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 2021 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.

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

S. Y. B. TECH. *2021 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	CIA	ESE				
BSC	EC201	Discrete Mathematics and Information Theory	3	-	-	3	40	60	-	-	-	100
PCC	EC202	Electronic Devices and Circuits	4	-	-	4	40	60	-	-	-	100
PCC	EC203	Digital Design and HD Language	4	-	-	4	40	60	-	-	-	100
PCC	EC204	Computer Organization and Architecture	3	-	-	3	40	60	-	-	-	100
HSMC	HS205	Universal Human Values & Ethics	3	-	-	3	40	60	-	-	-	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 Design and HDL Laboratory	-	-	2	1	-	-	-	50	-	50
LC	EC209	Electronics and Computer Workshop	-	-	2	1	-	-	50	-	-	50
MC	MC210	Mandatory Course-III Constitution of India – Basic features and fundamental principles	2	-	-	No	-	-	-	-	-	-
		Total	**19**	**1**	**6**	**21**	**200**	**300**	**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	CIA	ESE				
BSC	BS202	Engineering Mathematics - III	3	1	-	4	40	60	-	-	-	100
PCC	EC212	Principles of Communication	3	-	-	3	40	60	-	-	-	100
PCC	EC213	Fundamentals of DSP	3	-	-	3	40	60	-	-	-	100
PCC	EC214	Microcontroller & Microprocessor	3	-	-	3	40	60	-	-	-	100
PCC	EC215	Software Engineering, modeling and design	4	-	-	4	40	60	-	-	-	100
HSMC	HS216	Corporate Readiness-I	-	-	2	1					50	50
LC	EC217	POC Laboratory	-	-	2	1	-	-	-	25	-	25
LC	EC218	Fundamentals of DSP Laboratory	-	-	2	1	-	-		25		25
PROJ	EC219	Microcontroller & Microprocessor Laboratory	-	-	2	1	-	-	-	-	50	50
PROJ	EC220	PBL/Choice Based Subject	1	-	2	2	-	-	50	-	-	50
MC	MC221	Mandatory Course-IV Innovation - Project based – Sc., Tech, Social, Design & Innovation	2	-	-	No	-	-	-	-	-	Pass/ fail
		Total	**19**	**1**	**10**	**23**	**200**	**300**	**50**	**50**	**100**	**700**

Total Credits: 44 **Total Marks: 1400**

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

(Dr. A. B. Pawar)
Dean Academics

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

T. Y. B. TECH. *2021 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	ESE	OR	PR	TW	Total
PCC	EC301	Design and analysis of Algorithms	4		-	4	40	60	-	-	-	100
PCC	EC302	Analog Circuits and Control Systems	3	-	-	3	40	60	-	-	-	100
PCC	EC303	DBMS and SQL	3	-	-	3	40	60	-	-	-	100
PCC	EC304	Theory of Computations	3	1	-	4	40	60	-	-	-	100
PEC	EC305	Refer List of PEC1	3	-	-	3	40	60	-	-	-	100
HSMC	HS306	Corporate Readiness-II	-	-	2	1					50	50
LC	EC307	Analog Circuits and Control Systems Laboratory	-	-	2	1	-	-	-	50	-	50
LC	EC308	DBMS & SQL Laboratory	-	-	2	1	-	-	-	50	-	50
PROJ	EC309	Seminar & Communication Skill	-	-	4	2	-	-	50	-	-	50
MC	MC310	Mandatory Course-V: Sanjivani ECE Talks	1	-	-	Non Credit	-	-	-	-	-	Pass/ Fail
		Total	**17**	**1**	**10**	**22**	**200**	**300**	**50**	**100**	**50**	**700**

SEMESTER-VI

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/ Max Marks					
							Theory					
Cat	Code	Title	L	T	P	Credits	CIA	ESE	OR	PR	TW	Total
PCC	EC311	Embedded Systems and RTOS	4	-	-	4	40	60	-	-	-	100
PCC	EC312	System Programming and Operating System	3	-	-	3	40	60	-	-	-	100
PCC	EC313	Web Technology and APP Design	3	-	-	3	40	60	-	-	-	100
PEC	EC314	Refer List of PEC2	3	-	-	3	40	60	-	-	-	100
PROJ	EC315	Project Based Learning	-	-	2	1	-	-	-	-	50	50
PROJ	EC316	IPR & EDP	2	-	-	2	20	30	-	-	-	50
LC	EC317	Embedded Systems and RTOS 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	**16**	**-**	**10**	**20**	**180**	**270**	**50**	**100**	**100**	**700**

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

Total Credits: 42

Total Marks: 1400

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

(Dr. A. B. Pawar)
Dean Academics

SANJIVANI COLLEGE OF ENGINEERING KOPARGAON Approved

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

T. Y. B. TECH. *2021 Pattern* (Electronics and Computer Engineering) SEMESTER-VI

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/ Max Marks					
							Theory					
Cat	Code	Title	L	T	P	Credits	CIA	ESE	OR	PR	TW	Total
PCC	EC311	Embedded Systems and RTOS	4	-	-	4	40	60	-	-	-	100
PCC	EC312	System Programming and Operating System	3	-	-	3	40	60	-	-	-	100
PCC	EC313	Web Technology	3	-	-	3	40	60	-	-	-	100
PEC	EC314	Refer List of PEC2	3	-	-	3	40	60	-	-	-	100
PROJ	EC315	Project Based Learning	-	-	2	1	-	-	-	-	50	50
PROJ	PR316	IPR & EDP	2	-	-	2	20	30	-	-	-	50
LC	EC317	Embedded Systems and RTOS 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	**16**	**-**	**10**	**20**	**180**	**270**	**50**	**100**	**100**	**700**

Professional Elective Course 2 (PEC2):	
EC314A	Advanced Digital Signal Processing
EC314B	Power Electronics and Drives
EC314C	Data Mining

B Tech Honors in Embedded Systems and IoT w. e. f. Academic Year 2023-24

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	60	40	-	-	-	100
LC	EC8103	Embedded system hardware and software design Lab	-	-	2	1	-	-	-	50	-	50
		Total	**4**	**-**	**2**	**5**	**60**	**40**	**-**	**50**	**-**	**150**

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

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	60	40	-	-	-	100
		Total	**4**	**-**	**-**	**4**	**60**	**40**				**100**

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

(Dr. A. B. Pawar)
Dean Academics

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

SANJIVANI COLLEGE OF ENGINEERING, KOPARGAON
Approved

Final Year B. TECH. *2021 Pattern* (Electronics and Computer Engineering)

SEMESTER-VII

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks					
							Theory		OR	PR	TW	Total
Cat	Code	Title	L	T	P	Credits	CIA	ESE				
PCC	EC401	Deep Learning	3	-	-	3	40	60	-	-	-	100
PCC	EC402	IoT & WSN	3	-	-	3	40	60	-	-	-	100
PCC	EC403	Computer Networks and Security	3	-	-	3	40	60	-			100
PEC	EC404	Refer List of PEC3	4	-	-	4	40	60	-	-	-	100
PEC	EC405	Refer List of PEC4	3	-	-	3	40	60	-	-	-	100
LC	EC406	Deep Learning 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**	**200**	**300**	**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 Computing	EC405C	Big Data & Cloud Computing

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

	Code	NPTEL Course Title
Open Elective -I	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

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B. Tech. Electronics and Computer Engineering

2021 Pattern

Proposed Program Structure

(B. Tech. with effect from Academic Year 2021-2022)

(Revised S Y B. Tech. Sem-III 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 S. Y. B. Tech. Semester-IV of 2021 Pattern w.e.f A.Y 2022-2023 as per the guidelines. This document also contain 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

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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

S. Y. B. TECH. *2021 Pattern* (Electronics and Computer Engineering) SEMESTER-III

Course			Teaching Scheme (Hours/week)				Evaluation Scheme- Marks					
							Theory					
Cat	Code	Title	L	T	P	Credits	ESE	CIA	OR	PR	T W	Total
BSC	EC201	Discrete Mathematics and Information Theory	3	-	-	3	60	40	-	-	-	100
PCC	EC202	Electronic Devices and Circuits	4	-	-	4	60	40	-	-	-	100
PCC	EC203	Digital Design and HD Language	4	-	-	4	60	40	-	-	-	100
PCC	EC204	Computer Organization and Architecture	3	-	-	3	60	40	-	-	-	100
HSMC	HS205	Universal Human Values & Ethics	3	-	-	3	60	40	-	-	-	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 Design and HDL Laboratory	-	-	2	1	-	-	-	50	-	50
LC	EC209	Electronics and Computer Workshop	-	-	2	1	-	-	50	-	-	50
MC	MC210	Mandatory Course-III Constitution of India – Basic features and fundamental principles	2	-	-	Non Credit	-	-	-	-	-	Pass/ fail
		Total	**19**	**1**	**6**	**21**	**300**	**200**	**50**	**100**	**50**	**700**

SEMESTER-IV

Course			Teaching Scheme (Hours/week)				Evaluation Scheme- Marks					
							Theory					
Cat	Code	Title	L	T	P	Credits	ESE	CIA	OR	PR	T W	Total
BSC	BS202	Engineering Mathematics - III	3	1	-	4	60	40	-	-	-	100
PCC	EC212	Principles of Communication	3	-	-	3	60	40	-	-	-	100
PCC	EC213	Fundamentals of DSP	3	-	-	3	60	40	-	-	-	100
PCC	EC214	Microcontroller & Microprocessor	3	-	-	3	60	40	-	-	-	100
PCC	EC215	Software Engineering, modeling and design	4	-	-	4	60	40	-	-	-	100
HSMC	HS216	Corporate Readiness-I	-	-	2	1					50	50
LC	EC217	POC Laboratory	-	-	2	1	-	-	-	25	-	25
LC	EC218	Fundamentals of DSP Laboratory	-	-	2	1	-	-		25		25
PROJ	EC219	Microcontroller & Microprocessor Laboratory	-	-	2	1	-	-	-	-	50	50
PROJ	EC220	PBL/Choice Based Subject	1	-	2	2	-	-	50	-	-	50
MC	MC221	Mandatory Course-IV Innovation - Project based – Sc., Tech, Social, Design & Innovation	2	-	-	No	-	-	-	-	-	Pass/ fail
		Total	**19**	**1**	**10**	**23**	**300**	**200**	**50**	**50**	**100**	**700**

Total Credits: 44 **Total Marks: 1400**

Discrete Mathematics and Information Theory (EC201)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
CIA: 40 Marks
ESE: 60 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 propositional 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	2	3	1	0	2	-	-	-	3	3	-	3	-	2
EC201.4	2	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	6	EC201.6

	word lengths, Best prefix-free codes, Huffman codes, Lossy source coding with fixed code word lengths, Channel coding and cyclic codes.		

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. Self learning through presentation on Units I-VI

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Electronic Devices and Circuits (EC202)

Teaching Scheme
Lectures: 04 Hrs. / Week

Credits: 4

Examination Scheme
CIA: 40 Marks
End-Sem Exam: 60 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:

CO	CO Statement	Bloom's 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 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.	6 Hrs.	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	8 Hrs.	EC202.1 EC202.2

	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.		
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	8 Hrs.	EC202.2 EC202.3
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.	7 Hrs.	EC202.4
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 complimentary-symmetry stages, Distortions in amplifiers, Concept of Total Harmonic Distortion (THD).	8 Hrs.	EC202.5
Unit-VI	Voltage Regulators	No. of Hours	COs
	Block diagram of an adjustable three terminal positive and negative regulators (317,337).Typical connection diagram, current boosting. Low drop out 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.	EC202.6

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

CIA: 20 Marks Test on All units & Self Learning for 20 Marks

Digital Design and HD Language (EC203)

Teaching Scheme:
Lectures: 04 Hrs. / Week

Credits: 04

Examination Scheme:
CIA: 40 Marks
End-Sem Exam: 60 Marks
Total: 100 Marks

Prerequisite : Basic Knowledge of Logic Gates

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:

CO	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 Hrs.	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 Hrs.	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 Hrs.	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 Hrs.	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 Hrs.	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 Hrs.	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:

1. Test 1 will be conducted on UNIT 1 & UNIT 2 for 20 marks.

2. Test 2 will be conducted on UNIT 3 & UNIT 4 for 20 marks.

3. Test 3 will be conducted on UNIT 5 & UNIT 6 for 20 marks.

4. Poster Making/[Any Activity] will be conducted for 20 marks.

Total Marks(40) = Average of all Tests(20) + Poster Making/[Any Activity](20)

Computer Organization and Architecture (EC204)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
CIA: 40 Marks
End-Sem Exam: 60 Marks
Total: 100 Marks

Prerequisite course: Basic Electrical and Electronics Engineering Lab.

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

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC204.1	Explain the fundamental principles of computer.	2	Understand
EC204.2	Generalize the functionality of memories in microprocessor.	2	Understand
EC204.3	Illustrate the features of 8086 microprocessor.	2	Understand
EC204.4	Explain instruction set in microcontroller.	2	Understand
EC204.5	Execute basic Assembly Language Programs (ALP).	3	Apply
EC204.6	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
EC204.1	3	---	1	---	1	---	---	---	---	---	---	2	1	---
EC204.2	2	---	1	---	2	---	---	---	---	---	---	1	1	---
EC204.3	1	---	2	1	1	---	---	---	---	---	---	1	2	---
EC204.4	1	---	1	1	3	---	---	---	---	---	---	2	3	---
EC204.5	2	---	1	1	3	---	---	---	---	---	---	1	2	---
EC204.6	2	1	1	1	2	---	---	---	---	---	---	1	2	---

Course Contents

Unit-I	**Computer Evolution**	No. of Hours	COs
	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	EC204.1
Unit-II	**Computer Memory System**	No. of Hours	

	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: Semiconductor main memory, advanced DRAM organization. External Memory: Hard Disk organization	06	EC204.2
Unit-III	**Introduction to 8086**	No. of Hours	
	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	EC204.3
Unit-IV	**Introduction to Microcontroller**	No. of Hours	
	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	EC204.4
Unit-V	**Instruction sets in Microcontroller**	No. of Hours	
	Registers, addressing modes and instruction set of 8051, Structure of Assembly Language Programming, Introduction to simulation of 8051, Simple programs with 8051.	07	EC204.5
Unit-VI	**Timers and Interrupts in Microcontroller**	No. of Hours	
	Timer and Programming with Timer, interrupts and programming external hardware interrupts, Programming for serial communication interrupts, Programming for counters. Introduction and interfacing of ADC with 8051.	07	EC204.6

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:

1. Test1 will be conducted on UNIT1 & UNIT2 for 20 marks.
2. Test2 will be conducted on UNIT3 & UNIT4 for 20 marks.
3. Test3 will be conducted on UNIT5 & UNIT6 for 20 marks.
4. Programming Assignment will be conducted for 20 marks.

Total marks(40) = Average of all Tests(20) + Programming Assignment(20)

Universal Human Values and Ethics (HS205)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
CIA: 40 Marks
ESE: 60 Marks
Total: 100 Marks

Prerequisite: Nil

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
Tutorial: 01 Hr. / Week
Credits: 01

Examination Scheme
TW: 50 Marks
Total: 50 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
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 propositional 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
Practical: 2 Hrs. / Week
Credits: 01

Examination Scheme
PR: 50 Marks
Total: 50 Marks

Prerequisite : Basic knowledge of Semiconductor Physics.

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:

CO	CO Statement	Bloom's 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):

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC207.1	-	-	-	-	-	-	-	2	2	-	-	3	1	-
EC207.2	-	-	-	-	3	-	-	2	2	-	-	3	2	2
EC207.3	-	-	-	-	3	-	-	2	2	-	-	3	2	3
EC207.4	-	-	-	-	3	-	-	2	2	-	-	3	2	3
EC207.5	-	-	-	-	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 Design and HDL Laboratory (EC208)

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

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

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Prerequisite : Basic Knowledge of Logic Gates

Course Objectives:

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

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

CO	CO Statement	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):

CO	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 (Minimum 8 Practicals to be performed)	COs
1. Design and Implement 8:1 MUX using IC-74LS153 & Verify its Truth Table.	EC208.1, EC208.2
2. Design and Implement full adder / subtractor function using IC- 74LS138.	EC208.1, EC208.2
3. Design & Implement 3-bit code converter using IC-74LS138.(Binary to Gray)	EC208.1, EC208.2
4. Design and Implement 4-bit Comparator.	EC208.1, EC208.2
5. Design and Implement MOD-N using IC-74LS90 and draw a Timing diagram.	EC208.1, EC208.2
6. Design and Implement MOD-N using IC-74LS93 and draw Timing diagram	EC208.1, EC208.2
7. Design & Implement 4-bit Up/down Counter and MOD-N Up/down Counter using IC74HC191/ IC74HC193.	EC208.1, EC208.2
8. Design and Implement 4-bit Ring Counter/ Twisted ring Counter using shift registers IC 74HC194/IC74LS95.	EC208.1, EC208.2
9. To measure various TTL and CMOS parameters.	EC208.1, EC208.2
10. Write, simulate and verify, VHDL Code for four bit logical and arithmetic operations for ALU.	EC208.1, EC208.3
11. Write, simulate and verify, VHDL Code for D / JK flip flop.	EC208.1, EC208.3
12. Write a Verilog code for Half Adder.	EC208.1, EC208.3

Note: For each experiment refer datasheets. and we can simulate experiments using Virtual Labs (Optional).	

Electronics and Computer Workshop (EC209)

Teaching Scheme
Practical: 2 Hrs. / Week
Credits: 01

Examination Scheme
OR: 50 Marks,
Total: 50 Marks

Prerequisite : NIL

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

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC209.1	Acquire a basic knowledge about resistor, capacitor and inductor	2	Understand
EC209.2	Acquire a basic knowledge of operating Multi-meter, CRO, Power supply, Function generator.	2	Understand
EC209.3	Identify the components of computer	2	Understand
EC209.4	Install the operating systems	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
EC209.1	3	-	-	-	2	-	-	-	-	-	-	-	1	-
EC209.2	3	-	-	-	2	-	-	-	-	-	-	-	2	-
EC209.3	3	-	-	-	-	-	-	-	-	-	-	-	2	-
EC209.4	3	-	-	-	3	-	-	-	-	-	-	-	2	-

Course Contents

Experiment No.	**Title**	COs
1.	Study of basic electronics components.	EC209.1
2.	Demonstration of front and rear panel electronics instruments (Power supply, function generator, etc)	EC209.2
3.	Study of electronics measuring instruments (True RMS, Multi-meter, CRO, DSO etc.)	EC209.2
4.	Study of computer hardware	EC209.3
5.	Installation of Windows operating system	EC209.4
6.	Installation of Linux operating system	EC209.4
7.	Installation of application and system softwares	EC209.4
8.	Study of Computer networking components	EC209.3

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

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

Teaching Scheme — Examination Scheme
Practical: 2 Hrs. / Week — 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

2021 Pattern

Proposed Program Structure

(B. Tech. with effect from Academic Year 2021-2022)

(S Y B. Tech. Sem-IV 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 S. Y. B. Tech. Semester-IV of 2021 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

S. Y. B. TECH. *2021 Pattern* (Electronics and Computer Engineering) SEMESTER-III

Course			Teaching Scheme (Hours/week)				Evaluation Scheme- Marks					
							Theory					
Cat	Code	Title	L	T	P	Credits	CIA	ESE	OR	PR	TW	Total
BSC	EC201	Discrete Mathematics and Information Theory	3	-	-	3	40	60	-	-	-	100
PCC	EC202	Electronic Devices and Circuits	4	-	-	4	40	60	-	-	-	100
PCC	EC203	Digital Design and HD Language	4	-	-	4	40	60	-	-	-	100
PCC	EC204	Computer Organization and Architecture	3	-	-	3	40	60	-	-	-	100
HSMC	HS205	Universal Human Values & Ethics	3	-	-	3	40	60	-	-	-	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 Design and HDL Laboratory	-	-	2	1	-	-	-	50	-	50
LC	EC209	Electronics and Computer Workshop	-	-	2	1	-	-	50	-	-	50
MC	MC210	Mandatory Course-III Constitution of India – Basic features and fundamental principles	2	-	-	No	-	-	-	-	-	-
		Total	**19**	**1**	**6**	**21**	**200**	**300**	**50**	**100**	**50**	**700**

SEMESTER-IV

Course			Teaching Scheme (Hours/week)				Evaluation Scheme- Marks					
							Theory					
Cat	Code	Title	L	T	P	Credits	CIA	ESE	OR	PR	TW	Total
BSC	BS202	Engineering Mathematics - III	3	1	-	4	40	60	-	-	-	100
PCC	EC212	Principles of Communication	3	-	-	3	40	60	-	-	-	100
PCC	EC213	Fundamentals of DSP	3	-	-	3	40	60	-	-	-	100
PCC	EC214	Microcontroller & Microprocessor	3	-	-	3	40	60	-	-	-	100
PCC	EC215	Software Engineering, modeling and design	4	-	-	4	40	60	-	-	-	100
HSMC	HS216	Corporate Readiness-I	-	-	2	1					50	50
LC	EC217	POC Laboratory	-	-	2	1	-	-	-	25	-	25
LC	EC218	Fundamentals of DSP Laboratory	-	-	2	1	-	-		25		25
PROJ	EC219	Microcontroller & Microprocessor Laboratory	-	-	2	1	-	-	-	-	50	50
PROJ	EC220	PBL/Choice Based Subject	1	-	2	2	-	-	50	-	-	50
MC	MC221	Mandatory Course-IV Innovation - Project based – Sc., Tech, Social, Design & Innovation	2	-	-	No	-	-	-	-	-	Pass/ fail
		Total	**19**	**1**	**10**	**23**	**200**	**300**	**50**	**50**	**100**	**700**

Total Credits: 44 **Total Marks: 1400**

Engineering Mathematics III (BS202)

Teaching Scheme
Lectures: 03 Hrs. / Week
Tutorials: 01 Hr./ Week
Credits: 04

Examination Scheme
CIA: 40 Marks
ESE: 60 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
ESE: 60 Marks
CIA: 40 Marks
Total: 100 Marks

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Prerequisite Course : Fundamentals of communication

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Course Objectives:-

1. To acquaint the students with the fundamental principles of the modulation process & different amplitude modulation systems.
2. To acquaint the students with the fundamental principles of the modulation process & different angle modulation systems.
3. To explain different types of receivers & their performance parameters.
4. To highlight the various types of noises with their sources & effect on communication systems.
5. To introduce the students with the concept of sampling theorem & pulse modulation techniques.
6. To impart pre-requisites of digital communication systems & explore digital representation techniques.

Course Outcomes (COs):-

After completion of course students will be able to:

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
EC212.1	Describe & analyze the techniques of generation, transmission & reception of amplitude modulation systems.	2	Understand
EC212.2	Describe & analyze the techniques of generation, transmission & reception of angle modulation systems.	2	Understand
EC212.3	Compare the performance parameters of different receivers.	2	Understand
EC212.4	Classify the noise depending on their sources.	2	Understand
EC212.5	Exhibit the importance of sampling theorem & correlate with pulse modulation technique.	3	Apply
EC212.6	Characterize the quantization process and elaborate digital representation techniques	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
EC212.1	2	2	2	-	2	-	-	-	-	-	-	1	-	1
EC212.2	2	2	2	-	2	-	-	-	-	-	-	1	-	1
EC212.3	1	1	3	-	-	-	-	-	-	-	-	2	-	2
EC212.4	2	2	1	-	1	-	-	-	-	-	-	1	-	1
EC212.5	1	1	2	-	2	-	-	-	-	-	-	2	-	2
EC212.6	2	2	2	-	2	-	-	-	-	-	-	2	-	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	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, Narrowband FM & Wideband FM, Phase Modulation (PM), Relation Between FM & PM, Generation Methods of FM, Direct & Indirect Methods, Armstrong's Indirect Method, 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, PCM Generation and Reconstruction, Quantization of Signals: Quantization error, Uniform & Non-Uniform types of Quantization, Companding, A-law & μ-law, 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:
NPTEL Course “Principles of Communication Systems-I”, by Prof. Aditya.K. Jagannath.
https://nptel.ac.in/courses/108/104/108104091/

Continuous Internal Assessment:
1. Unit test
2. Poster presentation
3. Case study of any communication system

Digital Signal Processing (EC213)

Teaching Scheme
Lectures: 03 Hrs./Week

Credits: 03

Examination Scheme
ESE : 60 Marks
CIA: 40 Marks
Total: 100 Marks

Prerequisite course: Engineering Mathematics III

Course Objectives:

1. To introduce the concepts of signals and systems for discrete time signal.
2. To study different transforms for discrete time signals and systems.
3. To study implementation techniques of digital filters.
4. To learn the philosophy of FIR and IIR filter design.

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

Course Outcomes	Course outcome	Blooms Taxonomy	
		Level	Descriptor
EC213.1	Describe various signals and systems.	2	Understand
EC213.2	Determine the ZT on discrete time signals.	3	Apply
EC213.3	Determine the DFT on discrete time signals.	3	Apply
EC213.4	Compute discrete time signals with FFT algorithms.	3	Apply
EC213.5	Estimate the IIR filter for given specifications.	3	Apply
EC213.6	Estimate the FIR filter for a given window function.	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
EC213.1	3	---	1	---	2	---	---	---	---	---	---	2	2	---
EC213.2	2	---	1	---	3	---	---	---	---	---	---	1	2	---
EC213.3	2	---	2	---	2	---	---	---	---	---	---	2	3	---
EC213.4	2	---	2	---	1	---	---	---	---	---	---	1	2	---
EC213.5	2	---	2	---	3	---	---	---	---	---	---	3	3	---
EC213.6	2	---	2	---	3	---	---	---	---	---	---	3	3	---

Course Contents

Unit-I	**Introduction to Signals**	No. of Hours	CO .1

	Introduction and Classification of signals: Definition of signal and system, Continuous time and discrete time signal, different signal Operations Systems, System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral, Computation of convolution sum. Properties of convolution.	06	EC213.1
Unit-II	**Z Transform**	No. of Hours	CO 2
	Introduction, Definition, Standard properties, ZT of standard sequences and their inverses, ROC, Solution of difference equations, IZT by partial fraction, Applications of ZT.	07	EC213.2
Unit-III	**Discrete Fourier Transform**	No. of Hours	CO 3
	Basic elements of DSP, advantages over Analog signal processing, orthogonality. Introduction of DFT, Properties of DFT, Twiddle factor and its properties, circular convolution using-concentric circle, expression. Computation of linear convolution using circular convolution, circular convolution for avoidance of aliasing.	08	EC213.3
Unit-IV	**Fast Fourier Transform**	No. of Hours	CO 4
	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.	08	EC213.4
Unit-V	**IIR Filter Design**	No. of Hours	CO 5
	Design of IIR filters from analog filters, filter design by impulse invariance method and BLT. Butterworth filters, design of Butterworth filter, filter realization using direct form, cascade form and parallel form.	06	EC213.5
Unit-VI	**FIR Filter Design**	No. of Hours	CO 6
	Ideal filter requirements, Gibb's phenomenon, windowing techniques, characteristics and comparison of different window functions. frequency warping effect.	06	EC213.6

Text Books:

1. John G. Proakis, Dimitris G. Manolakis, — Digital Signal Processing: Principles, algorithms and applications Fourth edition, Pearson Prentice Hall. 2003

2. C. Ramesh Babu — Digital Signal processing, Laxmi Publication,3rd Edition 2004

3. S. Salivahanan - Digital Signal processing, MGH, 3rd Edition, 2011

Reference Books:

1. Ifeachor E.-Digital Signal Processing : Practical approach, Pearson publication,2nd edition, 2002

2. A. Nagoor Kani ― Digital Signal Processing, MGH, 2nd Edition, 2012

3. S. K.Mitra - Digital Signal Processing, 4th Edition, McGraw Hill Publication.2013

4. Schaum's Outline of Theory and Problems of Theory and Problems of Signals and Systems, Hwei P. Hsu,MGH, ISBN 0-07-030641-9

5. Schaum's Outline of Theory and Problems of Digital Signal Processing, Monson H. Hayes, MGH, ISBN 0–07–027389–8

e-Resources:

1. https://nptel.ac.in/courses/117/102/117102060/
2. http://www.dspguide.com/

Guidelines for Continuous Internal Assessment:

1. Test1 will be conducted on UNIT1 & UNIT2 for 20 marks.
2. Test2 will be conducted on UNIT3 & UNIT4 for 20 marks.
3. Test3 will be conducted on UNIT5 & UNIT6 for 20 marks.

4. Self-learning activity will be conducted for 20 marks.

Total marks(40) = Average of all Tests(20) + Self learning activity(20)

Microcontroller & Microprocessor (EC214)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
CIA: 40 Marks
ESE: 60 Marks
Total: 100 Marks

Prerequisite Course : Digital Design and HD Language

Course Objectives:

1. To learn and distinguish the architecture and programmer‘s model of advanced processor.
2. To identify the system level features and processes of advanced processors.
3. To acquaint the learner with application instruction set and logic to build assembly language programs.
4. To Interface microcontroller with real world input and output devices

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

CO’s	CO Statements	Blooms Taxonomy	
		Level	Descriptor
EC214.1	Illustrate advanced features of 80386 Microprocessor.	2	Understand
EC214.2	Implement the concepts of assembly language programming in microprocessors	3	Apply
EC214.3	Develop Programming in C for 8051	3	Apply
EC214.4	Develop programs in assembly language for interfacing peripherals using 8051 microcontroller	3	Apply
EC214.5	Describe architectures of PIC 18 microcontroller	2	Understand
EC214.6	Develop Simple programs for PIC 18	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	2	-	-	-	-	-	-	-	-	-	-	-	1	-
EC214.2	2	-	-	-	3	-	-	-	-	-	-	-	1	-
EC214.3	2	-	-	-	3	-	-	-	-	-	-	-	1	-
EC214.4	2	-	-	-	3	-	-	-	-	-	-	-	1	-
EC214.5	2	-	-	-	-	-	-	-	-	-	-	-	1	-
EC214.6	2	-	-	-	3	-	-	-	-	-	-	-	1	-

Course Contents

Unit-I	**Introduction to 80386**	**No. of Hours**	**CO**
	Evolution of Microprocessors, Salient features of 80386DX, Architecture and Signal Descriptions , Pin Diagram, Register Organization- Flag Register, Virtual Mode, Resume, Segment Descriptor Registers, Control Registers, system Address Registers, Debug and Test Registers, Addressing Modes- Scaled Indexed Mode, Based Scaled Indexed Mode, Based Scaled Indexed Mode with Displacement, Advantages, Disadvantages and Application of the Microprocessor.	07.	EC214.1
Unit-II	**Memory Management**	**No. of Hours**	**CO**
	Data Types, Real Address Mode, Memory Addressing in Real Mode, Protected Mode, Addressing in Protected Mode, Segmentation, Global Descriptor Table, Local Descriptor Table, Interrupt Descriptor Table Structure of an 80386 Descriptor, Paging Mechanism, Enhanced Instruction set of 80386,Comparison between various present microprocessors.	07 Hrs.	EC214.2
Unit-III	8051 Programming in C	No. of Hours	CO 3
	Why program the 8051 in C, Data types and time delay, I/O programming, Byte size I/O , Bit addressable I/O programming, Logic operations, Bit wise operators in C, Data conversion programs, Binary to decimal and ASCII conversion in 8051 C, Accessing code ROM space, RAM data space v. code data space, data serialization using 8051 C.	06 Hrs.	EC214.3
Unit-IV	8051 Interfacing	No. of Hours	CO 4
	LCD Interfacing, Keyboard Interfacing, Parallel and Serial ADC, DAC Interfacing, Sensor interfacing and Signal Conditioning	07 Hrs.	EC214.4
Unit-V	PIC18 Microcontrollers	No. of Hours	CO 5
	Microcontroller versus general purpose microprocessor, microcontrollers for embedded systems, criteria for choosing a microcontroller, PIC features, Block Diagram, Pin Diagram, I/O port pins and their functions.	07 Hrs.	EC214.5

Unit-VI	PIC Instructions and Programs	No. of Hours	CO 6
	Arithmetic Instructions, Signed number concepts and arithmetic operations, Logic and Compare instructions, Rotate instruction and Data Serialization, and Simple programs.	07 Hrs.	EC214.6

Text Books:

1. A.Ray, K.Bhurchandi, "Advanced Microprocessors and peripherals: Arch, Programming & Interfacing", Tata McGraw Hill, 3rd edition, 2006, ISBN 1-25-900613-1
2. James Turley, "Advanced 80386 Programming Techniques", McGraw-Hill, 1st edition, 2005. ISBN: 0-07-059841-X
3. M. Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay "The 8051 Microcontroller and Embedded Systems Using Assembly and C", 2nd Edition, , 2005
4. Microcontrollers and application, Ajay. V. Deshmukh, TMGH, 2005, ISBN 0-07-058595-4.
5. M. Ali Mazidi, Rolind McKinlay "PIC Microcontroller and Embedded Systems Using Assembly and C for PIC18", 2008, ISBN 978-81-317-1675-5

Reference Books:

1. Chris H. Pappas, William H. Murray, "80386 Microprocessor Handbooks", McGraw-Hill Osborne Media, ISBN-10: 0078812429, 13: 978-0078812422
2. Barry B. Bray , The Intel Microprocessor 8086/8088, 80186,80286, 80386 and 80486 Architecture, programming and interfacing, PHI, 8th Edition, 2009.
3. Mohammad Rafiquzzaman, "Microprocessors: Theory and Applications: Intel and Motorola", Prentice Hall, Revised edition 1992,ISBN-81-203-0848-4
4. Kenneth J. Ayala. The 8051 microcontroller, 3rd edition, Cengage learning, 2010
5. K.Uma Rao, Andhe Pallavi, "The 8051 microcontrollers, architecture and programming and applications", Pearson, 2009.

e-Resources:
NPTEL Course : https://onlinecourses.nptel.ac.in/noc23_ee47/course

Guidelines for Continuous Internal Assessment:
1. Test1 will be conducted on UNIT1 & UNIT2 for 20 marks.
2. Test2 will be conducted on UNIT3 & UNIT4 for 20 marks.
3. Test3 will be conducted on UNIT5 & UNIT6 for 20 marks.
4. Self-learning activity will be conducted for 20 marks.

Total marks(40) = Average of all Tests(20 Marks) + Self learning activity(20 Marks)

Software Engineering Modeling & Design (EC215)

Teaching Scheme
Lectures: 4 Hrs. / Week
Credits: 4

Examination Scheme
CIA: 40 Marks
ESE : 60 Marks
Total: 100 Marks

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Prerequisite : CFP

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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 model/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 Statement	Bloom's Taxonomy	
		Level	Descriptor
EC215.1	Identify process models for developing a software project.	2	Understand
EC215.2	Prepare Software Requirement Specification document from the problem statement of the given application.	3	Apply
EC215.3	Present the project planning and Management to S/W project development.	3	Apply
EC215.4	Summarize various design techniques of software application.	2	Understand
EC215.5	illustrate Object Oriented Design methodology for S/W project development.	4	Analyze
EC215.6	Demonstrate the use of appropriate modern tool 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	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
EC215.1	2	2	-	1	2	-	2	-	-	-	-	1	1	-
EC215.2	2	1	3	3	-	3	2	-	3	3	-	3	1	-
EC215.3	2	2	3	-	--	-	2	-	3	-	3	2	1	1
EC215.4	2	2	2	1	-	-	2	-	-	-	-	-	1	1
EC215.5	2	2	2	-	-	-	-	-	-	-	-	-	1	-
EC215.6	2	-	-	1	2	-	2	-	-	-	-	1	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	EC215.1
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 modeling, SRS plan, Case study	8	EC215.2
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	EC215.3
Unit-IV	Introduction to Software Design	No.of Hours	COs
	Introduction to Software Design, design methods: procedural/structural and object oriented, Requirement Vs Analysis, Architecture Vs Design , 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	EC215.4
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	8	EC215.5

	diagram-Interfaces & Components, deployment diagram, Package diagram		
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	EC215.6

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 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 :

1. https://www.onlinecourses.nptel.ac.in/noc23_cs106
2. https://www.coursera.org/learn/introduction-to-software-engineering

Guidelines for Continuous Assessment:-

1. Test1 will be conducted on UNIT1 & UNIT2 for 20 marks.
2. Test2 will be conducted on UNIT3 & UNIT4 for 20 marks.
3. Test3 will be conducted on UNIT5 & UNIT6 for 20 marks.
4. Self learning activity of drawing Use Case diagram, Class Diagram, Activity Diagram, Sequence Diagram, Communication Diagram,State Machine Diagram, Timing Diagram,Deployment Diagram Package Diagram in groups will be conducted for 20 marks.
5. Total marks(40) = Average of all Tests(20 Marks) + Self learning activity(20 Marks)

Corporate Readiness (HS216)

Teaching Scheme	Examination Scheme
Lectures: 2 Hrs./Week	Term Work: 50 Marks
Tutorial: --- Hr/Week	In-Sem Exam: --
	End-Sem Exam: --
Credits: 02	Total: 50 Marks

Prerequisite Course:(Verbal and Non-verbal communication, Writing & Reading Skills)

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 improve interpersonal and communication skills.
3. To develop reading and writing skills.
4. To demonstrate the importance of team work & leadership quality.
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 the course, student will be able to:

Course Outcome (s)		Bloom's Taxonomy	
		Level	Descriptor
CO1	Understanding the concepts of grammar through various topics	BTL 2	Understand
CO2	Understanding reading skills which can improve the phonetics	BTL 2	Understand
CO3	Apply the knowledge of Verbal Ability to apply it in written form	BTL 3	Apply
CO4	Analyse and apply the critical thinking ability as required to showcase leadership skills.	BTL 4	Analyse
CO5	Examining based on communication skills	BTL 4	Examine
CO6	Judging an ideal personality that fits Industry requirement.	BTL 5	Judge

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	PSO4
CO1	--	--	--	--	--	--	--	--	--	2	--	1	--	3	--	--
CO2	--	--	--	--	--	--	--	--	--	3	--	1	--	3	--	--
CO3	--	--	--	--	--	--	--	--	--	2	--	2	--	1	--	--
CO4	--	1	--	--	--	1	--	1	3	2	--	2	1	--	--	--
CO5	--	2	--	--	--	--	--	1	2	2	--	1	--	--	--	--
CO6	--	--	--	--	--	--	--	--	--	--	--	2	--	--	--	--

Course Contents			
UNIT-I	Verbal English	Hrs.	CO
	Para Jumbles, Idioms and phrases, Parts of speech, Brief overview of Tense	06 Hrs.	CO1
UNIT-II	Reading Skills	Hrs.	CO
	Reading Skills-why and how, Reading Newspaper, Reading Comprehension, Passage Reading	04 Hrs.	CO2
UNIT-III	Writing skills	Hrs.	CO
	Story Writing, Email Writing, Content Writing, Article and Passage Writing	04 Hrs.	CO3
UNIT-IV	Leadership and Teaming Up	Hrs.	CO
	Team work, Good team member qualities, Leadership qualities, Team work activities	06 Hrs.	CO4
UNIT-V	Communication Skills	Hrs.	CO
	Spoken English, Phonetics, Accent and Intonation, Interpersonal Activities	06 Hrs.	C05
UNIT-VI	Body Language	Hrs.	CO
	Reveals your Inner Self and Personality, Grooming, Personal Interviews	04 Hrs.	CO6

Text Books:

[T1]. A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Agarwal.
[T2]. Reasoning verbal and Non-Verbal by B. S. Sijwali.
[T3]. Master the Group Discussion & Personal Interview - Complete Discussion on the topics asked by reputed B-schools & IIMs by Sheetal Desarda.

References:

[R1]. Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical).
[R2]. Analytical Reasoning by M. K. Panday.
[R3]. Logical and analytical reasoning by K. Gupta.
[R4]. Multi-dimensional reasoning by Mishra & Kumar Dr. Lal.

E- Books:

[1].https://themech.in/quantitative-aptitude-and-logical-reasoning-books/
[2].https://www.thelocalhub.in/2021/01/reasoning-competitive-exams-pdf.html

E-learning Resources/MOOCs/ NPTEL Course Links:

[1]. https://www.practiceaptitudetests.com/non-verbal-reasoning-tests/
[2]. https://www.educationquizzes.com/11-plus/non-verbal-reasoning/
[3].
[4" https://www.livecareer.com/resume/examples/web-development/e-learning-developer
[4]. https://novoresume.com/career-blog/how-to-write-a-resume-guide

Principles of Communication Laboratory (EC217)

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

Examination Scheme:
PR: 25 Marks
Total: 25 Marks

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Prerequisite: Fundamentals of communication

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Course Objectives:-

1. To explain the communication system & various blocks.
2. To acquaint the students with the fundamental principles of the modulation process & different amplitude modulation systems.
3. To acquaint the students with the fundamental principles of the modulation process & different frequency modulation systems.
4. To highlight the various types of noises with their sources & effect on communication systems.
5. To introduce the students with the concept of sampling theorem & pulse modulation techniques.
6. To impart pre-requisites of digital communication systems & explore digital representation techniques.

Course Outcomes (COs):-

After completion of course students will be able to:

COs	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC217.1	Describe the communication systems & functioning of their components.	2	Understand
EC217.2	Describe & analyze the techniques of generation, transmission & reception of amplitude modulation systems.	2	Understand
EC217.3	Describe & analyze the techniques of generation, transmission & reception of frequency modulation systems.	2	Understand
EC217.4	Observe the effect of noise in the communication system.	2	Understand
EC217.5	Exhibit the importance of sampling theorem & correlate with pulse modulation technique.	3	Apply
EC217.6	Characterize the quantization process and elaborate digital representation techniques	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
EC217.1	1	1	-	-	-	-	-	2	2	2	-	2	-	2
EC217.2	2	2	2	-	2	-	-	2	2	2	-	1	-	1
EC217.3	2	2	2	-	2	-	-	2	2	2	-	1	-	1
EC217.4	2	2	2	-	2	-	-	2	2	2	-	1	-	1
EC217.5	2	2	2	-	2	-	-	2	2	2	-	2	-	2

EC217.6	2	2	2	-	2	-	-	2	2	2	-	2	-	2

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.	EC217.1
2	AM generation (DSB-FC): calculation of modulation index by graphical method, power of AM wave for different modulating signal and observer spectrum.	EC217.2
3	Frequency modulator & demodulator, Calculation of modulation index & BW of FM.	EC217.3
4	Verification of sampling theorem, PAM techniques (flat top & natural sampling), reconstruction of original signal, observing aliasing effect in frequency domain.	EC217.5
5	Study of PCM.	EC217.6
6	Study of DM: Generation and detection.	EC217.6
7	Study of line codes (NRZ, RZ, POLAR RZ, BIPOLAR (AMI), MANCHESTER) & their spectral analysis.	EC217.6
8	Write a code & simulate to generate amplitude modulation [AM] waveform for given modulation index, signal frequency & carrier frequency.	EC217.2
9	Simulation program to study the effect of ISI & noise in baseband communication systems.	EC217.4
10	Perform the Frequency Shift Keying [FSK] & observe the output waveforms at modulator & demodulator.	EC217.6

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:

NPTEL Course “Principles of Communication Systems-I”, by Prof. Aditya.K. Jagannath.

https://nptel.ac.in/courses/108/104/108104091/

Guidelines for Lab Assessment:

The laboratory assignments/experiments are to be submitted by students in the form of a journal.
Continuous assessment of laboratory work is done based on overall performance.
Each lab assignment/ experiment assessment will assign grade / marks based on parameters with appropriate weightage.
Suggested parameters for overall assessment as well as each lab assignment / experiment assessment include:
Timely completion.
Performance.
Punctuality and neatness.

Fundamentals of Digital Signal Processing Laboratory (EC218)

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

Examination Scheme
PR: 25 Marks
Total: 25 Marks

Course Objectives:

1. To study the fundamental concepts of signals.
2. To learn the basics of transforms.
3. To learn powerful, flexible and scalable general-purpose applications.

Course Outcomes (COs):

On completion of the course, student will be able to–

Course Outcomes	Course Outcome statement	Bloom's Taxonomy	
		Level	Descriptor
EC218.1	Estimate different operations on discrete time signals	3	Apply
EC218.2	Compute different discrete level transforms on signals	3	Apply
EC218.3	Select appropriate filter for given attributes	4	Analyse

Mapping of CO, PO & PSO:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC218.1	3	---	2	---	3	---	---	3	---	---	---	2	3	---
EC218.2	2	---	3	---	3	---	---	3	---	---	---	3	3	---
EC218.3	2	---	3	---	3	---	---	3	---	---	---	3	3	---

Practical Course Contents

- Minimum 08 experiments to be performed out of the mentioned list.
- Experiments can be performed using any software 's like Matlab/Scilab etc.

Sr. No.	List of Practical's	CO's
1	Write a program to generate various discrete signals	EC218.1
2	To perform functions on signals and sequences such as addition, multiplication, scaling, shifting, folding.	EC218.1

3	Write a program to verify the sampling theorem and aliasing effects with various sampling frequencies.	EC218.1
4	Write a program to calculate linear convolution for given signals.	EC218.1
5	To find Z and inverse Z transform and pole zero plot of Z-domain transfer function.	EC218.2
6	To study the properties of DFT like linearity and circular convolution.	EC218.2
7	Write a program to calculate 4-point Circular convolution compare the result with 8-point circular convolution.	EC218.2
8	Design Butterworth filter using Bilinear transformation method for LPF and draw the frequency response of the filter	EC218.3
9	Realization of the filter using direct form I, direct form II, cascade realization. (theory assignment)	EC218.3
10	To study the effect of different windows on FIR filter response.	EC218.3
11	To verify the Gibbs Phenomenon	EC218.1
12	Performing FFT and IFFT of a discrete sequence	EC218.2
13	To study interpolation and decimation.	EC218.3

Microcontroller & Microprocessor Laboratory (EC219)

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

Examination Scheme

TW: 50 Marks

Prerequisite: Nil

Course Objectives:

1. To learn and distinguish the architecture and programmer‘s model of advanced processor.
2. To identify the system level features and processes of advanced processors.
3. To acquaint the learner with application instruction set and logic to build assembly language programs.
4. To Interface microcontroller with real world input and output devices

Course Outcomes (COs):

After completion of course students will be able to

CO’s	Course Outcome Statement	Blooms Taxonomy	
		Level	Descriptor
EC219.1	Implement the concepts of assembly language programming in microprocessors	3	Apply
EC219.2	Develop Programming in C for 8051	3	Apply
EC219.3	Develop programs in assembly language for interfacing peripherals using 8051 microcontroller	3	Apply
EC219.4	Develop Simple programs for PIC 18	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
EC219.1	2	3	-	-	-	-	-	-	-	-	-	-	-	1
EC219.2	3	-	2	-	-	-	-	-	-	-	-	-	-	2
EC219.3	3	-	2	-	-	-	-	-	-	-	-	-	-	2
EC219.4	1	2	3	-	3	-	-	-	-	-	-	3	3	-

Practical Course Contents (Minimum 08 experiments to be performed):

Sr. No.	Title of Practical	COs
1	Write an assembly language program for Arithmetic operations using 80386	EC219.1
2	Write an 80386 assembly language program to accept a string and to display its length.	EC219.1
3	Write an Data types program using 8051 C.	EC219.2
4	Write an Binary(hex) to decimal program using 8051 C.	EC219.2

5	Write a Data Serialization program using 8051 C.	EC219.2
6	Write an embedded C program for interfacing of LCD with 8051	EC219.3
7	Write an embedded C program for interfacing of 4X4 keypad with 8051	EC219.3
8	Write a program to add two 16 bit numbers.	EC219.4
9	Write code to determine if data on PORT-B contains the value 99 H. If so, write letter 'Y' to PORT-C . otherwise, make PORT-C = 'N'	EC219.4

Note: Exp. 1,2,8 and 9 will be conducted using simulation

Project Based Learning (EC220)

Teaching Scheme

Practical: 04 Hrs /Week
Credits: 02

Examination Scheme

Practical Exam: 50 Marks
Total: 50 Marks

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1. Prerequisite of course: Fundamentals of Data Structures(ESIT137)

2. 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.

3. Course Outcomes (COs):

At the end of the course students will be able to:

CO	Course Outcome (s) statement	Bloom's Taxonomy	
		Level	Descriptor
EC220.1	Implement features of OOP basics and application.	3	Apply
EC220.2	Implement the concepts of Inheritance, Interface, Exception Handling in Java.	3	Apply
EC220.3	Recognize JDBC, Servlet, JSP, Collections etc.	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
EC220.1	2	0	2	0	3	0	0	0	0	0	0	3	0	2
EC220.2	2	1	1	0	2	0	0	0	0	0	0	2	0	3
EC220.3	3	1	2	0	3	0	0	0	0	0	0	3	0	3

4. List of Practical:

Sr. No.	List of Practical's	CO
1	Write a program in Java to create class, methods to display object details.	EC220.1
2	Write a program in Java to implement operations of the calculator.	EC220.1
3	Write a program in Java to sort integers and strings.	EC220.1
4	Write a Program in Java on method overloading	EC220.1
5	Write a program in Java to pass and return the object	EC220.1
6	Write a program in Java to implement string operations	EC220.1
7	Write a program in Java on constructor and constructor overloading	EC220.2
8	Write a java program for exception handling	EC220.2
9	Write a Program in java on single and multilevel inheritance	EC220.2
10	Write a program in Java to implement abstract class	EC220.2
11	Write a program in Java to implement interface	EC220.2
12	Write a program in Java to implement JDBC with static query.	EC220.3
13	Write a program in Java to implement JDBC with dynamic query.	EC220.3
14	Write a program in Java to implement servlet	EC220.3
15	Write a program in Java to implement JSP	EC220.3
16	Write a program in Java to implement Collections	EC220.3
17	Write a program in Java to implement Multithreading	EC220.3
16	Write a program in Java to implement Hibernet	EC220.3
17	Write a program in Java to implement I/O streams	EC220.3
18	Write a program in Java to implement Spring	EC220.3
19	Write a program in Java to implement Java 8 features	EC220.3
20	Write a program in Java to implement Wrapper Classes	EC220.3

Note: Implement any 13 Programs out of the given list.

5. Books:

1. Herbert Schildt, “Java: The Complete Reference”, McGraw Hill, (7th Edition).
2. E. Balagurusamy, “Programming with Java A Primer”, Tata McGraw Hill, (3rd Edition)
3. Deitel, H.M. & Deitel, “Java: How to Program”, Prentice Hall (8th Ed.).

6. e-Resources:

1. https://nptel.ac.in/courses/106/105/106105151/
2. https://www.javatpoint.com/
3. https://www.w3schools.com/java/default.asp
4. https://www.prepbytes.com/interview-questions/java-interview-questions/

Mandatory Course IV(MC221)

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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Prerequisite course: Communication skills.

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
MC221.1	Understand need of innovation and social problems	2	Understand
MC221. 2	Understand opportunity recognition and ideation management to solve the social problems	2	Understand
MC221.3	Understand the technological, human, economic, organizational, social and other dimensions of innovation	2	Understand
MC221.4	Understand the effective management of technological innovation requires the integration of people, processes and technology	2	Understand
MC221.5	Recognize opportunities for the commercialization of innovation	1	Remember
MC221.6	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
MC221.1	-	-	-	-	-	1	-	-	-	-	-	-	2	-
MC221.2	-	-	-	-	-	3	-	-	-	-	1	-	3	-
MC221.3	-	-	-	-	-	3	-	-	-	-	1	-	-	-

MC221.4	-	-	-	-	-	2	2	-	-	-	1	-	-	-
MC221.5	-	-	-	-	-	1	2	1	-	-	-	1	-	-
MC221.6	-	-	-	-	-	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.	MC221.1
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.	MC221.2
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.	MC221.3
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.	MC221.4
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.	MC221.5
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.	MC221.6

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

2021 Pattern

Proposed Program Structure

(B.Tech. with effect from Academic Year 2021-2022)

(T Y B. Tech. Sem-V 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 T. Y. B. Tech. Semester-V of 2021 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 the 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 analyze 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 modeling 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. 2021 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	ESE	OR	PR	TW	Total
PCC	EC301	Design and Analysis of Algorithm	4	-	-	4	40	60	-	-	-	100
PCC	EC302	Analog Circuits and Control Systems	3	-	-	3	40	60	-	-	-	100
PCC	EC303	DBMS and SQL	3	-	-	3	40	60	-	-	-	100
PCC	EC304	Theory of Computation	3	1	-	4	40	60	-	-	-	100
PEC	EC305	Refer List of PEC1	3	-	-	3	40	60	-	-	-	100
PROJ	EC306	Corporate Readiness-II	-	-	2	1	-	-	-	-	50	50
LC	EC307	Analog Circuits and Control Systems Laboratory	-	-	2	1	-	-	-	50	-	50
LC	EC308	DBMS and SQL Laboratory	-	-	2	1	-	-	-	50	-	50
PROJ	EC309	Seminar & Communication Skill	-	-	4	2	-	-	50	-	-	50
MC	MC310	Mandatory Course-V: Sanjivani ECE Talks	1	-	-	Non Credit	-	-	-	-	-	Pass/ Fail
		Total	18	1	10	22	200	300	50	100	50	700

SEMESTER-VI

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/Max Marks					
							Theory					
Cat	Code	Title	L	T	P	Credits	CIA	ESE	OR	PR	TW	Total
PCC	EC311	Embedded Systems and RTOS	4	-	-	4	40	60	-	-	-	100
PCC	EC312	System Programming and Operating System	3	-	-	3	40	60	-	-	-	100
PCC	EC313	Web Technology and APP Design	3	-	-	3	40	60	-	-	-	100
PEC	EC314	Refer List of PEC2	3	-	-	3	40	60	-	-	-	100
PROJ	EC315	Project Based Learning	-	-	2	1	-	-	50	-	-	50
PROJ	PR316	IPR & EDP	2	-	-	2	20	30	-	-	-	50
LC	EC317	Embedded Systems and RTOS Laboratory	-	-	2	1	-	-	-	25	-	25
LC	EC318	System Programming and Operating System Laboratory	-	-	2	1	-	-	-	25	-	25
LC	EC319	PEC2 Laboratory	-	-	2	1	-	-	25	-	-	25
LC	EC320	Creational Activity	-	-	2	1	-	-	-	-	25	25
MC	MC321	Mandatory Course-VI:	1	-	-	Non Credit	-	-	-	-	-	Pass/ Fail
		Total	16	-	10	20	180	270	75	50	25	600

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

Total Credits: 42 **Total Marks: 1300**

Design and Analysis of Algorithm (EC301)

Teaching Scheme
Lectures: 04 Hrs. / Week

Credits: 04

Examination Scheme
ESE : 60 Marks
CIA: 40 Marks
Total: 100 Marks

Prerequisite:

Course Objectives:

1. To develop problem solving abilities using mathematical theories
2. To analyze the performance of algorithms
3. To study algorithmic design strategies

Course Outcomes (COs):

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

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC301.1	Formulate the problem of algorithm design	2	Understand
EC301.2	Find the asymptotic performance of algorithms	3	Apply
EC301.3	Apply algorithmic strategies to solve given problem	3	Apply
EC301.4	Find optimal solution by applying various methods	3	Apply
EC301.5	Apply sorting algorithm	3	Apply
EC301.6	Explain the multithreaded and distributed algorithms	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	1	-	-	-	-	-	-	-	-	-	-	2
EC301.2	3	2	2	-	-	-	-	-	-	-	-	-	-	3
EC301.3	3	2	2	-	-	-	-	-	-	-	-	-	-	3
EC301.4	3	2	3	-	-	-	-	-	-	-	-	-	-	3
EC301.5	3	2	3	-	-	-	-	-	-	-	-	-	-	3
EC301.6	3	1	1	-	-	-	-	-	-	-	-	-	-	2

Course Contents

Unit No.		No. of Hours	COs
Unit-I	Fundamentals of algorithms	06	EC301.1
	The Role of Algorithms in Computing - What are algorithms, Algorithms as technology, Evolution of Algorithms, Design of Algorithm, Need of Correctness of Algorithm, Confirming correctness of Algorithm – sample		

	examples, Iterative algorithm design issues, characteristics of good algorithm.		
Unit-II	Models and Design	06	EC301.2
	Functional Model – Features, Recursive processes, Scope rules, Tail recursion, Checking correctness of Iterative process. Imperative Model – Basics, Specifications and Prototyping, Stepwise Refinement, Proof Rules – Basics, For loops, Goto and Exit loops, Functions and Procedures, Problem Solving using Greedy strategy - Knapsack problem, Huffman code generation algorithm.		
Unit-III	Abstract Algorithms	06	EC301.3
	Dynamic Programming, Divide and Conquer, Greedy strategy, Branch-n-Bound, Natural Algorithms –Evolutionary Algorithms and Evolutionary Computing, Introduction to Genetic Algorithm, Simulated Annealing, Artificial Neural Network and Tabu Search.		
Unit-IV	Complexity Theory	06	EC301.4
	Complexity theory – Counting Dominant operators, Growth rate, upper bounds, asymptotic growth, O, Ω, Θ, o and ω notations, polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, P-class problems, NP-class of problems, Polynomial problem reduction NP complete problems- vertex cover and 3-SAT and NP hard problem - Hamiltonian cycle.		
Unit-V	Amortized Analysis	06	EC301.5
	Amortized Analysis – Binary, Binomial and Fibonacci heaps, Dijkstra's Shortest path algorithm, Splay Trees, Time-Space tradeoff, Introduction to Tractable and Non-tractable Problems, Introduction to Randomized and Approximate algorithms, Embedded Algorithms: Embedded system scheduling (power optimized scheduling algorithm), sorting algorithm for embedded systems		
Unit-VI	Multithreaded and Distributed Algorithms	06	EC301.6
	Multithreaded Algorithms - Introduction, Performance measures, Analyzing multithreaded algorithms, Parallel loops, Race conditions. Problem Solving using Multithreaded Algorithms - Multithreaded matrix multiplication, Multithreaded merge sort. Distributed Algorithms - Introduction, Distributed breadth first search, Distributed Minimum Spanning Tree. String Matching- Introduction, The Naive string matching algorithm, The Rabin-Karp algorithm		
Text Books:			

1. Parag Himanshu Dave, Himanshu Bhalchandra Dave, “Design And Analysis of Algorithms”, Pearson Education, ISBN 81-7758-595-9
2. Gilles Brassard, Paul Bratley, “Fundamentals of Algorithmics”, PHI, ISBN 978-81-203-1131-2

Reference Books:

1. Michael T. Goodrich, Roberto Tamassia , “Algorithm Design: Foundations, Analysis and Internet Examples”, Wiley, ISBN 978-81-265-0986-7
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, MIT Press; ISBN 978-0-262-03384-8
3. Horowitz and Sahani, "Fundamentals of Computer Algorithms", University Press, ISBN: 978 81 7371 6126, 81 7371 61262
4. Rajeev Motwani and Prabhakar Raghavan, “Randomized Algorithms”, Cambridge University Press, ISBN: 978-0-521-61390-3
5. Dan Gusfield, “Algorithms on Strings, Trees and Sequences”, Cambridge University Press, ISBN:0-521-67035-7

e-Resources :

1. https://archive.nptel.ac.in/courses/106/106/106106131/

CIA : Test marks will be scaled to 20

Sr. No	Title	Marks	Schedule	COs
1	Test 1	20	After completion of unit I & II	EC301.1, EC301.2
2	Test 2	20	After completion of unit III & IV	EC301.3, EC301.4
3	Test 3	20	After completion of unit V & VI	EC301.5, EC301.6
4	CIA Activity	20	During Semester	

Analog Circuits and Control Systems (EC302)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ESE : 60 Marks
CIA: 40 Marks
Total: 100 Marks

Prerequisite Course: Signals and Systems EC213, Basic Electronics and Electrical Engineering ES1003

Course Objectives:

1. To introduce various diode applications
2. To study linear and non-linear applications of Op-Amp.
3. Knowledge of Converters and Usefulness of Filter in various fields.
4. To study response of first order and second order systems in the time domain.
5. To introduce the concept of system stability and different criteria for determining the same.
6. To introduce the principles of state space analysis in modeling physical systems.

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

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC302.1	Summarize the fundamental electronic components used in analog circuits	2	Understand
EC302.2	Determine linear & non- linear Applications of Op-amp and its usefulness.	3	Apply
EC302.3	Explain V to I, I to V, ADC and DAC, Analog Filter design	3	Apply
EC302.4	Compute different time domain specifications of first and second order systems.	3	Apply
EC302.5	Determine the stability of closed loop control systems using RH criterion and root locus	3	Apply
EC302.6	Outline the concepts of state space analysis in system modeling.	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
EC302.1	3	1	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	3	2	-	-	-	-	-	-	-	-	2	1	-
EC302.6	2	2	2	-	-	-	-	-	-	-	-	2	1	-

Course Contents

Unit-I	**Introduction to Analog circuits**	No. of Hours	COs
	Ideal Diode, Modeling the diode forward and reverse characteristics, Applications of Diode , BJT Amplifiers, BJT Biasing, Op-amp Block Diagram, Op-amp Parameters, Op-amp amplifiers.	06 Hrs.	EC302.1
Unit-II	**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, Applications of Integrator and Differentiator. Comparator, applications of comparator, Schmitt trigger, Square wave generator, Need of precision rectifier, Half wave, Full wave precision rectifiers.	07 Hrs.	EC302.2
Unit-III	**Converters and Filters using OP-AMP**	No. of Hours	COs
	I-V and V-I converter, DAC: 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, Need of Active filter over passive filter , Design of First order Active LP, HP, BP , wide and narrow band BR Butterworth filters , All pass filters, Applications of filter.	08 Hrs.	EC302.3
Unit-IV	**Introduction to Control Systems and time domain Analysis**	No.of Hours	COs
	Basic elements of a control system; Open loop and Closed loop systems; Transfer function, Signal flow graph, 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	06 Hrs.	EC302.4
Unit-V	**Stability Analysis**	No.of Hours	COs
	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, Polar Plots, Bode Plots	06 Hrs.	EC302.5
Unit-VI	**State Space Analysis**	No.of Hours	COs
	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	06 Hrs.	EC302.6

	properties; Computation of state transition matrix; Concepts of controllability and observability.		

Text Books:

1. Ramakant A. Gaikwad, “Op Amps and Linear Integrated Circuits”,4th Edition, Pearson Education 2021.

2. Salivahanan and Kanchana Bhaskaran, “Linear Integrated Circuits and applications”,1st Edition, Tata McGraw Hill, India, 2018.

3. Farid Golnaraghi, Benjamin C Kuo, “Automatic Control Systems”, 10th Edition, John Wiley and Sons,2017.

Reference Books:

1. George Clayton and Steve Winder, “Operational Amplifiers”, 5th Edition, Newnes,2003

2. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”,4th Edition, McGraw Hill Education ,2016

3. Curtis D. Johnson, “Process Control Instrumentation Technology”, 8th Edition, PHI Pvt. Ltd., New Delhi, 2011

Online Resources :
1. https://onlinecourses.nptel.ac.in/noc20_ee30/
2. https://nptel.ac.in/courses/107/106/107106081/

CIA : Test marks will be scaled to 20

Sr. No	Title	Marks	Schedule	COs
1	Test 1	20	After completion of unit I & II	EC302.1, EC302.2
2	Test 2	20	After completion of unit III & IV	EC302.3, EC302.4
3	Test 3	20	After completion of unit V & VI	EC302.5, EC302.6
4	CIA Activity	20	During Semester	

Database Management System & SQL (EC303)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ESE: 60 Marks
CIA: 40 Marks
Total: 100 Marks

Prerequisite course: Computer Organization & Architecture (EC204)

Course Objectives:

1. To study the fundamental concepts of database management.
2. To introduce a 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
	Installation of SQL/MySQL, 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, OLTP vs OLAP.	07	EC303.2
Unit-III	**Database Modification and Relational Database**	No.of Hours	COs
	Database Modification using SQL Insert, Update and Delete Queries,UTC,TIMESTAMPS. 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, Double Booking Problem.	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. Azure-DB, AWS.	06	EC303.6

Text Books:

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, 6th Edition, 2013.
2. Connally T, Begg C., "Database Systems", Pearson Education, 6th Edition, 2019.
3. R. P. Mahapatra and Govind Verma, “Database Management Systems”, Khanna Publishing House,3rd Edition,2013.

Reference Books:

1. Raghurama Krishan, “Database Management Systems”, McGrawHill, 2nd Edition, 2000.
2. S.K.Singh, “Database Systems : Concepts, Design and Application”, Pearson, Education, ISBN 978-81-317-6092-5.
3. Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled”, Addison Wesley, ISBN 978-0321826626.
4. Kristina Chodorow, Michael Dirolf, “MangoDB: The Definitive Guide”, O’Reilly Publications, ISBN 978-1449381561.

e-Resources: https://nptel.ac.in/courses/106/105/106105175/

Guidelines for Continuous Internal Assessment: Total: 40 Marks.

i)Centralized Test: 20 Marks.

ii)Project based Activity: 20 Marks.

Theory of Computations (EC304)

Teaching Scheme
Lectures: 3 Hrs. / Week
Tutorial: 1 Hr/Week
Credits: 4

Examination Scheme
ESE: 60 Marks
CIA: 40 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
EC304.1	Understand formal language, translation logic, essentials of translation, alphabets, language representation.	2	Understand
EC304.2	Construct regular expressions to present regular language.	3	Apply
EC304.3	Design Context Free Grammars.	3	Apply
EC304.4	Construct Push down Automaton model for the Context Free Language.	3	Apply
EC304.5	Devise Turing Machine for the different requirements outlined by theoretical computer science	3	Apply
EC304.6	Illustrate the concepts of NP completeness.	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
EC304.1	3	1	1	-	-	-	-	-	-	-	-	-	-	2
EC304.2	3	2	2	-	-	-	-	-	-	-	-	-	-	3
EC304.3	3	2	2	-	-	-	-	-	-	-	-	-	-	3
EC304.4	3	2	3	-	-	-	-	-	-	-	-	-	-	3
EC304.5	3	2	3	-	-	-	-	-	-	-	-	-	-	3
EC304.6	3	1	1	-	-	-	-	-	-	-	-	-	-	2

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	EC304.1
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	6	EC304.2
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.	6	EC304.3
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.	6	EC304.4
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	6	EC304.5
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.	6	EC304.6

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 : Test marks will be scaled to 20

Sr. No	Title	Marks	Schedule	COs
1	Test 1	20	After completion of unit I & II	EC215.1, EC215.2
2	Test 2	20	After completion of unit III & IV	EC215.3, EC215.4
3	Test 3	20	After completion of unit V & VI	EC215.5, EC215.6
4	CIA Activity	20	Tutorial During Semester	

Electromagnetics (EC305A)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
End-Sem Exam: 60 Marks
CIA: 40 Marks
Total: 100 Marks

Prerequisite course : Engineering Mathematics-II

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	06Hrs.	EC305A.1

	equation.		
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", 6th Edition ,Oxford University Press Inc, 2015.
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",4th Edition. John Wiley,2016

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”,2nd edition PHI, 2015
3. K. D. Prasad, “Antenna & Wave Propagation”, Satya Prakashan, New Delhi,2019
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 marks will be scaled to 20

Sr. No	Title	Marks	Schedule	COs
1	Test 1	20	After completion of unit I & II	EC305A.1, EC305A.2
2	Test 2	20	After completion of unit III & IV	EC305A.3, EC305A.4
3	Test 3	20	After completion of unit V & VI	EC305A.5, EC305A.6
4	CIA Activity	20	During Semester	

Network Theory And Analysis (EC305B)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme

End-Sem Exam: 60 Marks
CIA: 40 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	6 Hrs.	EC305B.3

	state response.		
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 networks.	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,2019
2. D. Roy Choudhury,“Networks And Systems” New Age International Publications, 2nd edition,2010
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.

Reference Books:

1. Alexander and Sadiku,”Electric Circuits”, McGraw Hill education (India) Pvt. Ltd., 5th edition, 2013.
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, 8th edition,2013
4 Agarwal, Anant, and Jeffrey H. Lang. “Foundation of Analog and Digital Electronic circuits”. San Mateo, CA: Morgan Kaufmann Publishers, Elsevier, July 2005.

Online Resource :
https://onlinecourses.nptel.ac.in/noc20_ee46/preview

CIA : Test marks will be scaled to 20

Sr. No	Title	Marks	Schedule	COs
1	Test 1	20	After completion of unit I & II	EC305B.1, EC305B.2
2	Test 2	20	After completion of unit III & IV	EC305B.3, EC305B.4
3	Test 3	20	After completion of unit V & VI	EC305B.5, EC305B.6
4	CIA Activity	20	During Semester	

PEC1-Software Testing & Quality Assurance (EC305C)

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

Examination Scheme
ESE : 60 Marks
CIA: 40 Marks
Total: 100 Marks

Prerequisite : Software Engineering Modelling & Design

Course Objectives :
1. To understand fundamentals concepts of software testing.
2. To learn Black box testing techniques.
3. To understand White box testing techniques.
4. To understand Testing Strategies, software quality and assurance systems.
5. To learn Test 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
EC305C.1	Retrieving real world application scenarios of software testing.	1	Remembering
EC305C.2	Describe black box testing	2	Understand
EC305C.3	Describe white box testing	2	Understand
EC305C.4	Demonstrate different approaches of Testing Strategies, software quality and assurance systems	3	Apply
EC305C.5	Illustrate the Test planning and Management.	3	Apply
EC305C.6	Use automated test tools for software testing.	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	2	-	-	1	-	-	-	-	-	-	-	1	-
EC305C.2	2	2	-	-	2	-	-	-	-	-	-	-	1	-
EC305C.3	2	2	-	-	2	-	-	-	-	-	-	-	1	-
EC305C.4	2	-	-	-	2	-	-	-	-	-	-	-	1	-
EC305C.5	2	3	-	-	3	-	-	-	-	-	-	-	1	-
EC305C.6	3	1	-	-	3	-	-	-	-	-	-	-	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, categories of defect in software,** Defect management, Verification and validation.	6	EC305C.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 Class Partitioning, **Cause Effect Testing,** Domain testing, Design of test cases, **Case studies of Black- Box testing.**	6	EC305C.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, **Multiple Condition Testing, MC/DC Coverage, Cyclomatic Complexity, CFG, Mutation Testing**, Challenges in White box testing, **Case-studies of White-Box testing.**	6	EC305C.3
Unit-IV	Testing Strategies and Quality Management	No.of Hours	COs
	Unit testing , 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, ISO 9000 Quality Standards.	6	EC305C.4
Unit-V	Test Planning and Management	No. of Hours	COs
	Requirement Traceability matrix, Essentials, Work bench, Testing process, Important Features of Testing Process, Misconceptions, Principles, Test Strategy, Test Plan, Testing Process and number of defects found, Cost aspect, methods, structured approach, Developing Test Strategy and Plan,Case studies	6	EC305C.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 web drivers.	6	EC305C.6

Text Books:

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

Reference Books:

1: Srinivasan Desikan, Gopalswamy Ramesh, “Software Testing principles and Practices”,Pearson Education. 2nd edition,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 education,2nd edition, 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_cs91
https://coursera.org/learn/introduction-software-testing

Guidelines for Continuous Assessment:-

1. Test 1 will be conducted on unit1 & Unit2 for 20 marks
2. Test 2 will be conducted on unit3 & Unit4 for 20 marks
3. Sum of both test score will be scaled to 20 marks
4. CIA Marks will be given based on NPTEL Software Testing course assignments score.
5. NPTEL best 6 assignment score will be scaled to 20 marks.
6. Additional 5 marks weightage will be given to the student who will get NPTEL certificate, provided maximum marks will be limited to 20.

Analog Circuits and Control Systems Laboratory (EC307)

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

Examination Scheme
PR : 50 Marks
Total: 50 Marks

Course Objectives :

1. To have an 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. Develop a strong foundation in circuit analysis using software tools

5. To gain knowledge of key concepts such as transfer functions, stability, frequency response, and controller design.

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

CO	CO Statement	Bloom's Taxonomy	
		Level	Descriptor
EC307.1	To gain knowledge of various Analog circuits	2	Understand
EC307.2	Implement various Applications of Op-amp	3	Apply
EC307.3	Implement a hardwired circuit to test performance and application for what it is being designed.	4	Analyze
EC307.4	Implement circuit using software tool to test performance and application for what it is being designed.	4	Analyze
EC307.5	To simulate and analyze control system behavior, design and system performance.	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
EC307.1	2	-	-	3	1	-	-	-	1	2	-	2	1	-
EC307.2	2	2	2	3	1	-	-	-	1	2	-	2	1	-
EC307.3	2	2	2	3	1	-	-	-	1	2	-	2	1	-
EC307.4	2	2	2	3	3	-	-	-	1	2	-	2	1	-
EC307.5	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	EC307.1 , EC307.3
2	Design, build and test diode half wave and full wave rectifiers	EC307.1 , EC307.3
3	Design, build and test integrator and differentiator for given frequency .	EC307.2 , EC307.3
4	Design, build and test precision half wave rectifier.	EC307.2 , EC307.3
5	Design, build and test Schmitt trigger and plot transfer characteristics.	EC307.2 , EC307.3
6	Design and implement 2 bit R-2R ladder DAC & Flash type ADC.	EC307.2 , EC307.3
7	Design, build and test square wave generator.	EC307.2 , EC307.3
8	Write MATLAB program for Step Response of a Second-Order System	EC307.5
9	Write MATLAB program to plot Bode plot of a Transfer Function	EC307.5
10	Write MATLAB program to plot Root Locus Plot	EC307.5
11	Write MATLAB program for State-Space Control Design	EC307.5
12	*Simulation on any one application of Op-amp	EC307.4
13	*Simulation on any one application of Diode	EC307.4

* Experiment is compulsory

DBMS and SQL Laboratory (EC308)

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
EC308.1	Construct ER model for given requirements and convert the same into database tables.	2	Understand
EC308.2	Illustrate basic program constructs in SQL and PL/SQL.	2	Understand
EC308.3	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
EC308.1	--	--	--	--	3	--	--	--	--	--	--	3	3	--
EC308.2	--	--	--	--	3	--	--	--	--	--	--	3	2	--
EC308.3	--	--	--	--	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.)	EC308.1, EC308.2
2	Write relational algebra queries for a given set of relations.	EC308.1, EC308.2
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.	EC308.2, EC308.3
4	Perform the following: a. Altering a Table, Dropping/Truncating/Renaming Tables, Backing up / Restoring a Database.	EC308.1, EC308.3
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).	EC308.2, EC308.3
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.	EC308.3
7	Write a PL/SQL program using looping statements to insert ten rows into a database table.	EC308.1, EC308.2
8	Given the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID) write a cursor to select the five highest paid employees from the table.	EC308.2, EC308.3
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.	EC308.3
10	Given an integer i, write a SQL procedure to insert the tuple (i, 'xxx') into a given relation.	EC308.2, EC308.3
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.	EC308.3

	● 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.	
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.	EC308.3
13	Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUD operations, Execution).	EC308.1, EC308.3

Seminar and Communication Skills (EC309)

Teaching Scheme
Practical: 4 Hrs./Week
Credits: 2

Examination Scheme
OR: 50 marks

Prerequisite Course: Communication Skills (CS107)

Course Objectives:

1. To identify, understand and discuss current real-world issues.
2. To study new technologies, researches, products and algorithms
3. To learn the basic principles of communication (verbal and non-verbal)

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

COs	CO Statement	Bloom's Descriptor	
		Level	Descriptor
EC309.1	To illustrate multiple thinking strategies to examine real-world issues	3	Apply
EC309.2	To explore a detailed literature survey and build a document with respect to technical publications	3	Apply
EC309.3	To acquire Reading, speaking, writing and presentation skills in both social and professional contexts	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
EC309.1	2	--	--	--	--	--	--	--	--	--	--	2	--	--
EC309.2	2	2	--	2	--	--	--	--	--	--	--	2	--	--
EC309.3	2	--	--	--	2	2	--	--	--	--	2	2	--	--

A. Guidelines:

- student will select a topic in the area of Electronics and Computer Engineering and preferably keeping track with recent technological trends and development
- The topic must be selected in consultation with the guide.
- Student will make a seminar presentation using audio/visual aids for a duration of 15-20 minutes and submit the seminar report.

B. Seminar topics may be from the following sample domains, but not limited to:

- Artificial Intelligence
- Computer Networking
- WSN and IOT
- Embedded systems
- Agriculture Engineering
- Biomedical Engineering
- Robotics/Process Automation
- Automotive Electronics, etc…

C. Activities to be monitored by the guide.

- Finalization of Seminar topic with broad literature survey.
- Preparation of Introduction and abstract.
- Finalization of topics and subtopics for chapters
- Preparation of conclusions and summery.
- Preparation of report and presentation.

Note:- Log book for all these activities shall be maintained.(For Student)

Note:- The Coordinator should prepare the format of the seminar as per the guidelines and provide the prescribed format to the students.

D. Guidelines for Seminar Report writing: A report with following contents shall be prepared:

a) Contents

1) Cover Page & Title Page
2) Certificate
3) Abstract
4) Acknowledgments
5) List of figures
6) List of tables
7) Abbreviations
8) Contents
9) Chapters
10) Appendix
11) References

b) Guidelines for making Seminar report:

1) Should be typed in MS-WORD on A/4 size executive bond paper using font - times new roman only
2) Main heading --- Font size 14 and BOLD.
3) Sub heading --- Font size 12 and BOLD.
4) Text --- Font size 12.
5) Spacing between lines must be 1.5 lines.
6) All figures should be numbered serially.
7) Colour images are also permitted.
8) Should be spiral bound form from one common place this is required to achieve uniformity.
9) Headers and footers must be placed as prescribed in the format.
10) Margins of pages shall confirm the following specification:
    a) Left margin – 3.5cm from edge of paper
    b) Right margin – 2 cm from edge of paper
    c) Top margin – 2 cm from edge of paper
    d) Bottom margin – 2 cm from edge of paper
12) The report must be prepared in consultation with guide and must be thoroughly checked.
13) All pages must be without border.
14) All text should be black in colour only.
15) References must be cited at appropriate place in the text and placed in Squared Brackets [ ].
16) Pages should be numbered from introduction onwards. First page of chapter should not have a printed page no.
17) Page numbers should be placed at the bottom centre.

Text Books:

1. Johnson-Sheehan, Richard, “Technical Communication”, Longman. ISBN 0-321-11764-6

2. M Ashraf Rizvi, “Effective Technical Communication”, Tata McGraw Hill Education Pvt. Ltd.

3. Rebecca Stott, Cordelia Bryan, Tory Young, “Speaking Your Mind: Oral Presentation and Seminar Skills (Speak-Write Series)”, Longman, ISBN-13: 978-0582382435

Reference books:

1. Meenakshi Raman, Sangeeta Sharma, " Technical Communication, Principles and Practice", Oxford University Press, (2nd Edition), (2012).
2. M. Ashraf Rizvi," Effective Technical Communication", Tata McGraw Hill Education Pvt. Ltd. (1st Edition), (2005).
3. C. Muralikrishna, Sunita Mishra," Communication Skills for Engineers", Pearson Education India, (2nd Edition), (2011) .
4. Thomas C Hayes, Paul Horowitz, "The Art of Electronics", Cambridge University Press, (3rd Edition), (2015).
5. Jim Williams, "Analog Circuit Design: Art, Science and Personalities", Elsevier EDN series for Design Engineers, (1st Edition), (2013).

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 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
- FINANCE
- ART FORM
- TECHNICAL TOPICS
- ROAD SAFETY
- ENTREPRENEURSHIP
- MOTIVATIONAL THOUGHTS
- ETHICS
- POLITICS

· BEHAVIORAL AND INTERPERSONAL SKILLS
· TOURISM
· SOCIAL SCIENCE
· DISASTER MANAGEMENT
· WOMEN'S EMPOWERMENT
· HEALTH
· ENGINEER AND SOCIETY
· TEAM WORK

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 2023-24

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	60	40	-	-	-	100
		Total	**4**	**-**	**-**	**4**	**60**	**40**				**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	60	40	-	-	-	100
LC	EC8103	Embedded system hardware and software design Lab	-	-	2	1	-	-	-	50	-	50
		Total	**4**	**-**	**2**	**5**	**60**	**40**	**-**	**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	60	40	-	-	-	100
LC	EC8202	ABAP Workbench Fundamentals Part - I Lab	-	-	2	1	-	-	-	50	-	50
		Total	**4**	**-**	**2**	**5**	**60**	**40**	**-**	**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	60	40	-	-	-	100
		Total	**4**	**-**	**-**	**4**	**60**	**40**				**100**

Microcontroller and Embedded C Programming (EC8101)

Teaching Scheme
Lectures: 4 Hrs. / Week
Credits: 4

Examination Scheme
ESE: 60 Marks
CIA: 40 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 Hours	COs
	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 the 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
ESE: 60 Marks
CIA: 40 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: 2 Hrs/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

2021 Pattern

Proposed Program Structure

(B. Tech. with effect from Academic Year 2021-2022)

(T Y B. Tech. Sem-VI 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	OR	End-Semester Oral Examination
CIA	Continuous Internal Assessment	P	Practical
EFC	Engineering Foundation Course	PCC	Professional Core Course
ESE	End-Semester Evaluation	PEC	Professional Elective Course
HSMC	Humanities/Social Sciences/Management Course	PR	End-Semester Practical Examination
IP	Induction Program	PROJ	Project
L	Lecture	T	Tutorial
MC	Mandatory Course	TW	Continuous Term Work Evaluation
OEC	Open Elective Course		

T. Y. B. TECH. *2021 Pattern* (Electronics and Computer Engineering) SEMESTER-VI

Course			Teaching Scheme (Hours/week)				Evaluation Scheme/ Max Marks					
							Theory					
Cat	Code	Title	L	T	P	Credits	CIA	ESE	OR	PR	T W	Total
PCC	EC311	Embedded Systems and RTOS	4	-	-	4	40	60	-	-	-	100
PCC	EC312	System Programming and Operating System	3	-	-	3	40	60	-	-	-	100
PCC	EC313	Web Technology	3	-	-	3	40	60	-	-	-	100
PEC	EC314	Refer List of PEC2	3	-	-	3	40	60	-	-	-	100
PROJ	EC315	Project Based Learning	-	-	2	1	-	-	-	-	50	50
PROJ	PR316	IPR & EDP	2	-	-	2	20	30	-	-	-	50
LC	EC317	Embedded Systems and RTOS 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	**16**	**-**	**10**	**20**	**180**	**270**	**50**	**100**	**100**	**700**

Professional Elective Course 2 (PEC2):	
EC314A	Advanced Digital Signal Processing
EC314B	Power Electronics and Drives
EC314C	Data Mining

B Tech Honors in Embedded Systems and IoT w. e. f. Academic Year 2023-24

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	60	40	-	-	-	100
LC	EC8103	Embedded system hardware and software design Lab	-	-	2	1	-	-	-	50	-	50
		Total	**4**	**-**	**2**	**5**	**60**	**40**	**-**	**50**	**-**	**150**

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

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	60	40	-	-	-	100
		Total	**4**	**-**	**-**	**4**	**60**	**40**				**100**

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

(Dr. A. B. Pawar)
Dean Academics

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

Embedded Systems and RTOS (EC311)

Teaching Scheme
Lectures: 04 Hrs/Week
Credits:04

Examination Scheme
ESE:60 Marks
CIA:40 Marks
Total: 100 Marks

Prerequisite Course: Microprocessors and Microcontrollers (EC214), Computer Organization and Architecture (EC204)

Course Objectives:

1. To consciousness among students towards different embedded applications around them.
2. To understand step by step process of designing embedded systems application using waterfall model.
3. To recognize hardware platforms used for designing embedded system for specified application.
4. To realize design of real time system using μCOS-II RTOS and inspect various designing issues of real time system with respect to specific applications.
5. To become competent in design of real time and non real time embedded system application using RTOS and Embedded Linux respectively.
6. To develop skills for implementing application specific embedded systems.

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

Course Outcomes	Statements	Bloom's Descriptor	
		Level	Descriptor
EC311.1	Explain different design aspects of embedded system	2	Understand
EC311.2	Foster step by step design process of embedded systems for specified application using waterfall model.	3	Apply
EC311.3	Utilize capabilities of modern hardware in designing embedded systems	4	Analyse
EC311.4	Explain the structure and working of real-time and non real-time Operating Systems used in embedded system design.	2	Understand
EC311.5	Implement formal methods of RTOS for the design of real-time systems.	3	Apply
EC311.6	Design embedded systems for different domestic and industrial application by applying 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
EC311.1	1	2	-	-	-	-	-	-	-	-	3	-	1	-
EC311.2	-	2	2	-	3	1	3	1	-	1	3	3	2	-
EC311.3	3	2	1	-	3	-	-	-	-	-	-	-	3	-
EC311.4	3	1	1	-	2	-	-	-	-	-	-	-	3	-
EC311.5	2	-	-	-	1	-	-	-	-	-	-	-	3	-
EC311.6	1	2	2	-	2	2	-	-	-	-	-	2	2	-

Course Contents

Unit-I	Basics of Embedded Systems	No. of Hrs	COs
	Introduction to Embedded Systems, definition, Applications and recent trends in embedded system, Block diagram, Architecture of embedded system, Characteristics, Classification, Design Metrics, Optimization of Design metrics, Key Design challenges, Design constraints	08	EC311.1
Unit-II	**Embedded System Development Cycle**		
	Requirement engineering, requirement Specification, Hardware-Software Partitioning, Hardware-Software co-design, Integration, Testing, Quality Assurance, Aesthetic Design, Maintenance, and Electronics Waste Management. Iterative model, Agile model, Kano's model of customer satisfaction.	08	EC311.2
Unit-III	**Embedded System Hardware Design**		
	Hardware Architecture of embedded System, Sensors, Signal Conditioning circuits, Actuators, device drivers, Microcontrollers/Microprocessors/reconfigurable hardware, Introduction to advanced microcontrollers, ARM family, Multi core processors & SoC, Open Source prototyping boards, Communication mechanisms, Mechanical Assembly & aesthetic design, Specifications & Selection criteria of all	08	EC311.3
Unit-IV	**Embedded System Software Design**		
	Software Architectures of embedded System, Concept and necessity of RTOS, Types of RTOS, Non Real-time Operating Systems: Introduction to Embedded Linux, Embedded Linux architecture, Real Time OS: Introduction to Vxworks, Introduction to µCOS-II: Features, Architecture.	08	EC311.4
Unit-V	**µCOS-II Real Time Operating System**		
	File structure, Concept of Task, Assign static and dynamic priority to the tasks, Multitasking, Clock tick Types of services: - System Services, Task management Services, Time management services, Shared resources/critical section of code, Concept of deadlock, Protection mechanisms, ITC/IPC Services.	08	EC311.5
Unit-VI	**Applications of Embedded Systems**		
	Digital Camera, Automatic Chocolate vending machine, smart Mobile Phone, Home automation, farm automation, industrial automation, Voice operated devices like Alexa and IoT devices	08	EC311.6

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", Prentice Hall, 2 edition, 2010

Reference 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.
3. Dr. K. V. Prasad, “Embedded Real Time Systems: Concepts, Design and Programming”, Dreamtech Press, 2003 ISBN: 978-81-772-2461-0

e-Resources:

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

CIA:- Project Based Learning. (On entire syllabus)

The students can select hardware, software or system level projects. The project can be implemented using Microcontroller, Device driver or RTOS tools which students have studied and used during the course.

System Programming and Operating System (EC312)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ESE: 60 Marks
CIA: 40 Marks
Total: 100 Marks

Prerequisite Course: Computer Fundamentals and Programming (ES1002)

Course Objectives:

1. To explore system programming concepts, like the use and implementation of Macro processor and Assembler
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	Course Outcome Statements	Bloom's Taxonomy	
		Level	Descriptor
EC312.1	Determine the concept of Systems Programming, Macro processor and Assembler	3	Apply
EC312.2	Identify toy compiler and Loader for the given architecture.	3	Apply
EC312.3	Abstract the concepts of OS along with process management.	3	Apply
EC312.4	Apply deadlock detection methods for solving deadlocks.	3	Apply
EC312.5	Classify memory scheduling policies for process scheduling.	4	Analyze
EC312.6	Elaborate the concept of I/O devices and file system	3	Apply

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

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO11	PO1 2	PS O1	PSO2
EC312.1	1	2	2	-	2	-	-	-	-	-	-	-	-	1
EC312.2	1	-	-	-	2	-	-	-	-	-	-	-	-	-
EC312.3	2	3	2	-	3	-	-	-	-	-	-	-	-	2
EC312.4	2	3	2	-	2	-	-	-	-	-	-	-	-	2
EC312.5	2	3	2	-	2	-	-	-	-	-	-	-	-	2
EC312.6	2	-	-	-	2	-	-	-	-	-	-	-	-	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. **Macros and Assemblers:** Macro Definition and call, Macro expansion Elements of Assembly language programming. Simple assembler scheme, Structure of an assembler, Design of single and two pass assemblers.	08 Hrs.	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 and Linkers:** Loader Schemes: Compile and go, General Loader Scheme, Absolute loaders, subroutine linkages, relocating loaders, direct linking loaders, Design of an absolute loader. Relocation and linking concepts,	08 Hrs.	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. Concept of thrashing in OS. **Process Management:** Process Concept, Process states, Process control, Threads, Scheduling: Types of scheduling: Preemptive, non preemptive, Scheduling algorithms: FCFS, SJF, RR.	08 Hrs.	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.	08 Hrs.	EC312.4
Unit -V	**Memory Management**	No. of Hours	Cos
	Basics of memory management, Swapping, Memory Allocation, Virtual memory,Paging, Segmentation,Demand Paging, Page replacement, Page replacement algorithms – Optimal FIFO, LRU, LRU approximation, counter algorithm, Allocation of frames	08 Hrs.	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	08 Hrs.	EC312.6

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:

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

Online 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

1. Class Test (20) – Total 02 Test

Test	Content	Marks	20 Marks
Test-I-	UNIT I & UNIT-II	20 Marks	
Test-II	UNIT III & UNIT-IV	20 Marks	40/2=20

2. Assignment on UNIT V & UNIT VI (10 Marks)
3. CIA Activity—Literature Survey (10 Marks)

CIA Total Marks (40)= Test (20) +Assignment(10) + CIA Activity (10)

Web Technology (EC313)

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

Examination Scheme
ESE : 60 Marks
CIA: 40 Marks
Total: 100 Marks

Prerequisite Course:

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	Course Outcome Statements	Bloom's Taxonomy	
		Level	Descriptor
EC313.1	Acquire the necessary skills to design dynamic and interactive web-pages using HTML5 in a simplified manner..	3	Apply
EC313.2	Determine appropriate client-side technologies to design web-based applications.	3	Apply
EC313.3	Demonstrate interactivity using jQuery in web-based applications.	3	Apply
EC313.4	Examine suitable server-side technologies to design web-based applications.	3	Apply
EC313.5	Design dynamic and interactive web-pages in a simplified manner using PHP.	3	Apply
EC313.6	Investigate the use of Content Management and frameworks in designing web-based applications.	3	Apply

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

	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO11	PO12	PSO 1	PSO2
EC313.1	3	–	3	–	2	–	–	–	–	–	–	1	2	3
EC313.2	2	–	2	–	3	–	–	–	–	–	–	2	2	3
EC313.3	2	–	1	–	2	–	–	–	–	–	–	3	2	3
EC313.4	2	–	3	–	1	–	–	–	–	–	–	2	2	3
EC313.5	1	–	2	–	3	–	–	–	–	–	–	1	2	3
EC313.6	1	–	2	–	3	–	–	–	–	–	–	2	2	3

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.	EC313.1
Unit-II	**Client Side Technologies**	No.of Hours	

	CSS: Need of CSS, Types of CSS, CSS Selectors, CSS for basic HTMLtags, 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 (Embedded, External), Data types, ControlStructures, Arrays, Functions and Scopes, Objects in JS.	07 Hrs.	EC313.2
Unit-III	**Client Side Technologies and Frameworks**	No.of Hours	
	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. ***(Case study on Youtube)***	08 Hrs.	EC313.3
Unit-IV	**Server side Technologies**	No.of Hours	
	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. ***(Case study on CET Website)***	08 Hrs.	EC313.4
Unit-V	**Introduction to PHP**	No.of Hours	
	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. ***(Case study on Uber taxi booking services)***	08 Hrs.	EC313.5
Unit-VI	**Frameworks**	No.of Hours	
	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 ***(Case study on PaypaL)***	08 Hrs	EC313.6

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. (AICTE)

Reference Books:

1. Ivan Bayross,"Web Enabled Commercial Application Development Using HTML, JavaScript, DHTMLand 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.(AICTE)

Guidelines for Continuous Internal Assessment: 40 Marks (Website development) Students need to develop website for their own portfolio.

Advanced Digital Signal Processing (EC314A)

Teaching Scheme
Lectures: 03 Hrs./Week

Credits: 03

Examination Scheme
ESE : 60 Marks
CIA: 40 Marks
Total: 100 Marks

Prerequisite course: Fundamentals of DSP (EC213)

Course Objectives:

1. To introduce the modern digital signal processing algorithms and applications.
2. To study wavelet transforms for discrete time signals and systems.
3. To study Linear prediction and various Filters and Power Spectrum estimation
4. To introduce applications of signal processing in different domains

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

Course Outcomes	Course outcome	Blooms Taxonomy	
		Level	Descriptor
EC314A.1	Implement sampling rate conversion by decimation & Interpolation process	3	Apply
EC314A.2	Apply Wavelet Transform on a time value signal.	3	Apply
EC314A.3	Compute forward and backward linear prediction of a stationary random process using Levinson-Durbin Algorithm	3	Apply
EC314A.4	Solve adaptive filters and its application using LMS algorithm & RLS algorithm.	3	Apply
EC314A.5	Execute parametric & non-parametric methods for power spectrum estimation.	3	Apply
EC314A.6	Explain different Digital Signal Processing 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
EC314A.1	3	---	1	---	2	---	---	---	1	---	---	2	2	---
EC314A.2	2	---	1	---	3	---	---	---	1	---	---	1	2	---
EC314A.3	2	---	2	---	2	---	---	---	1	---	---	2	3	---
EC314A.4	2	---	2	---	1	---	---	---	1	---	---	1	2	---
EC314A.5	2	---	2	---	3	---	---	---	1	---	---	3	3	---
EC314A.6	2	---	2	---	3	---	---	---	1	---	---	3	3	---

Course Contents

Unit-I	**Introduction to Digital Signal Processing**	No. of Hours	CO .1

	Review of Discrete time signals and systems and frequency analysis of discrete time linear time invariant systems, implementation of discrete time systems, correlation of discrete time systems Sampling, decimation by a factor 'D', Interpolation by a factor 'I', sampling rate conversion by a factor 'I/D', Implementation of sampling rate conversion, Multistage implementation of sampling rate conversion	07	EC314A.1
Unit-II	**Wavelet transforms**	No. of Hours	CO 2
	Introduction, wavelet coefficients – orthonormal wavelets and their relationship to filter banks, multi-resolution analysis, and Haar and Daubechies Wavelet.	06	EC314A.2
Unit-III	**Linear prediction and Optimum Linear Filters**	No. of Hours	CO 3
	Random signals, Correlation Functions and Power Spectra, Representation of a Stationary Random Process. Forward and Backward Linear Prediction. Solution of the Normal Equations. The Levinson-Durbin Algorithm. Properties of the Linear Prediction-Error Filters.	07	EC314A.3
Unit-IV	**Adaptive filters**	No. of Hours	CO 4
	Introduction to Adaptive Filters, Applications of Adaptive Filters: -Adaptive Channel Equalization, Adaptive noise cancellation, Linear Predictive coding of Speech Signals, Adaptive direct form FIR filters-The LMS algorithm, Properties of LMS algorithm. Adaptive direct form filters- RLS algorithm	07	EC314A.4
Unit-V	**Power Spectrum Estimation**	No. of Hours	CO 5
	Non parametric Methods for Power Spectrum Estimation: - Bartlett Method, Welch Method, Blackman &Tukey Methods. Parametric Methods for Power Spectrum Estimation: - Relationship between the auto correlation and the model parameters, Yule and Walker methods for the AR Model Parameters, Burg Method for the AR Model parameters, ARMA Model for Power Spectrum Estimation.	07	EC314A.5
Unit-VI	**DSP Processor and Applications**	No. of Hours	CO 6
	General Architecture of DSP, Multiplier and Multiplier Accumulator(MAC), Barrel shifter, DSP processor TMS320C67XX/MSP430(Features and Architecture). Application of DSP in different domains (speech Processing, Image processing, biomedical field and Radar signal processing).	06	EC314A.6

Text Books:

1. John G. Proakis, Dimitris G. Manolakis, - Digital Signal Processing: Principles, algorithms and applications 4th edition, Pearson Prentice Hall, 2012

2. Mitra, Sanjit Kumar, and Yonghong Kuo - Digital signal processing: a computer-based approach. Volume 2, McGraw-Hill Higher Education, 2006.

3. Haykin, Simon S. - Adaptive filter theory, 5th edition, Pearson Education India, 2013

4. Oppenheim, Alan V. -Discrete-time signal processing, Pearson Education India, 1999

Reference Books:

1. Ifeachor E.-Digital Signal Processing: Practical approach, Pearson publication,2nd edition, 2002

2. K.P. Soman and K.L. Ramchandran - Insight into WAVELETS from theory to practice, Eastern Economy Edition, 2008

3. S. K.Mitra - Digital Signal Processing, 4th Edition, McGraw Hill Publication.2013

4. Rulph Chassaing and Donald Reay - Digital Signal Processing and Applications with the TMS320C6713 and TMS320C6416 DSK, John Wiley & Sons, Inc., Hoboken, New Jersey,2008

e-Resources:

1. https://nptel.ac.in/courses/117/102/117102060/
2. http://www.dspguide.com/
3. https://ekeeda.com/degree-courses/electrical-engineering/advanced-digital-signal-processing

Guidelines for Continuous Internal Assessment:

1. Test1 will be conducted on UNIT1 & UNIT2 for 20 marks.
2. Test2 will be conducted on UNIT3 & UNIT4 for 20 marks.
3. Test3 will be conducted on UNIT5 & UNIT6 for 20 marks.

4. Self-learning activity will be conducted for 20 marks.

Total marks(40) = Average of all Tests(20) + Self learning activity(20)

Power Electronics and Drives (EC314B)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
CIA: 40 Marks
ESE : 60 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 and single phase and three phase inverters	2	Understand
EC314B.3	Select suitable power converter to control electric motors	4	Analyze
EC314B.4	Select approriate Battery Management System	3	Apply
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.	8	EC314B.1
Unit-II	AC-DC and DC-AC 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.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.	7	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.	8	EC314B.3
Unit-IV	Introduction to Battery Management System	No. of Hrs	COs
	BMS functionality, Battery pack topology, Voltage Sensing, Temperature Sensing, Current Sensing, Isolation sensing, Thermal control, Protection, Communication Interface. Battery State of Charge and State of Health Estimation, Cell Balancing:Battery state of charge estimation (SOC), voltage-based methods to estimate,SOC,Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium ion aging: Positive electrode, Cell Balancing	7	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.	7	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	8	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 20 Marks
2. Test will be conducted on Uni3 & Unit4 for 20 Marks
3. Test will be conducted on Uni5 & Unit6 for 20 Marks

Test 60 Marks will be scaled to 20 marks

4. Self learning activity (20 Marks) will be conducted in groups for design of Power supply, Fan Regulator, DC motor control, AC motor control, DC Drives, AC Drives.

Total CIA (40 marks)= Test(20 Marks)+ Self Learning(20)

Data Mining (EC314C)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
ESE : 60 Marks
CIA: 40 Marks
Total: 100 Marks

Prerequisite Course: 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
EC 314C.1	Describe data mining process through Knowledge Discovery in Data Mining	2	Understand
EC 314C.2	Explore various Data preprocessing Methods	2	Understand
EC 314C.3	Optimize the mining process by choosing best data mining technique	3	Apply
EC 314C.4	Identify appropriate data mining algorithms to solve real world problems	3	Apply
EC 314C.5	Identify the hidden patterns in the data	2	Understand
EC 314C.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
EC314C.1	1	1	-	-	-	-	-	-	-	-	-	1	1	-
EC314C.2	2	2	1	-	2	-	-	-	-	-	-	2	3	-
EC314C.3	3	2	2	-	2	-	-	-	-	-	-	2	2	-
EC314C.4	2	1	-	-	-	-	-	-	-	-	-	1	1	-
EC314C.5	2	1	1	-	2	-	-	-	-	-	-	2	1	-
EC314C.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.	EC314C.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	08 Hrs.	EC314C.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.	EC314C.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	08 Hrs.	EC314C.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.	08 Hrs.	EC314C.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.	07 Hrs.	EC314C.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/

Guidelines for Continuous Assessment:-

Online Course: 10 Marks

Students need to complete online course

End to End Industry Ready Data Mining Project: 30 Marks

This will be a Group activity. Each group will be assigned a problem statement and will be provided dataset access. Students need to develop end to end Solution for a given problem and find out useful insights from a given dataset using data mining techniques. Students need to submit detailed report of the same.

Project Based Learning (EC315)

Teaching Scheme
Practical: 2 Hrs. / Week
Credits: 01

Examination Scheme
TW: 50 Marks
Total: 50 Marks

Preamble:

The main stream engineering education follows traditional classroom teaching, in which the major focus is mainly on the lecturer and the student has very little (if any) choice on the learning process. This traditional approach no doubt has been effective for years; however rapid development in engineering and technology requires adopting a teaching approach that would assist students not only in developing a core set of industry relevant skills, but also enable them to adapt to changes in their professional career. Today the employers' demands are: Communication skills, Ability to work in Interdisciplinary teams, Analytical skills, Management skills. This consideration concludes that Project-Based Learning (PBL) is the best way to fulfill industry needs.

Course Objectives:

- To emphasize project based learning activities that are long-term, interdisciplinary and student-centric.
- To inculcate independent and group learning by solving real world problem with the help of available resources.
- To be able to develop application based on the fundamentals of electronics and computer engineering by possibly the integration of previously acquired knowledge.
- To get practical experience in all steps in the life cycle of the development of electronics and computer Systems: specification, design, implementation, and testing
- To be able to select and utilize appropriate hardware and software tools to design and analyze the proposed system.
- To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

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

CO's	Course Outcomes	Blooms Taxonomy	
		Level	Descriptor
EC315.1	Identify the real world problem (possibly of interdisciplinary nature) through a rigorous literature survey and formulate/set relevant aim and objectives.	3	Apply
EC315.2	Contribute to society by following professional ethics and safety measures.	2	Understand
EC315.3	Propose a suitable solution based on the fundamentals of electronics and Computer engineering by the integration of previously acquired knowledge.	3	Apply
EC315.4	Analyze the results and arrive at valid conclusion.	4	Analyze
EC315.5	Use of technology in proposed work and demonstrate learning in oral and written form.	3	Apply
EC315.6	Develop ability to work as an individual and as a team member.	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
CO1	3	2			3	3	2				2	2	-	-
CO2						3	3	3			2	2	-	-
CO3	3	2	3	1	3	2	1	2			1	2	-	-
CO4	3	3	3		3			2				2	-	-
CO5	2	1	1		2			3	2	3		2	-	-

CO6									3	3	2	3	-	-

Guidelines for PBL:

Group Structure:

The students plan, manage and complete a task/project/activity which addresses the stated problem.

1. Create groups of max 4 (four) students.
2. A supervisor/mentor teacher assigned to individual groups

Project Selection:

Survey through journals, patents or field visit (A problem can be theoretical, practical, social, technical, symbolic, cultural and/or scientific), check the physibility of solution, analyze the problem, design and find the values of components.

There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content and structure of the activity.

The problem-based project oriented model for learning is recommended. The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. A problem can be theoretical, practical, social, technical, symbolic, cultural and/or scientific and grows out of students' wondering within different disciplines and professional environments. As stated in the preamble as electronics and computer engineering is an important grounding for other disciplines (computer science, signal processing, and communications), the project topic can be Interdisciplinary in nature.

However the chosen problem must involve the application of electronics and computer engineering fundamentals.

Tools for testing:

Recommended to use tools like Software IDE. DSO, PCB Manufacturing Equipment's, Scilab / Matlab, Multisim, Eagle etc.

Ethical Practices, team work and project management:

Use IEEE standards for project manufacturing, respect the time of others, attend the reviews, poster presentation and model exhibitions, strictly follow the deadline of project completion, comply with all legislation requirements that govern workplace health and safety practices.

Effective Documentation:

In order to make our engineering graduates capable to prepare effective documentation, it is required for the students to learn the effective writing skills. The PBL final report is expected to consist of the Literature Survey, Problem Statement, Aim and Objectives, System Block Diagram, System Implementation Details, Discussion and Analysis of Results, Conclusion, System Limitations and Future Scope. Many freely available software tools (for instance Medley (Elsevier), Grammerly) are expected to be used during the preparation of PBL synopsis and final report. It is expected that the PBL guides/mentors shall teach students about utilizing valid sources of information (such as reference papers, books, magazines, etc.) related to their PBL topic.

Evaluation & Continuous Assessment:

Progress of PBL is monitored regularly on a weekly basis. Weekly review of the work is necessary. During process of monitoring and continuous assessment and evaluation the individual and team performance is to be measured. PBL is monitored and continuous assessment is done by supervisor

/mentor and authorities.

Students must maintain an institutional culture of authentic collaboration, self-motivation, peer-learning and personal responsibility.

Supervisor/mentor and Students must actively participate in assessment and evaluation processes.

It is recommended that the all activities are required to be recorded and regularly. A regular assessment of PBL work is required to be maintained in PBL log book by students. It is expected that the PBL log book must include following:

1. Weekly monitoring by the PBL guide,
2. Assessment sheet for PBL work review by PBL guide and PBL Evaluation.

Rubrics.

Term work (TW) recommended Parameters for assessment, evaluation and weightage:

1. Idea Inception (kind of survey). (10%)
2. Outcome (Participation/ publication, copyright, patent, product in market). (50%)
3. Documentation (Gathering requirements, design & modeling, Implementation/execution, use of technology and final report, other documents). (15%)
4. Attended reviews, poster presentation and model exhibition. (10%)
5. Demonstration (Poster Presentation, Model Exhibition etc). (10%).
6. Awareness /Consideration of - Environment/ Social /Ethics/ Safety measures/Legal Aspects. (5%)

Text Books:

1. Setting the Standard for Project Based Learning, Book by John Larmer, John R. Mergendoller, and Suzie Boss
2. Project Based Teaching: How to Create Rigorous and Engaging Learning Experiences, Book by John Larmer and Suzie Boss

Reference Book:

1. Hacking Project Based Learning: 10 Easy Steps to PBL and Inquiry in the, Book by Erin M. Murphy and Ross Cooper.
2. M. Krašna, "Project based learning (PBL) in the teachers' education," 2016 39th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), Opatija, 2016, pp. 852-856, doi: 10.1109/MIPRO.2016.7522258.

Web resources:

- https://www.edutopia.org/project-based-learning
- https://atlasabe.org/resource/project-based-learning-buck-institute-for-education
- www.schoology.com
- www.howstuffworks.com

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		3		2			
CO2								3		3		2			
CO3								3		3		2			
CO4								3		3		2			
CO5								3	2	3	3	3			
CO6								3	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.	CO
	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.	CO
	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.	CO
	5.1Concept 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		5

	Recognizing.		
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

Embedded Systems and RTOS Laboratory (EC317)

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

Examination Scheme
PR: 50 Marks
Total : 50 Marks

Prerequisite Course: Microprocessors and Microcontrollers (EC214), Computer Organization and Architecture (EC204)

Course Objectives:

1. To consciousness among students towards different embedded applications used in day to day life.
2. To create awareness about different hardware platforms available for embedded system design along with list of features and selection criteria.
3. 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: After completion of the course the students will be able to,

Course Outcomes	Statement	Bloom's Descriptor	
		Level	Descriptor
EC317.1	Implement different hardware and software tools used for designing embedded system	3	Apply
EC317.2	Asses embedded Operating System's behavior for different circumstances.	5	Evaluate
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)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC317.1	1	-	-	-	3	-	-	-	-	-	-	2	2	-
EC317.2	2	1	-	-	2	-	-	-	-	-	-	-	2	-
EC317.3	3	2	2	1	2	-	-	-	2	-	-	-	3	-

Practical Course Contents (Minimum 08 Experiments) :

Sr. No.	Title of Practical	COs
1	Program Arduino board to perform different operations on GPIO using Arduino IDE tool.	EC317.1
2	Interfacing of NodeMCU ESP8266 module with Temperature sensor	EC317.1
3	Porting of µCOS-II on ARM7 controller.	EC317.1
4	Simulation of multitasking with µCOS-II on ARM7 microcontroller for three tasks to blink 3 LEDs with 3 different rates.	EC317.2
5	Observing effect of change in priority and change in delays for simple multitasking application with µCOS-II on ARM7.	EC317.2
6	Implementation of semaphore service for signaling and synchronization application with COS-II on ARM7 controller	EC317.2
7	Implementation of mailbox service for Inter task communication with µCOS-II on ARM7 controller.	EC317.2

8	Implementation of message queue service for Inter task communication with µCOS-II on ARM7 controller.	EC317.2
9	Porting of Embedded Linux components Boot-loader, Kernel and File System on ARM9 board.	EC317.3
10	Writing an application using Embedded Linux on ARM9 board.	EC317.3
11	Implementation of a kernel space code for device driver with Embedded Linux.	EC317.3
12	Porting of OS on Raspberry Pi	EC317.1

System Programming and Operating System Laboratory (EC318)

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

Examination Scheme
PR: 50 Marks
Total: 50 Marks

Prerequisite Course: Computer Fundamentals and Programming (ES1002)

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 the design of various system programming tools for the development of programs.	2	Understand
EC318.2	To Design and implement Macro Preprocessor	3	Apply
EC318.2	To Design and implement Assembler	3	Apply
EC318.2	To Summarize the basic concept of an operating system and its various commands.	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
EC318.1	3	2	2	2	3	----	---	----	----	-----	----	…..	---	1
EC318.2	3	2	1	2	3	----	---	----	----	-----	----	…….	----	2
EC318.2	3	2	2	2	2	----	---	----	----	-----	----	…….	----	2
EC318.2	3	2	2	2	3	----	---	----	----	-----	----	…….	----	2

Sr. No.	Title of Practical	Cos
1.	Illustrate the 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.	Explain the 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
13.	Implementation of FCFS Disk scheduling algorithm	EC318.2

Note1 : Perform any 09 experiments. **Note2**: Experiment 02 and Experiment 07 are Mandatory.

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:

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

Advanced Digital Signal Processing Laboratory (EC319A)

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

Examination Scheme
PR: 25 Marks
Total: 25 Marks

Prerequisite Course: S.Y ECE Sem-III – Fundamentals of DSP Laboratory (EC218)

Course Objectives:

1. Apply advanced signal processing techniques beyond the basics, including multirate signal processing, wavelet transforms, and adaptive filtering.
2. Understanding of advanced DSP concepts and their applications in diverse fields.
3. Gain practical experience in implementing DSP algorithms on hardware platforms

Course Outcomes (COs):

On completion of the course, student will be able to–

Course Outcomes	Course Outcome statement	Bloom's Taxonomy	
		Level	Descriptor
EC319A.1	Implement different algorithm for signal Processing	3	Apply
EC319A.2	Estimate various parameters of different signals	3	Apply
EC319A.3	Design different applications of Digital Signal processing for given requirement	3	Apply

Mapping of CO, PO & PSO:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC319A.1	2	---	2	---	3	---	---	3	---	---	---	2	3	---
EC31A.2	3	---	3	---	3	---	---	3	---	---	---	3	3	---
EC319A.3	2	---	3	---	3	---	---	3	---	---	---	3	3	---

Practical Course Contents

- Minimum 08 experiments to be performed out of the mentioned list.
- Experiments can be performed using any software's like Matlab/Scilab etc.

Sr. No.	List of Practical's	CO's
1	Write a program to implement Multi-rate Sampling.	EC319A.1
2	Time-Frequency Analysis with the Continuous Wavelet Transform	EC319A.1
3	Implement Signal Reconstruction from Continuous Wavelet Transform Coefficients.	EC319A.1

4	Implement the Levinson-Durbin algorithm for solving the autocorrelation normal equation	EC319A.1
5	Implement Adaptive filter using LMS algorithm	EC319A.2
6	Estimate the PSD of a noisy signal using periodogram	EC319A.2
7	Estimation of power spectrum using parametric methods (Yule Walker &Burg).	EC319A.2
8	Generation of DTMF (Dual Tone Multiple Frequency) signals	EC319A.3
9	Implement a practical example on a Digital Signal Processor	EC319A.3
10	Design a filter bank for applications such as audio equalization, subband coding, or audio analysis.	EC319A.3

Power Electronics and Drives Laboratory (EC319B)

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

Examination Scheme
OR : 50 Marks
Total: 50 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 evaluate performance of DC and AC Drives and excitation techniques

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

COs	Course Outcome 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	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	Power electronic conversion system (DC-AC/DC-DC), with suitable load.	EC319B.4
9	Chopper fed DC drive	EC319B.5
10	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

Data Mining Laboratory (EC319C)

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

Examination Scheme
OR: 50 Marks
Total: 50 Marks

Prerequisite Course: Problem Solving using Python(ES1007)

Course Objectives:

1. To Understand the data sets and data preprocessing Techniques.
2. To introduce algorithms for data mining tasks such as association rule mining,classification, clustering and regression.
3. To give Exposure to students on real life datasets for analysis and prediction

Course Outcomes (COs):

After successfully completing the course students will be able to:

	Course Outcome (s)	Bloom's Taxonomy	
		Level	Descriptor
EC319C.1	Demonstrate different preprocessing techniques	3	Apply
EC319C.2	Implement principle algorithms and techniques used in data mining	3	Apply
EC319C.3	Apply Advance programming skills to solve Practical problems in data mining	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
EC319C.1	3	2	2	2	3	-	-	-	-	-	-	-	-	1
EC319C.2	3	2	1	2	3	-	-	-	-	-	-	-	-	3
EC319C.3	3	2	2	2	2	-	-	-	-	-	-	-	-	3

Sr. No.	Title of Practical	Cos
1.	List all the categorical (or nominal) attributes and the real-valued attributes separately from given dataset and converting categorical attributes to real-valued attributes	EC319C.1
2.	Demonstration of Data Processing Techniques on suitable data set	EC319C.1, EC319C.3
3.	Implementation of Apriori algorithm	EC319C.2, EC319C.3
4.	Implementation of FP- Growth algorithm	EC319C.2, EC319C.3
5.	Implementation of Decision Tree Induction on suitable data set	EC319C.2, EC319C.3
6.	Classification of data using Bayesian approach	EC319C.2, EC319C.3
7.	Implementation of k-means Data Clustering algorithm on suitable data set	EC319C.2, EC319C.3
8.	Implementation of mining time series data on suitable data set	EC319C.2, EC319C.3

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

	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	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	4	MC322.3

	treatment and disposal method.Common Hazardous Waste Treatment facilities (TSDF).		
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

Embedded system hardware and software design (EC8102)

Teaching Scheme
Lectures: 4 Hrs. / Week

Credits: 4

Examination Scheme
CIA : 40 Marks
ESE: 60 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. Techno-Economical prospective of embedded system,	6	EC8102.1
Unit-II	**Recent trends in Embedded System Hardware**		
	Embedded processor technology **IC technology** **Design technology** Microcontroller selection criteria,	7	EC8102.2

	Introduction to advanced microcontroller, ARM family of microcontroller, Generalized block diagram of ARM Processor, Concept and working principle of multi core processors, SoC.		
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.

e 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.	Test on Unit 1 to 3	10+10 +10= 30	midterm or afer completion of unit 3	EC8102.1 EC8102.2 EC8102.3
2.	MCQ Test on Unit 4 to 6	10+10 +10= 30	At the second last week of the semester.	EC8102.4 EC8102.5 EC8102.6
	Final marks = 30+30=60 scaled to 20 by total/3			

3.	CIA Activity:- Develop any application based on problem statemnet given by subject teacher	20	At the second last week of the semester.	ALL COs
	Assessment will be strict as per rubrics as follows Performance →05 M Understanding → 5M Presentation → 05M Writeups→03M Timely submission→02M			

Embedded system hardware and software design Laboratory (EC8103)

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

Examination Scheme
PR: 50 Marks
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

ABAP Workbench Fundamentals Part - II (EC8203)

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

Examination Scheme
CIA : 40 Marks
ESE: 60 Marks
Total: 100 Marks

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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

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
2021 Pattern

Proposed Program Structure

(B.Tech. with effect from Academic Year 2021-2022)

(B. Tech. Sem-VII with effect from Academic Year 2024-2025)

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 2021 Pattern w.e.f A.Y 2024-2025 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. *2021 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	ESE	OR	PR	TW	Total
PCC	EC401	Deep Learning	3	-	-	3	40	60	-	-	-	100
PCC	EC402	IoT & WSN	3	-	-	3	40	60	-	-	-	100
PCC	EC403	Computer Networks and Security	3	-	-	3	40	60	-			100
PEC	EC404	Refer List of PEC3	4	-	-	4	40	60	-	-	-	100
PEC	EC405	Refer List of PEC4	3	-	-	3	40	60	-	-	-	100
LC	EC406	Deep Learning 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**	**200**	**300**	**100**	**100**	**100**	**800**

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	Big Data & Cloud Computing

Final Year B. TECH. 2021 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	50
PROJ	EC415	Project Stage-II	-	-	4	2	-	-	50	-	-	150
		Total	8	-	16	16	75	225	100	-	100	700

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

	Offered During academic Year 2023-2024	
	Code	NPTEL Course Title
Open Elective -I	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	Machine Learning
	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

Deep Learning (EC401)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme
CIA: 40 Marks
ESE : 60 Marks
Total: 100 Marks

Prerequisite:
Data Mining (EC 314C)

Course Objectives:
1. To acquire knowledge on the basics of neural networks
2. To introduce Convolutional Neural Networks and its applications
3. To study architectures of advanced Convolutional Neural Network Techniques
4. To understand the fundamentals of Natural Language Processing
5. To introduce the concepts and techniques associated with Natural Language Processing
6. To get familiar with recent trends in Generative AI and Large Language Models

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 Artificial Neural Neural Network Architecture	2	Understand
EC401.2	Explore different CNN Architectures	2	Understand
EC401.3	Demonstrate use of different CNN architectures to build deep learning applications	3	Apply
EC401.4	Articulate the main concepts, key technologies and fundamentals of Natural Language Processing	3	Apply
EC401.5	Identify appropriate NLP Techniques to solve real world problems	3	Apply
EC401.6	Demonstrate emerging and enhanced Large Language Models to build advanced applications	3	Apply

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

	PO1	PO2	PO 3	PO4	PO5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
EC401.1	2	1	-	-	-	-	-	-	-	-	-	1	1	-
EC401.2	2	2	1	-	3	-	-	-	-	-	-	2	2	-
EC401.3	3	2	2	-	2	-	-	-	-	-	-	2	3	-
EC401.4	3	2	2	-	-	-	-	-	-	-	-	3	2	-
EC401.5	2	1	1	-	2	-	-	-	-	-	-	1	1	-
EC401.6	1	2	2	-	2	-	-	-	-	-	-	2	2	-

Course Contents

	Unit-I	Introduction to Artificial Neural Network	No. of Hours	COs
		Difference between Classical Machine Learning and Deep Learning, Introduction to ANN, Perceptron, Feedforward Neural Networks, Cost Functions,Activation Functions,Random Initialization ,Multilayer Perceptrons (MLPs), Optimizers,Backpropagation	06 Hrs.	EC401.1
	Unit-II	**Convolutional Neural Networks**	**No. of Hours**	**COs**
		Introduction to CNNs, Architecture,Convolution function, CNN layers: Convolution, pooling and fully connected layers,batch normalization, difference between parameter and Hyperparameter, Hyperparameter tuning ,CNN Applications:Facial emotion recognition,Image captioning	06 Hrs.	EC401.2
	Unit-III	**Advanced CNN**	**No. of Hours**	**COs**
		Advanced CNN architecture: AlexNet,VGGNet , YOLO,Generative Adversarial Network(GAN) etc,Advanced Training Techniques: transfer learning,Data Augmentation	07 Hrs.	EC401.3
	Unit-IV	**Preprocessing in NLP**	**No. of Hours**	**COs**
		Introduction to NLP, Text preprocessing:tokenization, stemming, lemmatization, stop-word removal, and part-of-speech tagging,Word Embeddings: Word2Vec (CBOW and Skip Gram), Glove, FastText	06 Hrs.	EC401.4
	Unit-V	**Advanced NLP Techniques**	**No. of Hours**	**COs**
		Introduction to RNNs,Comparison of ANN with RNN, Back propagation through time (BPTT), Vanishing and Exploding Gradients, LSTM Architecture ,GRU, Encoder And Decoder-Sequence to Sequence Architecture,Attention Mechanism,Transformer Architecture	07 Hrs.	EC401.5
	Unit-VI	**Introduction to Generative AI and Large Language Models**	**No. of Hours**	**COs**

		Comparison of AI with Generative AI, Introduction to Generative AI and Large Language Models (LLMs),Evolution OF LLM Models,Generative AI's Evolution, Types of LLM,Difference Between Large Language Models and Generative AI, BERT,GPT,overview of Dall-E, ChatGPT and Gemini,LLM Applications.	07 Hrs.	EC401.6
	Text Books:			
	1.Rajiv Chopra, "Deep Learning", Khanna Book Publishing, Delhi 2020 2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O"REILLY, SPD, 2017. 3.Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning (Adaptive Computation and Machine Learning series)", MIT Press, 2017.			
	Reference Books:			
	1. Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly Media 2.Aston zhang," Dive into Deep Learning",Cambridge university 3.Christopher Marming, "Foundations of statistical Natural Language processing",MIT Press 4.Christopher M. Bishop," Deep Learning: Foundations and Concepts",Springer			
	e-Resources: 1. NPTEL Course on "Deep Learning", by Prof. Mitesh M. Khapra, IIT Ropar Link of the Course: https://onlinecourses.nptel.ac.in/noc21_cs76/preview 2. NPTEL Course on "Deep Learning" by Prof. Prabir Kumar Biswas,IIT Kharagpur Link of the Course :https://onlinecourses.nptel.ac.in/noc19_cs54/preview			
	CIA: Online Course: 20 Marks Students need to complete online course **End to End Industry Ready Deep Learning Project: 20 Marks** This will be a Group activity. Each group will be assigned a problem statement and will be provided dataset access. Students need to develop end to end Solution for a given problem using different deep learning techniques. Students need to submit detailed report of the same.			

Internet of Things & Wireless Sensor Networks (EC402)

Teaching Scheme
Lectures: 03 Hrs./ Week

Credits: 03

Examination Scheme
CIA: 40 Marks
ESE : 60 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 & 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 knowledge 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	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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, Industry 4.0.	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 & 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 & gathering, MAC Protocols, Routing Protocols.	06 Hrs.	EC402.6
Books:			
Text Books:			

1. S. Misra, A. Mukherjee & A. Roy, “Introduction to IoT” Cambridge University Press, 1st Edition, 2021.
2. S. Misra, C. Roy & A. Mukherjee, “Introduction to Industrial Internet of Things & Industry 4.0” CRC Press, 1st Edition, 2021.
3. Kazem Sohraby, Daniel Minoli & Taieb Znati, “Wireless Sensor Networks Technology, Protocols & Applications”, John Wiley & Sons, 1st Edition, 2016.
4. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, 1st Edition, Wiley, 2013.
5. Hakima Chaouchi, “The Internet of Things Connecting Objects to the Web”, Wiley Publications,1st Edition,2010.
6. Olivier Hersent, David Boswarthick, & Omar Elloumi , “The Internet of Things: Key Applications & Protocols”, Wiley Publications, 1st Edition, 2011.

Reference Books:

1. Holger Karl & Andreas Willig, “Protocols & Architectures for Wireless Sensor Networks”, John Wiley & Sons, Ltd.,1st Edition, 2005.
2. Olivier Hersent, Omar Elloumi & David Boswarthick, “The Internet of Things: Applications to the Smart Grid & Building Automation”, 1st Edition Wiley, 2011.
3. Clint Smith, Daniel Collins, “Wireless Networks”, 3rd Edition, 2014, McGraw Hill Publications.

Useful Links for IoT Applications & 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
ESE: 60 Marks
CIA: 40 Marks
Total: 100 Marks

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Prerequisite Course: Principles of Communication (EC212)

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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	PO8	PO9	PO10	PO11	PO12	PSO1	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", McGraw 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, PBL

Communication I (EC404A)

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

Examination Scheme
CIA: 40 Marks
ESE: 60 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: 40 Marks
ESE: 60 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
CIA: 40 Marks
ESE: 60 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 (40 Marks): One Case Study on each unit

Communication-II (EC405A)

Teaching Scheme:
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme:
CIA: 40 Marks
ESE: 60 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	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	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
CIA: 40 Marks
ESE:60 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	Learn various applications of block chain in different sectors.	**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
EC405.1	2	1	2	1	-	-	-	-	-	-	-	2	-	2
EC405.2	2	3	3	2	-	-	-	-	-	-	-	1	-	2
EC405.3	1	1	2	2	-	-	-	-	-	-	-	1	-	2
EC405.4	1	1	2	2	-	-	-	-	-	-	-	1	-	2
EC405.5	2	2	2	2	-	-	-	-	-	-	-	1	-	2
EC405.6	2	1	1	1	-	-	-	-	-	-	-	1	-	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- 20 Marks
- case study 20 MARKS

Big data and Cloud Computing(EC405C)

Teaching Scheme
Lectures: 03 Hrs. / Week

Credits: 03

Examination Scheme

End-Sem Exam: 60 Marks
CIA: 40 Marks
Total: 100 Marks

Prerequisite:
Database Management Systems and SQL(EC303)

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
EC405C.1	Describe Big Data primitives	2	Understand
EC405C.2	Explore different Big data processing techniques with hadoop	2	Understand
EC405C.3	Understand distributed computing techniques with Spark	2	Understand
EC405C.4	Articulate the main concepts, key technologies and fundamentals of cloud computing	2	Understand
EC405C.5	Understand cloud enabling technologies and virtualization.	2	Understand
EC405C.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
EC405C.1	2	1	-	-	-	-	-	-	-	-	-	1	1	-
EC405C.2	2	2	1	-	3	-	-	-	-	-	-	1	2	-
EC405C.3	3	2	2	-	2	-	-	-	-	-	-	2	3	-
EC405C.4	3	2	2	-	-	-	-	-	-	-	-	2	2	-
EC405C.5	2	1	1	-	2	-	-	-	-	-	-	1	1	-
EC405C.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.	EC405C.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.	EC405C.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.	EC405C.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.	EC405C.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.	EC405C.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.	EC405C.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:

NPTEL Course on Big Data Computing

Computer Networks and Security Laboratory (EC408)

Teaching Scheme
Lectures: 2 Hrs. / Week

Examination Scheme

PR: 50 Marks

Credits : 1

Total: 50 Marks

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Prerequisite Course: Principles of Communication (EC212)

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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**
EC408.1	Select proper transmission media and tools for computer networking.	2	Understand
EC408.2	Demonstrate use of networking components and devices.	3	Apply
EC408.3	Execute simulation of computer networking protocols.	3	Apply
EC408.4	Demonstrate network environment using different network utilities.	3	Apply
EC408.5	Implement different configuration of TCP/IP protocols	3	Apply
EC408.6	Develop cryptography and network security algorithm	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
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.	EC408.1
2.	Introduction and making use of networking components and devices like LAN adapter, Hub, Switches, Routers etc.	EC408.1, EC408.2
3.	Installation and introduction of simulation tools packet tracer/GNS3/ Boson NetSim.	EC408.3
4.	Simulation of various LAN topologies and their creation using network devices, cables and Computer.	EC408.3
5.	Familiarization of network environment, understanding and using network utilities : ipconfig, netstat, ping, arp, telnet, ftp, finger, traceroute.	EC408.4
6.	Configuration of TCP/IP protocols in Window/LINUX.	EC408.5
7.	Configuration of TELNET protocols on router for remote access.	EC408.5
8.	Implementation of RSA public key algorithm.	EC408.6

Books:

Text Books:

1. Behrouz A. Forouzan, “Data Communications and Networking”, McGraw 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/

Internet of Things & Wireless Sensor Networks Laboratory (EC407)

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

Examination Scheme
PR : 50 Marks
Total: 50 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 & 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 knowledge 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	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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	-

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 & program for blinking LED.	EC407.3
6.	Interfacing temperature sensor LM35 with Arduino board & program to display temperature.	EC407.4
7.	Interfacing IR sensor with Arduino board & 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 & 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
13.	Study of Raspberry-Pi, Beagle board, Arduino & different operating systems for RaspberryPi/Beaglebone/Arduino. Understanding the process of OS installation on RaspberryPi/Beaglebone/Arduino .	EC407.3
14.	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:

1. S. Misra, A. Mukherjee & A. Roy, “Introduction to IoT” Cambridge University Press, 1st Edition, 2021.
2. S. Misra, C. Roy & A. Mukherjee, “Introduction to Industrial Internet of Things & Industry 4.0” CRC Press, 1st Edition, 2021.
3. Kazem Sohraby, Daniel Minoli & Taieb Znati, “Wireless Sensor Networks Technology, Protocols & Applications”, John Wiley & Sons, 1st Edition, 2016.
4. Adrian McEwen, Hakim Cassimally, “Designing the Internet of Things”, 1st Edition, Wiley, 2013.
5. Hakima Chaouchi, “The Internet of Things Connecting Objects to the Web”, Wiley Publications,1st Edition,2010.
6. Olivier Hersent, David Boswarthick, & Omar Elloumi , “The Internet of Things: Key Applications & Protocols”, Wiley Publications, 1st Edition, 2011.

Reference Books:

1. Holger Karl & Andreas Willig, “Protocols & Architectures for Wireless Sensor Networks”, John Wiley & Sons, Ltd.,1st Edition, 2005.
2. Olivier Hersent, Omar Elloumi & David Boswarthick, “The Internet of Things: Applications to the Smart Grid & Building Automation”, 1st Edition Wiley, 2011.
3. Clint Smith, Daniel Collins, “Wireless Networks”, 3rd Edition, 2014, McGraw Hill Publications.

Useful Links for IoT Applications & 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 & neatness

Deep Learning Laboratory (EC406)

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

Examination Scheme
OR : 50 Marks
Total: 50 Marks

Prerequisite: Data Mining Laboratory(EC319)

Course Objectives:

1. To understand key concepts Artificial neural network
2. To get familiar with Deep Learning Techniques
3. To get familiar with recent trends in Generative AI and LLM

Course Outcomes (COs):

After completion of course students will be able to

COs	Statement	Bloom's Taxonomy	
		Level	Descriptor
EC 406.1	Apply Fundamental Principles of Deep Learning	3	Apply
EC 406.2	Implement Deep Learning Algorithms to Solve Real-world problems	3	Apply
EC 406.3	Identify The Deep Learning Algorithms For Various Types of Learning Tasks in various domains	3	Apply

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

COs	PO1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
EC406.1	2	2	1	-	-	-	-	-	-	-	-	2	-	1
EC406.2	2	2	3	1	2	-	-	-	-	-	-	1	-	2
EC406.3	2	3	2	2	1	-	-	-	-	-	-	2	-	2

Practical Course Contents:

Sr. No.	Title of Practical	COs
1.	Setting up the Google colab Environment, Installing Keras,Tensorflow and PyTorch libraries.	EC 406.1
2.	Implementation of Artificial Neural network on suitable dataset	EC 406.1 EC 406.2
3.	Implementation of Convolution Neural Network on computer vision problems	EC 406.2 EC 406.3
4.	Implementation of (CNN model with Fully connected layer) for Image classification on MNIST dataset	EC 406.2 EC 406.3

5.	Implementation of Recurrent Neural network on suitable dataset	EC 406.2 EC 406.3
6.	Implementation of RNN-LSTM on suitable dataset for sentiment analysis	EC 406.2 EC 406.3
7.	Implementation of Autoencoder algorithms for encoding the real-world data	EC 406.2 EC 406.3
8.	Implementation of Generative Adversial Networks for image generation and unsupervised tasks	EC 406.2 EC 406.3

Books:

Text Books:

1.Rajiv Chopra, “Deep Learning”, Khanna Book Publishing, Delhi 2020
2. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner's Approach”, O‟REILLY, SPD, 2017.
3.Ian Goodfellow, Yoshua Bengio, Aaron Courville, ”Deep Learning (Adaptive Computation and Machine Learning series”, MIT Press, 2017.

Reference Books:

1. Nikhil Buduma, Nicholas Locascio, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, O'Reilly Media
2.Aston zhang,” Dive into Deep Learning”,Cambridge university
3.Christopher Marming, “Foundations of statistical Natural Language processing”,MIT Press
4.Christopher M. Bishop,” Deep Learning: Foundations and Concepts”,Springer

e-Resources:

1. NPTEL Course on “Deep Learning”, by Prof. Mitesh M. Khapra, IIT Ropar
Link of the Course: https://onlinecourses.nptel.ac.in/noc21_cs76/preview
2. NPTEL Course on “Deep Learning” by Prof. Prabir Kumar Biswas,IIT Kharagpur
Link of the Course :https://onlinecourses.nptel.ac.in/noc19_cs54/preview

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	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
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	Last 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	Last Week of August	150 Marks (90+60)
3	Demonstration of 25% to 75 % project Completion (Circuit/use case Diagram, power Supply design, Module Design,software Simulation)	DMC	SE2 by GA	First Week of october	150 Marks
4	Presentation and demonstration of 100% Project Completion	Panel of Examiners comprising of guide, external examiner and chairman	ESE	First week of December	150 marks

DMC- Department Monitoring Committee
GA- Group Activity
SE- Shuffle Examination
ESE-End Sem Examination