective-1, Open Elective-2 and Open Elective-3.

Students can complete this open elective in the VIIth or/and VIIIth Sem.

Students have to register themselves by selecting the mentor given in the below table only for the selected course. The selection of mentors is essential to keep the track of registered students for Open Elective.

NPTEL Courses offered during July to Oct 2023 (Academic Year 2023-2024)

	NPTEL Course Title	Weeks	Start Date	Name of Staff mentor	Link to join the course
Open Elective -1	Deep Learning - IIT Ropar	12 Weeks	July 24, 2023	Prof. S. S. Kulkarni	https://onlinecourses.nptel.ac.in/noc23_cs110/preview
	Ethical Hacking	12 Weeks	July 24, 2023	Prof. N. Y. Siddiqui	https://onlinecourses.nptel.ac.in/noc23_cs75/preview
	Organizational Behavior	12 Weeks	July 24, 2023	Dr. N. K. Darwante	https://onlinecourses.nptel.ac.in/noc23_mg73/preview
	Programming In Java	12 Weeks	July 24, 2023	Prof. N. I. Bhopale	https://onlinecourses.nptel.ac.in/noc23_cs74/preview
Open Elective -2	Introduction To Algorithms And Analysis	12 Weeks	July 24, 2023	Prof. M. A. Sayyad	https://onlinecourses.nptel.ac.in/noc23_cs88/preview
	Modern Digital Communication Techniques	12 Weeks	July 24, 2023	Prof. D. G. Lokhande	https://onlinecourses.nptel.ac.in/noc23_ee113/preview
	Natural Language Processing	12 Weeks	July 24, 2023	Prof. N. D. Kapale	https://onlinecourses.nptel.ac.in/noc23_cs80/preview
	E-Business	12 Weeks	July 24, 2023	Prof. D. P. Mahurkar	https://onlinecourses.nptel.ac.in/noc23_mg88/preview
Open Elective -3	Hardware Modeling Using Verilog	8 Weeks	July 24, 2023	Prof. S. K. Gupta	https://onlinecourses.nptel.ac.in/noc23_cs76/preview
	Financial Accounting	8 Weeks	July 24, 2023	Prof. P. M. Vibhute	https://onlinecourses.nptel.ac.in/noc23_mg80/preview
	Project Management	8 Weeks	July 24, 2023	Dr. S. V. Chaudhary	https://onlinecourses.nptel.ac.in/noc23_mg69/preview
	Google Cloud Computing Foundations	8 Weeks	Aug 21, 2023	Prof. G. A. Bhatane	https://onlinecourses.nptel.ac.in/noc23_cs90/preview
	Data Science For Engineers	8 Weeks	July 24, 2023	Prof. Y. R. Khandekar	https://onlinecourses.nptel.ac.in/noc23_cs97/preview

NPTEL Courses offered during Jan to April 2024 (Academic Year 2023-2024)

	NPTEL Course Title	Weeks	Start Date	Name of Staff mentor	Link to join the course
Open Elective -1	Deep Learning - IIT Ropar	12 Weeks	Jan 22, 2024	Prof. S. S. Kulkarni	https://onlinecourses.nptel.ac.in/noc24_cs59/preview
	An Introduction to Artificial Intelligence	12 Weeks	Jan 22, 2024	Dr. B. S. Agarkar	https://onlinecourses.nptel.ac.in/noc24_cs08/preview
	Organizational Behaviour: Individual Dynamics in Organization	12 Weeks	Jan 22, 2024	Dr. N. K. Darwante	https://onlinecourses.nptel.ac.in/noc24_mg45/preview
	Programming In Java	12 Weeks	Jan 22, 2024	Prof. N. I. Bhopale	https://onlinecourses.nptel.ac.in/noc24_cs43/preview
Open Elective -2	Digital Design with Verilog	12 Weeks	Jan 22, 2024	Prof. S. K. Gupta	https://onlinecourses.nptel.ac.in/noc24_cs61/preview
	Principles of Digital Communication	12 Weeks	Jan 22, 2024	Prof. D. G. Lokhande	https://onlinecourses.nptel.ac.in/noc24_ee25/preview
	Natural Language Processing	12 Weeks	Jan 22, 2024	Prof. N. D. Kapale	https://onlinecourses.nptel.ac.in/noc24_cs39/preview
	E-Business	12 Weeks	Jan 22, 2024	Prof. D. P. Mahurkar	https://onlinecourses.nptel.ac.in/noc24_mg16/preview
Open Elective -3	Project Management	8 Weeks	Jan 22, 2024	Dr. S. V. Chaudhary	https://onlinecourses.nptel.ac.in/noc24_mg01/preview
	Embedded System Design with ARM	8 Weeks	Jan 22, 2024	Prof. M. A. Sayyad	https://onlinecourses.nptel.ac.in/noc24_cs24/preview
	Cloud Computing and Distributed Systems	8 Weeks	Jan 22, 2024	Prof. G. A. Bhatane	https://onlinecourses.nptel.ac.in/noc24_cs09/preview
	Data Science For Engineers	8 Weeks	Jan 22, 2024	Prof. Y. R. Khandekar	https://onlinecourses.nptel.ac.in/noc24_cs53/preview

Industrial Internship (EC414)

Teaching Scheme
PR : 12 Hrs/Week

Credits: 06

Examination Scheme
OR: 50 Marks
TW: 100 Marks
Total : 150 Marks

Prerequisite: Engineering Knowledge

Course Objectives:

1. To encourage and provide opportunities for students to get professional/personal experience through internships.
2. To learn and understand real life/industrial situations.
3. To get familiar with various tools and technologies used in industries and their applications.
4. To nurture professional and societal ethics.
5. To create awareness of social, economic and administrative considerations in the working environment of industry /organizations.
6. To learn integration of conceptual aspects & practical world.

Course Outcomes (COs): After completion of course, students will be able to

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC414.1	Explain professional competence through industry internship.	2	Understand
EC414.2	Apply knowledge gained through internships to complete academic activities in a professional manner.	3	Apply
EC414.3	Classifying the appropriate technology and tools to solve given problem.	2	Understand
EC414.4	To demonstrate abilities of a responsible professional and use ethical practices in day-to-day life.	2	Understand
EC414.5	Creating network and social circle and developing relationships with industry people.	3	Apply
EC414.6	To analyze various career opportunities and decide carrier goals.	3	Apply

Mapping of Course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC414.1	2	2	2	2	3	1	1	3	1	2	1	1	1	1
EC414.2	1	2	2	2	3	2	1	3	1	2	2	1	2	1
EC414.3	-	-	-	-	-	1	-	-	2	2	1	1	1	2
EC414.4	2	-	-	-	-	2	2	3	-	1	-	2	2	1
EC414.5	-	-	-	-	-	1	2	1	1	1	2	1	1	2
EC414.6	-	-	-	-	-	1	-	2	2	1	-	2	1	1

Internship provides an excellent opportunity to learner to see how the conceptual aspects learned in classes are integrated into the practical world. Industry internship provides much more professional experience as value addition to classroom teaching.

Guidelines:

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales.

Core objective is to expose technical students to the industrial environment, which cannot be simulated/experienced in the classroom and hence creating competent professionals in the industry and to understand the social, economic and administrative considerations that influence the working environment of industrial organizations.

Engineering internships are intended to provide students with an opportunity to apply conceptual knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Final Year Engineering curriculum.

Duration:

Internship is to be completed after semester 7 and before commencement of semester 8 of at least 4 to 6 weeks; and it is to be assessed and evaluated in semester 8.

Internship work Identification:

Students may choose to undergo Internship at Industry/Govt. Organizations/NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry [1].

Students must register at Intern Shala [2]. Students must get Internship proposals sanctioned from college authority well in advance. Internship work identification process should be initiated in the VIth semester in coordination with training and placement cell/ industry institute cell/ internship cell. This will help students to start their internship work on time. Also, it will allow students to work in vacation period after their VIth semester examination and before academic schedule of semester VII.

Student can take internship work in the form of the following but not limited to:

- Working for consultancy/ research project,
- Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /
- Learning at Departmental Lab/Tinkering Lab/ Institutional workshop,
- Development of new product/ Business Plan/ registration of start-up,
- Industry / Government Organization Internship,
- Internship through Internshala,
- In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship,
- Research internship under professors, IISC, IIT's, Research organizations,
- NGOs or Social Internships, rural internship,
- Participate in open-source development.

Internship Workbook:

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed every day by the supervisor.

Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training.

Internship Work Evaluation:

Every student is required to prepare a maintain documentary proofs of the activities done by him as internship diary or as workbook. The evaluation of these activities will be done by Programme Head/Cell In-charge/ Project Head/ faculty mentor or Industry Supervisor based on- Overall compilation of internship activities, sub-activities, the level of achievement expected, evidence needed to assign the points and the duration for certain activities.

Assessment and Evaluation is to be done in consultation with internship supervisor (Internal and External – a supervisor from place of internship.

Recommended evaluation parameters:

Internship /Workbook and Internship Report - 50 Marks

Evaluation through Seminar Presentation/Viva-Voce at the Institute-

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Depth of knowledge and skills
- Communication & Presentation Skills
- Team Work
- Creativity
- Planning & Organizational skills
- Adaptability
- Analytical Skills
- Attitude & Behavior at work
- Societal Understanding
- Ethics
- Regularity and punctuality
- Attendance record
- Diary/Work book
- Student's Feedback from External Internship Supervisor

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period.

Internship workbook may be evaluated on the basis of the following criteria:

- Proper and timely documented entries
- Adequacy & quality of information recorded
- Data recorded
- Thought process and recording techniques used
- Organization of the information

The report shall be presented covering following recommended fields but limited to,

- Title/Cover Page
- Internship completion certificate
- Internship Place Details- Company background-organization and activities/Scope and object of the study / Supervisor details
- Index/Table of Contents
- Introduction
- Title/Problem statement/objectives
- Motivation/Scope and rationale of the study
- Methodological details
- Results / Analysis /inferences and conclusion
- Suggestions / Recommendations for improvement to industry, if any

•Attendance Record
•Acknowledgement
•List of references (Library books, magazines and other sources)

Feedback from internship supervisor (External & Internal)

Post internship, faculty coordinator should collect feedback about student with recommended parameters include as- Technical knowledge, Discipline, Punctuality, Commitment, Willingness to do the work, Communication skill, individual work, Team work, Leadership….

Reference:

https://www.aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

https://internship.aicte-india.org/

Project Stage II (EC415)

Teaching Scheme
Practical: 04 Hrs./Week
Credits: 02

Examination Scheme
OR : 50 Marks

Prerequisite:-

Course Objectives:

1. To understand the Product/software Development Process including budgeting through Project.
2. To plan for various activities of the project and distribute the work amongst team members.
3. To inculcate electronic hardware or software implementation skills by artwork design, effective trouble-shooting practices, algorithm and model design.
4. Knowing the significance of aesthetics and ergonomics while designing electronic products and modeling.
5. To develop student's abilities to transmit technical information clearly and test the same by demonstration on the Project
6. To understand the importance of document design by compiling Technical reports on the Project work carried out.

Course Outcomes:- After completion of this course students will be able to:

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC415.1	Recognize the technical aspect and cost-estimation of the project.	1	Remember
EC415.2	Organize engineering problems based on experimental, statistical and computational methods to meet desired needs.	2	Understand
EC415.3	Design and simulate the project by using EDA tools or processes to meet desired needs within realistic constraints.	3	Apply
EC415.4	Work as a leader or productive member of a multi-disciplinary and multi-cultural team.	5	Evaluate
EC415.5	Design, simulate, and implement desired systems (hardware and software) by using modern and appropriate tools and techniques.	6	Create
EC415.6	Organize a technical report and demonstrate the project.	3	Apply

Mapping of course Outcomes to Program Outcomes (POs) & Program Specific Outcomes (PSOs)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC415.1	2	2	2	2	3	2	1	3	2	3	3	3	2	2
EC415.2	2	2	2	2	3	2	1	3	2	2	2	2	2	2
EC415.3	2	2	2	2	3	2	1	3	1	2	2	1	2	2
EC415.4	2	2	2	2	3	2	1	3	2	3	3	3	2	2
EC415.5	2	2	2	2	3	2	1	3	2	2	2	2	2	2
EC415.6	2	2	2	2	3	2	1	3	1	2	2	1	2	2

Guidelines:

- It is recommended to evaluate "final year project stage II -Oral " BASED ON OUTCOME.

  The proposed evaluation guidelines are as follows.

  1. 25% weightage is reserved for the knowledge & contribution of Individual's during oral examination.

  2. The remaining 75% weightage is to be reserved for the outcome. As one project can have a common outcome, these marks will be the same for all the project partners.

  Each possible outcome with the corresponding weightage among the remaining 75% is as follows:-

Sr No.	Proposed Outcome	Parameter	Weightage
1.	Sponsored project/ Consultancy/ turnkey projects	Sponsorship Amount >Rs. 10K. Sponsorship Amount <Rs. 10K. Sponsorer is reputed industry & the project expenses are born by them (based on industry) Sponsorship without financial assistance	100% 90% 90% 80%
2.	Publication	International Journal (Scopus/SCI) National Journal(Scopus/SCI) International Conference(Scopus/SCI) National Conference(Scopus/SCI) Open Access(Paid) Journal Conference(Other)	100% 100% 100% 90% 80% 75%
3.	Research grant or funding	New Proposal Filled(along with faculty) Assistance in Already Sectioned Project Individual Application filled(any amount)	100% 90% 100%
4.	Patent	Patent application Filed Successfully	100%
5.	Startup	If registered If Incubated in Sanjivani Incubation Center	100% 100%
6.	National/International project competition.	Winner 1st Runner Up 2nd Runner Up Participated (International) Participated (National) Participated (State) Participated (Regional)	100% 100% 100% 95% 85% 80% 75%
7.	Projects addressing special problems of society.	If successfully implemented and accepted by the intended client (training to next year student for operation and maintenance is a must)	100%
8.	Projects addressing the special needs of the department or institute.	If successfully implemented in Campus (training to next year student for operation and maintenance is a must)	100%

- **Review I:** Online review shall be conducted one and half months from the start of semester.
  - ➢ Project Review committee & Project Guide shall take review of progress in direction to achieve outcome.
  - ➢ Project Review committee & Project Guide shall give necessary guidelines to achieve outcome.
  - ➢ Project coordinator shall maintain record of Review .
- **Review II:** Online review shall be conducted two and half months from the start of semester.
  - ➢ Project Review committee & Project Guide shall take review of progress in direction to achieve outcome.
  - ➢ Project Review committee & Project Guide shall give necessary guidelines to achieve outcome.
  - ➢ Project coordinator shall maintain record of Review .
- **Project work Repository**
  - ➢ To ensure easy accessibility and maintenance of project work records, all projects should be available on web repositories like Gitlab/Github.
  - ➢ Students should upload their documents periodically and make them readily available to the faculties for further documentation.
  - ➢ In addition ,at the end of the final semester, each student must submit a DVD labeled with the student's name, roll number, department, and project title.
  - ➢ DVD should contain the following details:
    1. Final copy of complete project report
    2. Details of the required software/hardware used in the project
    3. A 1-minute recorded video of the project execution and a short summary
    4. A detailed PowerPoint presentation of the project
    5. Source code and its execution summary
    6. Patent copy/project exhibition participation certificate/conference participation certificate.
    7. Soft copy of published research paper, if applicable
- **Report submission in hard bound form**
  - ➢ Students should prepare report in latex as per given templete.
  - ➢ Plagiarism check report should be included in the report.