SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)

Puducherry

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING

ACADEMIC REGULATIONS 2023
(R-2023)

CURRICULUM AND SYLLABI
Volume – IV

COLLEGE VISION AND MISSION

Vision

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society.

Mission

M1: Quality Education:

To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices.

M2: **Research and Innovation:**

To foster value based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues.

M3: Employability and Entrepreneurship:

To inculcate the employability and entrepreneurial skills through value and skill based training.

M4: Ethical Values:

To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society.

DEPARTMENT VISION AND MISSION

Vision

To promote proficiency in the field of Electrical and Electronics Engineering by creating a stimulating environment for research, innovation and entrepreneurship

Mission

M1: Quality Education:

To impart high quality technical education with problem solving capabilities by innovative pedagogy in emerging technologies.

M2: Industrial and Societal Needs:

To cater the dynamic needs of the industry and society by strengthening industry-institute interaction.

M3: Research and Innovation:

To nurture the spirit of research attitude by carrying out innovative technologies pragmatically.

M4: Placement and Entrepreneurship:

To inculcate the professionalism in career by advancing synergetic skills to compete in the corporate world.

PROGRAMME OUTCOMES (POs)

PO1: Engineering knowledge:

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

PO2: Problem analysis:

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

PO3: Design/development of solutions:

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

PO4: Conduct investigations of complex problems:

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage:

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

PO6: The engineer and society:

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

PO7: Environment and sustainability:

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

PO8: Ethics:

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

PO9: Individual and team work:

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication:

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

PO11: Project management and finance:

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

PO12: Life-long learning:

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Professional Knowledge:

To possess strong educational foundation in Electrical and Electronics Engineering to attain successful career with professional responsibility

PEO2: Innovative Skills:

To enrich the skills to design and develop innovative solutions for engineering problems in a multidisciplinary environment

PEO3: Ethics:

To actively embrace leadership qualities for achieving professional goals with ethical values

PEO4: Adaptability:

To enhance intellectual competency along with technical skills by adapting to the current trends through eternal learning.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Core Proficiency:

Utilize the engineering core knowledge to identify, formulate, design, and investigate the complex engineering problems of Power Electronics, Electrical Machines and Power Systems.

PSO2: Cutting Edge Technologies:

Explore the new cutting-edge technologies in the field of Electric Vehicle, Automation, Artificial Intelligence, Robotics and Renewable Energy to compete in global market

PSO3: Design and Evolution:

Capability to comprehend the technological advancements with the usage of modern design tools for analysing and designing systems to confront the rapid pace of industrial innovations.

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAMME

Sl. No	Course Category	Breakdown of Credits
1	Humanities and Social Sciences including Management courses (HS)	15
2	Basic Science Courses (BS)	20
3	Engineering Science including workshop, drawing, basics of electrical / mechanical / computer etc. (ES)	24
4	Professional Core Courses (PC)	71
5	Professional Electives Courses (PE)	18
6	Open Electives Courses (OE)	09
7	Project Work and Internship (PA)	13
8	Ability Enhancement Courses (AEC*)	-
9	Mandatory Courses (MC*)	-
Total		**170**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl. No	AICTE Suggested Course Category	Credits per Semester								Total Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Science (HS)	3	5	1	1	2	-	-	3	15
2	Basic Sciences (BS)	7	4	5	4	-	-	-	-	20
3	Engineering Sciences (ES)	4	8	4	4	4	-	-	-	24
4	Professional Core (PC)	8	4	13	11	8	15	12	-	71
5	Professional Electives (PE)	-	-	-	3	3	3	3	6	18
6	Open Electives (OE)	-	-	-	-	3	3	3	-	09
7	Project Work (PA)	-	-	-	-	1	1	2	8	12
8	Internship (PA)	-	-	-	-	-	-	1	-	01
9	Ability Enhancement Courses (AEC*)	-	-	-	-	-	-	-	-	-
10	Mandatory courses (MC*)	-	-	-	-	-	-	-	-	-
Total		**22**	**21**	**23**	**23**	**21**	**22**	**21**	**17**	**170**

**** AEC and MC are not included for CGPA calculation***

HONOUR / MINOR DEGREE PROGRAMME:

The student is permitted to opt for earning an Honour / Minor degree in the same discipline of engineering in addition to the degree in his/her own discipline. To earn an Honour / Minor degree the student is required to earn an additional 18 - 20 credits (over and above the total 170 credits prescribed in the curriculum) starting from fourth semester onwards by completing 5 additional courses offered in respective semesters. A student is eligible to exercise this option if he/she has passed all the courses offered upto third semester in the first attempt itself and has earned a CGPA / GPA* (*for lateral entry) of not less than 8.0. The prescribed courses offered for Honour / Minor degree are given in Annexure - IV

SEMESTER – I										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC01	Engineering Mathematics - I	BS	3	1	0	4	25	75	100
2	U23BSTC01	Physical Science for Engineers	BS	3	0	0	3	25	75	100
3	U23ESTC02	Engineering Mechanics	ES	2	1	0	3	25	75	100
4	U23EET101	Electrical Engineering	PC	3	0	0	3	25	75	100
5	U23EET102	Electronics - I	PC	3	0	0	3	25	75	100
Theory cum Practical										
6	U23ENBC01	Communicative English - I	HS	2	0	2	3	50	50	100
Practical										
7	U23ESPC02	Design Thinking and IDEA Lab	ES	0	0	2	1	50	50	100
8	U23EEP101	Electrical Engineering Laboratory	PC	0	0	2	1	50	50	100
9	U23EEP102	Electronics - I Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23EEC1XX	Certification Course - I**	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23EEM101	Induction Programme	MC	2 Weeks			-	-	-	-
							22	**425**	**575**	**1000**

SEMESTER – II										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC02	Engineering Mathematics - II	BS	3	1	0	4	25	75	100
2	U23CSTC01	Programming in C	ES	3	0	0	3	25	75	100
3	U23ESTC01	Basics of Civil and Mechanical Engineering	ES	3	0	0	3	25	75	100
4	U23EET203	Electronics - II	PC	3	0	0	3	25	75	100
5	U23HSTC01	Universal Human Values - II	HS	2	0	0	2	25	75	100
Theory cum Practical										
6	U23ENBC02	Communicative English - II	HS	2	0	2	3	50	50	100
Practical										
7	U23ESPC03	Engineering Graphics using AutoCAD	ES	0	0	2	1	50	50	100
8	U23CSPC01	Programming in C Laboratory	ES	0	0	2	1	50	50	100
9	U23EEP203	Electronics - II Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
10	U23EEC2XX	Certification Course - II **	AEC	0	0	4	-	100	-	100
Mandatory Course										
11	U23EEM202	Sports Yoga and NSS	MC	0	0	2	-	100	-	100
							21	**525**	**575**	**1100**

 # Professional Electives are to be selected from the list given in Annexure I
$ Open electives are to be selected from the list given in Annexure II
***** Certification courses are to be selected from the list given in Annexure III (A)***
**** Skill Enhancement Courses (I and II) are to be selected from the list given in Annexure III (B)***

Dr. P. Jamuna

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC03	Probability and Statistics	BS	3	1	0	4	25	75	100
2	U23ADTC01	Programming in Python	ES	3	0	0	3	25	75	100
3	U23EET304	Electromagnetic Theory	PC	2	1	0	3	25	75	100
4	U23EET305	Electrical Machines - I	PC	3	0	0	3	25	75	100
5	U23EET306	Electronics - III	PC	3	0	0	3	25	75	100
Theory cum Practical										
6	U23EEB301	Electric Circuit Analysis	PC	2	0	2	3	**50**	**50**	100
Practical										
7	U23ENPC01	General Proficiency - I	HS	0	0	2	1	50	50	100
8	U23MAPC01	Engineering Mathematics Laboratory	BS	0	0	2	1	50	50	100
9	U23ADPC01	Programming in Python Laboratory	ES	0	0	2	1	50	50	100
10	U23EEP304	Electrical Machines - I Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23EEC3XX	Certification Course - III **	AEC	0	0	4	-	100	-	100
12	U23EES301	Skill Enhancement Course - I*	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23EEM303	Climate Change	MC	2	0	0	-	100	-	100
							23	**675**	**625**	**1300**

SEMESTER – IV										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23MATC04	Numerical Methods and Optimization	BS	3	1	0	4	25	75	100
2	U23CSTC03	Data Structures	ES	3	0	0	3	25	75	100
3	U23EET407	Electrical Machines - II	PC	3	0	0	3	25	75	100
4	U23EET408	Transmission and Distribution	PC	2	1	0	3	25	75	100
5	U23EEE4XX	Professional Elective - I #	PE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23EEB402	Control Systems	PC	2	0	2	3	50	50	100
Practical										
7	U23ENPC02	General Proficiency - II	HS	0	0	2	1	50	50	100
8	U23CSPC02	Data Structures Laboratory	ES	0	0	2	1	50	50	100
9	U23EEP405	Electrical Machines - II Laboratory	PC	0	0	2	1	50	50	100
10	U23EEP406	Electronics - III Laboratory	PC	0	0	2	1	50	50	100
Ability Enhancement Course										
11	U23EEC4XX	Certification Course - IV **	AEC	0	0	4	-	100	-	100
12	U23EES402	Skill Enhancement Course - II*	AEC	0	0	2	-	100	-	100
Mandatory Course										
13	U23EEM404	Right to Information and Good Governance	MC	2	0	0	-	100	-	100
							23	**675**	**625**	**1300**

Dr. P. Jamuna

SEMESTER – V										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC02	Research Methodology	HS	2	0	0	2	25	75	100
2	U23ITTC02	Programming in Java	ES	3	0	0	3	25	75	100
3	U23EET509	Electrical Measurements and Instrumentation	PC	3	0	0	3	25	75	100
4	U23EET510	Microprocessor and Microcontroller	PC	3	0	0	3	25	75	100
5	U23EEE5XX	Professional Elective - II #	PE	3	0	0	3	25	75	100
6	U23XXO5XX	Open Elective - I $	OE	3	0	0	3	25	75	100
Practical										
7	U23ITPC02	Programming in Java Laboratory	ES	0	0	2	1	50	50	100
8	U23EEP507	Electrical Measurements and Instrumentation Laboratory	PC	0	0	2	1	50	50	100
9	U23EEP508	Microprocessor and Microcontroller Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23EEW501	Micro Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23EEC5XX	Certification Course - V **	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23EEM505	Essence of Indian Traditional Knowledge	MC	2	0	0	-	100	-	100
							21	**600**	**600**	**1200**

SEMESTER – VI										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23EET611	Power System Analysis	PC	2	1	0	3	25	75	100
2	U23EET612	Embedded System	PC	3	0	0	3	25	75	100
3	U23EET613	Power Electronics	PC	3	0	0	3	25	75	100
4	U23EEE6XX	Professional Elective - III #	PE	3	0	0	3	25	75	100
5	U23XXO6XX	Open Elective - II $	OE	3	0	0	3	25	75	100
Theory cum Practical										
6	U23EEB603	Electrical Machine Design	PC	2	0	2	3	50	50	100
Practical										
7	U23EEP609	Power System Analysis Laboratory	PC	0	0	2	1	50	50	100
8	U23EEP610	Embedded System Laboratory	PC	0	0	2	1	50	50	100
9	U23EEP611	Power Electronics Laboratory	PC	0	0	2	1	50	50	100
Project Work										
10	U23EEW602	Mini Project	PA	0	0	2	1	100	-	100
Ability Enhancement Course										
11	U23EEC6XX	Certification Course - VI **	AEC	0	0	4	-	100	-	100
Mandatory Course										
12	U23EEM606	Gender Equality	MC	2	0	0	-	100	-	100
							22	**625**	**575**	**1200**

Dr. P. Jamuna

SEMESTER – VII										
Sl. No	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23EET714	Industrial Automation and Control	PC	3	0	0	3	25	75	100
2	U23EET715	Renewable Energy Sources	PC	3	0	0	3	25	75	100
3	U23EEDC02	Electric and Hybrid Vehicles	PC	3	0	0	3	25	75	100
4	U23EEE7XX	Professional Elective - IV #	PE	3	0	0	3	25	75	100
5	U23XXO7XX	Open Elective - III $	OE	3	0	0	3	25	75	100
Practical										
6	U23EEP712	Industrial Automation and Control Laboratory	PC	0	0	2	1	50	50	100
7	U23EEP713	Renewable Energy Sources Laboratory	PC	0	0	2	1	50	50	100
8	U23EEP714	Electric Vehicles Laboratory	PC	0	0	2	1	50	50	100
Project Work										
9	U23EEW703	Project Phase - I	PA	0	0	4	2	50	50	100
10	U23EEW704	Internship / Inplant Training	PA	0	0	2	1	100	-	100
							21	**425**	**575**	**1000**

SEMESTER – VIII										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	U23HSTC03	Entrepreneurship and Business Management	HS	3	0	0	3	25	75	100
2	U23EEE8XX	Professional Elective - V #	PE	3	0	0	3	25	75	100
3	U23EEE8XX	Professional Elective - VI #	PE	3	0	0	3	25	75	100
Project Work										
4	U23EEW805	Project Phase - II	PA	0	0	16	8	50	100	150
							17	**125**	**325**	**450**

Annexure – I

PROFESSIONAL ELECTIVE COURSES

Professional Elective – I (Offered in Semester IV)		
Sl. No.	**Course Code**	**Course Title**
1	U23EEDC01	Electrical Safety Engineering
2	U23EEE402	Nano Electronics
3	U23EEE403	Conventional Power Engineering
4	U23EEE404	Energy Storage Technology
5	U23EEE405	Digital Logic Design using VHDL
Professional Elective – II (Offered in Semester V)		
Sl. No.	**Course Code**	**Course Title**
1	U23EEE506	Utilization of Electrical Energy
2	U23EEE507	Special Electrical Machines
3	U23EEE508	High Voltage Engineering
4	U23EEE509	Automotive Electronics for Electrical Engineering
5	U23EEE510	Modern Control Systems
Professional Elective – III (Offered in Semester VI)		
Sl. No.	**Course Code**	**Course Title**
1	U23EEE611	Finite Element Analysis for Electrical Engineering
2	U23EEE612	Electric Traction
3	U23EEE613	Electrical Energy Audit and Conservation
4	U23EEE614	Intelligent Control Techniques for Electrical Applications
5	U23EEE615	Internet of Things for Smart System
Professional Elective – IV (Offered in Semester VII)		
Sl. No.	**Course Code**	**Course Title**
1	U23EEE716	Advanced Electric Drives and Control
2	U23EEE717	Multilevel Power Converters
3	U23EEE718	Power System Operation and Control
4	U23EEE719	Flexible AC Transmission System
5	U23EEE720	Modelling and Simulation of Green Energy Systems
Professional Elective – V (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U23EEE821	SMPS and UPS
2	U23EEE822	Robotics and Automation
3	U23EEE823	Protection and Switchgear
4	U23EEE824	Digital Signal Processing for Electrical Engineering
5	U23EEE825	AI Techniques in Electrical System
Professional Elective – VI (Offered in Semester VIII)		
Sl. No.	**Course Code**	**Course Title**
1	U23EEE826	Industrial Electrical System
2	U23EEE827	Power Electronics for Renewable Energy Systems
3	U23EEE828	Restructured Power System
4	U23EEE829	Optimization Techniques
5	U23EEE830	Smart Grid

Annexure – II

OPEN ELECTIVE COURSES

Sl. No.	Course Code	Course Title	Offering Department	Permitted Department
Open Elective – I (Offered in Semester V)				
1.	U23HSOC01	Intellectual Property Rights	MBA	Offered in Semester V for EEE, ECE, ICE, CIVIL, BME, CCE, FT Offered in Semester VI for CSE, IT, MECH, MECHATRONICS, AI&DS
2.	U23HSOC02	New Product Development	MBA	
3.	U23HSOC03	Finance for Engineers	MBA	
4.	U23HSOC04	Economics for Engineers	MBA	
5.	U23HSOC05	Marketing Management	MBA	
Open Elective – II (Offered in Semester VI)				
1.	U23EEDC01	Electrical Safety Engineering	EEE	ECE, ICE, MECH, CIVIL, MCTR, CCE, BME, IT, CSE, FT, AI&DS, CSBS
2.	U23EEOC01	Solar Photovoltaic Fundamental and Applications	EEE	ECE, ICE, MECH, CIVIL, MCTR, CCE, BME, IT, CSE, FT, AI&DS, CSBS
3.	U23ECOC01	Engineering Computation with MATLAB	ECE	EEE, ICE, MECH, CIVIL, CCE, BME, AI&DS, MECHATRONICS
4.	U23ECOC02	Consumer Electronics	ECE	EEE, ICE, CSE, IT, MECH, CIVIL, CCE, BME, MECHATRONICS, FT
5.	U23CSOC01	Structured Query Language	CSE	ECE, EEE, ICE, MECH, CIVIL, BME, MECHTRONICS
6.	U23CSOC02	Computer Peripherals and Networking	CSE	OFFERED TO ALL BRANCHES
7.	U23ITOC01	Database System: Design & Development	IT	EEE, ECE, ICE, MECH, CIVIL, BME, MECHATRONICS
8.	U23ITOC02	Computer Hardware and Troubleshooting	IT	EEE, ECE, ICE, MECH, CCE, BME, MECHATRONICS
9.	U23MEOC01	Rapid Prototyping	MECH	EEE, ECE, ICE, CIVIL, BME, FT
10.	U23MEOC02	Material Handling System	MECH	EEE, ICE, CIVIL, MECHATRONICS
11.	U23CEOC01	Energy and Environment	CIVIL	EEE, ECE, MECH, BME, IT, MECHATRONICS
12.	U23CEOC02	Global Warming and Climate Change	CIVIL	EEE, ECE, CSE, IT, ICE, MECH, BME, CCE, AI&DS

13.	U23ICOC01	Sensors and Transducers	ICE	EEE, ECE, CSE, IT, MECH, CIVIL, CCE, CSBS, AI&DS
14.	U23ICOC02	Instrumentation for Industry 4.0	ICE	EEE, ECE, CSE, IT, MECH, CIVIL, CCE, CSBS, AI&DS, MECHATRONICS
15.	U23BMOC01	Medical Electronics	BME	EEE, ECE, CSE, IT, ICE, CCE, MECH, AI&DS, MECHATRONICS
16.	U23BMOC02	Telemedicine	BME	EEE, ECE, CSE, IT, ICE, CCE, AI&DS
17.	U23CCOC01	Introduction to Communication Technologies	CCE	EEE, ICE, CSE, IT, MECH, CIVIL, BME, AI&DS MECHATRONICS
18.	U23CCOC02	Introduction to Computer Networks	CCE	EEE, ICE, MECH, CIVIL, BME, AI&DS, MECHATRONICS
19.	U23CBOC01	Business Applications of Game Theory	CSBS	EEE, ECE, ICE, MECH, CIVIL, BME, CCE, MECHATRONICS
20.	U23CBOC02	Cryptology and Analysis	CSBS	EEE, ICE, MECH, CIVIL, BME, MECHATRONICS
21.	U23ADDC01	Principles of Artificial Intelligence and Machine Learning	AI&DS	EEE, ECE, ICE, CSE, IT, MECH, CIVIL, CCE, BME, MECHATRONICS
22.	U23ADOCO2	Introduction to Data Science	AI&DS	EEE, ECE, ICE, CSE, IT, MECH, CIVIL, CCE, BME, MECHATRONICS
23.	U23MCOC01	Building Automation	MCTR	EEE, ECE, ICE, MECH
24.	U23MCOC02	Automation in Manufacturing	MCTR	EEE, ICE, MECH
25.	U23FTOC01	Textile Arts and Crafts	FT	EEE, ECE, ICE, CSE, IT, MECH, CIVIL, CCE, BME, AI&DS, MECHATRONICS
26.	U23FTOC02	Garment Manufacturing Technology	FT	EEE, ECE, ICE, CSE, IT, MECH, CIVIL, CCE, BME, AI&DS, MECHATRONICS
Open Elective – III (Offered in Semester VII)				
1.	U23EEDC02	Electric and Hybrid Vehicles	EEE	ECE, ICE, MECH, CCE, BME, AI&DS, MECHATRONICS
2.	U23EEOC02	Energy Conservation and Management	EEE	ECE, ICE, MECH, CIVIL, CCE, BME, IT, CSE, AI&DS, MECHATRONICS
3.	U23ECOC03	IoT and its Applications	ECE	EEE, ICE, CSE, IT, MECH, CIVIL, CCE, FT
4.	U23ECOC04	RFID System Design and Testing	ECE	EEE, ICE, CSE, IT, MECH, CIVIL, CCE, BME, MECHATRONICS
5.	U23CSOC03	Web Programming	CSE	ECE, EEE, ICE, MECH, CIVIL, BME, MECHTRONICS
6.	U23CSOC04	Cloud Technology	CSE	ECE, EEE, ICE, MECH, CIVIL, BME, MECHTRONICS
7.	U23ITOC03	Essentials of Data Science	IT	EEE, ECE, ICE, CSE, MECH, CIVIL, CCE, BME, MECHATRONICS

8.	U23ITOC04	Big Data Technologies	IT	EEE, ICE, MECH, CIVIL, CCE, BME
9.	U23MEOC03	Creativity Innovation and New Product Development	MECH	EEE, ECE, ICE, CIVIL, BME, MECHATRONICS
10.	U23MEOC04	Supply Chain Management	MECH	EEE, ECE, CIVIL, MECHATRONICS
11.	U23CEOC03	Disaster Management	CIVIL	EEE, ECE, ICE, CSE, IT, MECH, BME, CCE, AI&DS
12.	U23CEOC04	Air Pollution and Solid Waste Management	CIVIL	EEE, ECE, ICE, CSE, IT, MECH, BME, CCE, AI&DS
13.	U23ICOC03	Fuzzy Logic and Neural Networks	ICE	CSE, IT, MECH,CSBS, AI&DS, MECHATRONICS
14.	U23ICOC04	Industrial Automation	ICE	ECE, CSE, IT, MECH,CCE, CSBS, AI&DS
15.	U23BMOC03	Medical Robotics	BME	EEE, ECE, CSE, IT, ICE, CCE, MECH, AI&DS, MECHATRONICS
16.	U23BMOC04	Tele health Technology	BME	EEE, ECE, ICE, CCE
17.	U23CCOC03	Web App Development	CCE	EEE, ECE, ICE, CSE,IT, MECH, CIVIL, BME, AI&DS, MECHATRONICS
18.	U23CCOC04	Network Essentials and Security	CCE	EEE, ICE, CSE, IT, MECH, CIVIL, BME, AI&DS, MECHATRONICS,
19.	U23CBOC03	Engineering Economics	CSBS	EEE, ECE, ICE, CSE, IT, MECH, CIVIL, BME, AIDS, CCE, FT, MECHATRONICS,
20.	U23CBOC04	Conversational AI	CSBS	EEE, ECE, ICE, MECH, CIVIL, BME, MECHATRONICS
21.	U23ADOC03	Data science Application of Vision	AI&DS	EEE, ECE, ICE, CSE, IT, MECH, CIVIL, CCE
22.	U23ADOC04	Artificial Intelligence Applications	AI&DS	EEE, ECE, ICE, CSE, IT, MECH, CIVIL, CCE, BME, MECHATRONICS
23.	U23MCOC03	Non-Destructive Testing	MCTR	EEE, ECE, ICE, MECH
24.	U23MCOC04	Robots and Systems in Smart Manufacturing	MCTR	EEE, ECE, ICE, MECH
25.	U23FTOC03	Fundamentals of Fashion Design	FT	EEE, ECE, ICE, CSE, IT, MECH, CIVIL, CCE, BME, AI&DS, MECHATRONICS
26.	U23FTOC04	Pattern Making	FT	EEE, ECE, ICE, CSE, IT, MECH, CIVIL, CCE, BME, AI&DS, MECHATRONICS

Dr. P. Jamuna

Annexure – III

ABILITY ENHANCEMENT COURSES – (A) CERTIFICATION COURSES

S. No	Course Code	Course Title
1	U23EECX01	Adobe Photoshop
2	U23EECX02	Adobe Animate
3	U23EECX03	Adobe Dreamweaver
4	U23EECX04	Adobe After Effects
5	U23EECX05	Adobe Illustrator
6	U23EECX06	Adobe InDesign
7	U23EECX07	Autodesk AutoCAD -ACU
8	U23EECX08	Autodesk Inventor - ACU
9	U23EECX09	Autodesk Revit - ACU
10	U23EECX10	Autodesk Fusion 360 - ACU
11	U23EECX11	Autodesk 3ds Max - ACU
12	U23EECX12	Autodesk Maya - ACU
13	U23EECX13	Cloud Security Foundations
14	U23EECX14	Cloud Computing Architecture
15	U23EECX15	Cloud Foundation
16	U23EECX16	Cloud Practitioner
17	U23EECX17	Cloud Solution Architect
18	U23EECX18	Data Engineering
19	U23EECX19	Machine Learning Foundation
20	U23EECX20	Robotic Process Automation / Medical Robotics
21	U23EECX21	Advance Programming Using C
22	U23EECX22	Advance Programming Using C ++
23	U23EECX23	C Programming
24	U23EECX24	C++ Programming
25	U23EECX25	CCNP Enterprise: Advanced Routing
26	U23EECX26	CCNP Enterprise: Core Networking
27	U23EECX27	Cisco Certified Network Associate - Level 2
28	U23EECX28	Cisco Certified Network Associate- Level 1
29	U23EECX29	Cisco Certified Network Associate- Level 3
30	U23EECX30	Fundamentals Of Internet of Things
31	U23EECX31	Internet Of Things / Solar and Smart Energy System with IoT
32	U23EECX32	Java Script Programming
33	U23EECX33	NGD Linux Essentials
34	U23EECX34	NGD Linux I
35	U23EECX35	NGD Linux II
36	U23EECX36	Advance Java Programming

37	U23EECX37	Android Programming / Android Medical App Development
38	U23EECX38	Angular JS
39	U23EECX39	Catia
40	U23EECX40	Communication Skills for Business
41	U23EECX41	Coral Draw
42	U23EECX42	Data Science Using R
43	U23EECX43	Digital Marketing
44	U23EECX44	Embedded System Using C
45	U23EECX45	Embedded System with IOT / Arduino
46	U23EECX46	English For IT
47	U23EECX47	Plaxis
48	U23EECX48	Sketch Up
49	U23EECX49	Financial Planning, Banking and Investment Management
50	U23EECX50	Foundation Of Stock Market Investing
51	U23EECX51	Machine Learning / Machine Learning for Medical Diagnosis
52	U23EECX52	IOT Using Python
53	U23EECX53	Creo (Modelling & Simulation)
54	U23EECX54	Soft Skills, Verbal, Aptitude
55	U23EECX55	Software Testing
56	U23EECX56	MX-Road
57	U23EECX57	CLO 3D
58	U23EECX58	Solid works
59	U23EECX59	Staad Pro
60	U23EECX60	Total Station
61	U23EECX61	Hydraulic Automation
62	U23EECX62	Industrial Automation
63	U23EECX63	Pneumatics Automation
64	U23EECX64	Agile Methodologies
65	U23EECX65	Block Chain
66	U23EECX66	Devops
67	U23EECX67	Artificial Intelligence
68	U23EECX68	Cloud Computing
69	U23EECX69	Computational Thinking
70	U23EECX70	Cyber Security
71	U23EECX71	Data Analytics
72	U23EECX72	Databases
73	U23EECX73	Java Programming
74	U23EECX74	Networking
75	U23EECX75	Python Programming
76	U23EECX76	Web Application Development (HTML, CSS, JS)
77	U23EECX77	Network Security

78	U23EECX78	MATLAB
79	U23EECX79	Azure Fundamentals
80	U23EECX80	Azure AI (AI-900)
81	U23EECX81	Azure Data (DP -900)
82	U23EECX82	Microsoft 365 Fundamentals (SS-900)
83	U23EECX83	Microsoft Security, Compliance and Identity (SC-900)
84	U23EECX84	Microsoft Power Platform (PI-900)
85	U23EECX85	Microsoft Dynamics Fundamentals 365 - CRM
86	U23EECX86	Microsoft Excel
87	U23EECX87	Microsoft Excel Expert
88	U23EECX88	Securities Market Foundation
89	U23EECX89	Derivatives Equinity
90	U23EECX90	Research Analyst
91	U23EECX91	Portfolio Management Services
92	U23EECX92	Cyber Security
93	U23EECX93	Cloud Security
94	U23EECX94	PMI – Ready
95	U23EECX95	Tally - GST & TDS
96	U23EECX96	Advance Tally
97	U23EECX97	Associate Artist
98	U23EECX98	Certified Unity Programming
99	U23EECX99	VR Development

ABILITY ENHANCEMENT COURSES – (B) SKILL ENHANCEMENT COURSES

Sl. No.	Course Code	Course Title
1	U23EES301	**Skill Enhancement Course 1 ***
		1) Testing of Electronics Devices and PCB Board Designing
		2) Design of Solar power plant and Installation
		3) Demonstration / Troubleshooting of Electrical and Electronics Equipments
2	U23EES402	**Skill Enhancement Course 2 ***
		1) Mobile Phone Servicing
		2) Autonomous Robotics
		3) Repair and Maintenance of Power Supply, Inverter and UPS

** Any one course to be selected from the list*

Dr. P. Jamuna

Annexure – IV

B. Tech Honours / Minor Programme - ELECTRIC VEHICLES

CURRICULUM

COURSE DETAILS												
Sl. No.	Semester	Course Code	Course Title	Course Type**	Category	Periods			Credits	Max. Marks		
						L	T	P		CAM	ESM	Total
1	IV	U23VXT401	Electrical Vehicles: Design, Dynamics and Testing	T	PC / IC	3	-	-	3	25	75	100
2	V	U23VXT502	Energy Storage and Battery Management System	T	PC / IC	3	-	-	3	25	75	100
3	VI	U23VXB603	Electric Drives and Controls	B	PC / IC	3	-	2	4	50	50	100
4	VII	U23VXB704	Modelling and Simulation of EHV	B	PC / IC	3	-	2	4	50	50	100
5	VIII	U23VXT805	Autonomous and Connected Vehicles	T	PC / IC	3	-	-	3	25	75	100
6	VIII	U23VXW806	Project Work	PA	PC / IC	-	-	4	2	50	50	100
Total									**19**	**225**	**375**	**600**
Equivalent NPTEL courses##												
1	IV	U23VXT401	Electrical Vehicles: Design, Dynamics and Testing	Vehicle Dynamics and Electric Motor Drives					3	**12 WEEKS COURSE**		
2	IV			Vehicles and Renewable Energy					3			
3	V	U23VXT502	Energy Storage and Battery Management System	Electrochemical Energy Storage					3			

The student shall be given an option to earn 3 credits through one 12-week NPTEL course (Equivalent) instead of any one theory course listed for Honour / Minor degree programme and shall be completed before the commencement of eighth semester. The equivalent courses are subject to change based on its availability as per NPTEL course list.

** T – Theory, B – Theory cum Practical, PA – Project Work

Department	**Mathematics**			Programme: **B. Tech.**			
Semester	**I**			Course Category: **BS**		End Semester Exam Type: **TE**	
Course Code	**U23MATC01**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**ENGINEERING MATHEMATICS – I**	**3**	**1**	**0**	**4**	**25**	**75**	**100**

(Common to ALL Branches Except CSBS)

Prerequisite	**Basic Mathematics**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the concept of Eigen values and Eigen vectors, Diagonalization of a Matrix	**K3**
	CO2 Solve higher order differential equations	**K3**
	CO3 Understand the different types of partial differential equations	**K3**
	CO4 Know about the Applications of double and triple integrals	**K3**
	CO5 Gain the knowledge about Vector Calculus and its Applications	**K3**

UNIT – I	**Matrices**	**Periods:12**
Rank of a Matrix - Systems of Linear Equations - Characteristic equation - Cayley Hamilton Theorem - Eigen values and Eigen vectors of a real Matrix - Diagonalization of Matrices.		**CO1**
UNIT – II	**Differential Equations (Higher Order)**	**Periods:12**
Linear Differential equations of higher order with constant coefficients - Euler's linear equation of higher order with variable coefficients – Method of Variation of parameters.		**CO2**
UNIT – III	**Functions of Several Variables**	**Periods:12**
Partial derivatives - Total derivatives - Maxima and Minima of two variables - Lagrange's Method of multipliers.		**CO3**
UNIT – IV	**Multiple Integrals**	**Periods:12**
Multiple Integrals - Change of order of integration (Cartesian form). Applications: Area as a double integral (Cartesian form) – Volume as a triple integral (Cartesian form).		**CO4**
UNIT – V	**Vector Calculus**	**Periods:12**
Gradient - Divergence and Curl - Directional derivatives - Irrotational and Solenoidal vector fields - Properties (Statement only) - Gauss Divergence Theorem and Stoke's Theorem (without proofs).		**CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. M.K. Venkataraman, "Engineering Mathematics", The National Publishing Company, Chennai, 2nd Edition, 2016.
2. N. P Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Lakshmi Publications, New Delhi, 9th Edition, 2018.
3. S. Narayanan and T.K. Manickavasagam Pillay, "Differential Equations and Its Applications", Viswanathan Printers & Publishers Pvt Ltd, 2014.

Reference Books

1. G. Balaji, "Matrices and Calculus (Engineering Mathematics - I)", Balaji Publications, 9th Edition, 2023.
2. A. Singaravelu, "Engineering Mathematics - I", Meenakshi Agency, Chennai, 23rd Edition, 2016.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley, 10th Edition, 2019.
4. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 6th Edition, 2018.
5. C W. Evans, "Engineering Mathematics - A Programmed Approach", 3rd Edition, 2019.

Web References

1. http://www.yorku.ca/yaoguo/math1025/slides/chapter/kuttler-linearalgebra-slides-systemsofequation-handout.pdf
2. http://www.math.cum.edu/~wn0g/2ch6a.pdf
3. https://nptel.ac.in/courses/122/104/122104017/
4. https://nptel.ac.in/courses/111/106/111106051/
5. https://nptel.ac.in/courses/111/108/111108081/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	2	1	1	-	-	-	-	1	2	1	1
2	3	2	1	1	-	1	1	-	-	-	-	1	2	1	1
3	3	2	1	1	-	1	1	-	-	-	-	1	2	1	1
4	3	2	1	1	-	1	1	-	-	-	-	1	2	1	1
5	2	2	1	-	-	-	1	-	-	-	-	1	2	1	1

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Physics / Chemistry**		Programme: **B. Tech.**					
Semester	**I / II**		Course Category: **BS**			End Semester Exam Type: **TE**		
Course Code	**U23BSTC01**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**PHYSICAL SCIENCE FOR ENGINEERS**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
(Common to ALL Branches)									
Prerequisite	**Physics of 12th standard or equivalent / Chemistry of 12th standard or equivalent.**								
Course Outcomes	**On completion of the course, the students will be able to**								BT Mapping (Highest Level)
	CO1	Understand the basic of properties of magnetic, dielectric and superconductors.							**K2**
	CO2	Identify the wave nature of the particles, physical significance of wave functions							**K3**
	CO3	Understand the basic principles of laser and fiber optics communication							**K2**
	CO4	Understand and familiar with the water treatment.							**K2**
	CO5	Understand the electrode potential for its feasibility in electrochemical reaction and uses of various batteries.							**K2**
	CO6	Understand the specific operating condition under which corrosion occurs and suggest a method to control corrosion.							**K2**

Section A - Physics

UNIT – I	**Magnetic, Dielectric and Superconducting Materials**	**Periods:08**
Introduction to magnetic materials, Ferromagnetism - Domain theory - Types of energy – Hysteresis - Hard and Soft magnetic materials - ferrites - Dielectric materials - Types of polarization – Langevin-Debye equation - Frequency effects on polarization-Dielectric breakdown- Ferroelectric materials -Superconducting materials and their properties		**CO1**
UNIT – II	**Quantum Mechanics**	**Periods:07**
Matter Waves - de Broglie Wavelength - Uncertainty Principle –Physical Significance of wave functions - Schrodinger wave Equation - Time Dependent - Time Independent - Application to Particle in a One Dimensional Box - Tunnel Diode.		**CO2**
UNIT – III	**Laser and Fiber Optics**	**Periods:07**
Lasers - Principles of Laser - Spontaneous and Stimulated Emissions - Einstein's Coefficients - Population Inversion and Laser Action – components of laser - Types of Lasers – NdYAG, CO_2 laser, GaAs Laser Fiber Optics - Principle and Propagation of light in optical fiber - Numerical aperture and acceptance angle - Types of optical fibers (material, refractive index, mode)		**CO3**

Section B - Chemistry

UNIT – IV	**Water and its Treatment**	**Periods:08**
Water: Sources and impurities, Water quality parameters: Definition and significance of-color, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD. Desalination of brackish water: Reverse osmosis-disadvantages of using hard water in boiler - Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning) and External treatment-Ion exchange demineralization and zeolite process.		**CO4**
UNIT – V	**Electrochemical Cells and Storage Devices**	**Periods:08**
Galvanic cells, single electrode potential, standard electrode potential, electrochemical series. EMF of a cell and its measurement. Nernst equation. Electrolyte concentration cell. Reference electrodes-hydrogen, calomel and Ag/AgCl. Batteries and fuel cells: Types of batteries- alkaline battery-lead storage battery- nickel-cadmium battery- fuel cell H2 -O2 fuel cell-applications.		**CO5**
UNIT – VI	**Corrosion**	**Periods:07**
Corrosion – Introduction - factors – types - chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control – material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Uses of inhibitors, metallic coating – anodic coating, cathodic coating. Metal cladding, Electroplating of Copper and electro less plating of nickel.		**CO6**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. V Rajendran, "Engineering Physics", TMH, New Delhi, 2nd Edition, 2017.
2. S. S Dara, "A text book of Engineering Chemistry", S.Chand Publications, 15th Edition, 2021.
3. C.Jain, Monica Jain, "Engineering Chemistry", Dhanpat Rai Pub. Co., New Delhi, 17th Edition, 2015.

Reference Books

1. G. Balaji, "Matrices and Calculus (Engineering Mathematics - I)", Balaji Publications, 9th Edition, 2023.
2. A. Singaravelu, "Engineering Mathematics - I", Meenakshi Agency, Chennai, 23rd Edition, 2016.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley, 10th Edition, 2019.
4. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 6th Edition, 2018.
5. C W. Evans, "Engineering Mathematics - A Programmed Approach", 3rd Edition, 2019.

Web References

1. https://www.sciencedaily.com/terms/materials_science.htm.
2. https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/materials science.html.
3. https://study.com/academy/lesson/semiconductors-superconductors-definition-properties.html
4. https://mechanicalc.com/reference/engineering-materials
5. http://ndl.ethernet.edu.et/bitstream/123456789/89589/1/%5BPerez_N.%5D_Electrochemistry_and_corrosion%28BookZZ.org%29.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	-	-	-	-	2	2	2
2	3	2	3	2	-	-	-	-	-	-	-	-	2	2	2
3	3	2	3	2	-	-	-	-	-	-	-	-	2	2	2
4	3	1	-	-	-	-	-	-	-	-	-	-	2	2	2
5	3	1	-	-	-	-	-	-	-	-	-	-	2	2	2
6	3	1	-	-	-	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Mechanical Engineering**	Programme: **B. Tech.**						
Semester	**I / II**	Course Category: **ES**			End Semester Exam Type: **TE**			
Course Code	**U23ESTC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ENGINEERING MECHANICS**	**2**	**1**	**0**	**3**	**25**	**75**	**100**

(Common to EEE, ECE, MECH, CIVIL, Mechatronics Branches)

Prerequisite	**Engineering Physics**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Recognize the basics of equilibrium of particles in 2D and 3D	**K2**
	CO2 Review the requirements of equilibrium of rigid bodies in 2D and 3D.	**K2**
	CO3 Solve problem related to friction force.	**K3**
	CO4 Compute the center of mass and moment of inertia of surfaces and solids.	**K3**
	CO5 Predict displacement, velocity and acceleration of dynamic particles.	**K3**

UNIT – I	**Basics and Statics of Particles**	**Periods: 09**
Introduction - Units and Dimensions - Vectorial representation of forces and moments – Coplanar Forces - Lami's theorem, Parallelogram and triangular Law of forces -Resolution of forces - Equilibrium of a particle - Principle of transmissibility - Equivalent system of force - Free body diagram		**CO1**
UNIT – II	**Equilibrium of Rigid Bodies**	**Periods: 09**
Types of supports and their reactions -requirements of stable equilibrium - Moments and Couples -Moment of a force about a point and about an axis -Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem -Equilibrium of Rigid bodies in two dimensions – Forces in space -Equilibrium of a particle in space - Equivalent systems of forces - Equilibrium of Rigid bodies in three dimensions (Descriptive only).		**CO2**
UNIT – III	**Structural Analysis of Trusses and Friction**	**Periods: 09**
Trusses - Definition of a truss - Simple Trusses - Analysis of Trusses - Method of joints - Method of sections - Friction force - Laws of sliding friction - equilibrium analysis of simple systems with sliding friction -wedge friction- Rolling resistance.		**CO3**
UNIT – IV	**Properties of Surfaces and Solids**	**Periods: 09**
Determination of centroid of areas, volumes and mass - Pappus and Guldinus theorems - moment of inertia of plane and areas- Parallel axis theorem and perpendicular axis theorem, radius of gyration of area- product of inertia- mass moment of inertia.		**CO4**
UNIT – V	**Dynamics of Particles**	**Periods: 09**
Displacements, Velocity and acceleration, their relationship - Relative motion - Curvilinear motion - Newton's law - Work Energy Equation of particles -Impulse and Momentum -Impact of elastic bodies.		**CO5**

Lecture Periods: 30	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Beer and E. R. Johnston Jr., "Vector Mechanics for Engineers", McGraw-Hill Education India Pvt Ltd., 11th Edition, 2016.
2. J.L. Meriam & L.G. Karidge, "Engineering Volume I and Engineering Mechanics: Dynamics", Wiley, 8th Edition, 2016.
3. R.C. Hibbeller, "Engineering Mechanics", Prentice Hall, 14th edition, 2016.

Reference Books

1. Arthur P. Boresi and Richard J. Schmidt, "Engineering Mechanics: Statics and Dynamics", Thomson Asia Private Limited, Singapore, 2010.
2. D. P. Sharma "Engineering Mechanics", Dorling Kindersley India Pvt. Ltd, New Delhi, 2010
3. S. Rajasekaran, G. Sankarasubramanian, "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt., Ltd., 2012.
4. S. S. Bhavikatti and K.G. Rajashekarappa, "Engineering Mechanics", New Age International(P) Ltd, New Delhi, 7th Edition, 2019.
5. Dr. I. S Gujral, "Engineering Mechanical", Lakshmi Publication (P) Ltd., 2nd Edition, 2011.

Web References

1. http://nptel.iitm.ac.in/video.php?subjectId=112103108
2. http://www.nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/Engineeringmechanics/Table of Contents.html
3. https://nptel.ac.in/courses/112/106/112106286/
4. https://www.coursera.org/learn/engineering-mechanics-statics
5. https://nptel.ac.in/courses/122/104/122104014/

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	-	-	-	-	-	-	-	1	1	1	1
2	3	2	2	3	-	-	-	-	-	-	-	1	1	1	1
3	3	2	2	3	-	-	-	-	-	-	-	1	1	1	1
4	3	2	2	3	-	-	-	-	-	-	-	1	1	1	1
5	3	2	2	3	-	-	-	-	-	-	-	1	1	1	1

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**I**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23EET101**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL ENGINEERING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								

Prerequisite	**Physics**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Evaluate the current, voltage and power using different laws in DC circuits.	**K3**
	CO2 Familarlize different terms, laws and parameters governing the magnetic circuits.	**K3**
	CO3 Analyze the different AC circuits and impart the concepts of poly phase system.	**K3**
	CO4 Develop the various domestic wiring with the preventive safety measures.	**K4**
	CO5 Acquire skills about the factory wiring, estimation and protection methods for industries.	**K4**

UNIT – I	**DC Circuits**	**Periods:09**
Concept of Potential difference, current, work, power, energy -Electrical networks and its types – active and passive elements - ideal and practical sources, concept of dependent and independent sources - Ohm's law, Kirchhoff's laws, Current and voltage division rule, Simplification of networks using series , parallel connection - Network solutions using Mesh and Nodal analysis, Star/Delta transformation.		**CO1**
UNIT – II	**Magnetic Circuits**	**Periods:09**
Definitions of magnetism – Magnetic effect of electric current – Important terms of magnetic circuits – Comparison of Magnetic and Electric circuits – Electromagnetic induction – Lenz law – Induced EMF – Self and Mutual Induction – Amperes law - Energy stored in magnetic circuits - Magnetic Hysteresis and Eddy current - Magnetic Material and B-H Curve.		**CO2**
UNIT – III	**AC Circuits**	**Periods:09**
AC waveform – terms and definitions, form factor, peak factor- R-L, R-C, RLC series and parallel circuits, phasor representation in Polar and Rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase balanced AC Circuits (Y-Δ and Y-Y), relationship between line and phase values – Power measurement – Two Wattmeter method – AC filters and its types.		**CO3**
UNIT – IV	**Electrical Safety And Domestic Wiring**	**Periods:09**
Safety measures in electrical system – Electrical tools and accessories-Wiring Standards -Types of domestic wiring – Staircase, doctor's room, fluorescent lamp, LED lamp and corridor wiring- Residential wiring-Layout of electrical power system and its functions- Insulators, fuses, relays and circuit breakers- Electrical shock and rescue methods - Applications.		**CO4**
UNIT – V	**Industrial Wiring**	**Periods:09**
Single line diagram of industrial wiring - Three phase wiring connections - Factory wiring - Godown wiring - panel wiring - Commercial wiring - Indian Electricity rules - Types of Conductors, Cables, sizing and selection- Electrical Estimation and installation -Energy audit - Earthing – Types of earthing – Difference between neutral and earth wire – Introduction to Megger - Introduction to ECAD - Applications.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2nd Edition, 2019.
2. R. K. Rajput, "Basic Electrical and Electronics Engineering", University Science Press, 2nd Edition, 2017.
3. R. Muthusubramaniam, S. Salivahanan and K. A. Mureleedharan, "Basic Electrical Electronics and Computer Engineering", Tata McGraw Hill, 2018.

Reference Books

1. Thaddeus W. Fowler, "Electrical Safety", Diane Publishing Company, 5th Edition, 2013.
2. A. Sudhakar and S. P. Shyam Mohan, "Circuits and Networks: Analysis and Synthesis", Tata McGraw Hill Publishing Company Ltd., New Delhi, 4th Edition, 2017.
3. B. L. Theraja, A. K. Theraja, "A Textbook of Electrical Technology – Volume - I", S Chand & amp; Co. Ltd., New Delhi, 23rd Edition, 2009.
4. Stephen L. Herman, "Electrical Wiring", Cengage Learning India, 15th Edition, 2014.
5. S. K. Bhattacharya, S. Chatterji, "Projects in Electrical, Electronics, Instrumentation and Computer Engineering", S. Chand & Co, 2nd Edition, 2010.

Dr. P. Jamuna

Web References

1. https://www.electrical4u.com/
2. https://www.allaboutcircuits.com/
3. https://nptel.ac.in/courses/108105112/
4. https://nptel.ac.in/courses/108108076/
5. https://demonstrations.wolfram.com/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
2	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
3	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
4	3	3	3	2	2	-	-	-	-	-	-	1	3	3	3
5	3	3	3	2	2	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**I**	Course Category: **PC**			End Semester Exam Type :**TE**			
Course Code	**U23EET102**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRONICS – I**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	**Mathematics, Physics**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Acquire knowledge about semiconductor devices and their characteristics for applications like rectifiers, clippers, clampers and regulator circuits.	**K3**
	CO2 Gain knowledge of transistor biasing techniques and stability considerations for applications like amplifier and switching circuits.	**K3**
	CO3 Comprehend the physical structure, types and characteristics of FET.	**K2**
	CO4 Describe the behavior of special and optoelectronic devices.	**K2**
	CO5 Apply Boolean Algebra and Karnaugh map for designing combinational logic circuits.	**K3**

UNIT – I	**PN Junction Diodes**	**Periods: 09**
Semiconductor - **PN junction diode:** Forward and Reverse bias - Effect of temperature - Static and Dynamic resistance - Equivalent models - Transition and diffusion capacitances - Reverse Recovery time. **Diode applications:** Rectifiers, Clippers and Clampers. **Zener diode**: VI Characteristics - Zener as regulator - Introduction to SiC diodes.		**CO1**

UNIT – II	**Bipolar Junction Transistors**	**Periods: 09**
BJT: NPN and PNP transistors - Ebers - Moll Model - CB, CE and CC configurations - Transistor characteristics - Biasing - DC and AC load line - Operating point - Stabilization - Bias compensation techniques - Thermal stability and runaway - Amplification – Transistor switching times – Base width modulation – Breakdown voltage – Voltage in open emitter configuration and open base configuration - BJT ratings - Introduction to HBT and SJT.		**CO2**

UNIT – III	**Field Effect Transistors**	**Periods: 09**
JFET: Construction - Drain and transfer characteristics - Shockley's equation - Comparison between JFET and BJT - Biasing - **MOSFET:** Construction, Types and characteristics - FET ratings - Introduction to SiC MOSFET - HFET.		**CO3**

UNIT – IV	**Special Devices and Optoelectronic Devices**	**Periods: 09**
Special Devices: Varactor diode – PIN diode – Tunnel diode – Schottky diode – SCR – DIAC – TRIAC and UJT. **Optoelectronic Devices:** Photo diodes - Photo transistors - PV cells - Opto couplers - LED - LDR - LCD.		**CO4**

UNIT – V	**Number system and Combinational Circuits**	**Periods: 09**
Number systems: Binary, Decimal, Octal and Hexa decimal -1s and 2s complement - Binary arithmetic - BCD addition and subtraction - Boolean theorems - Digital logic gates - Universal gates. **Combinational Circuits**: Design of combination circuits using NAND and NOR gates - POS, SOP simplification - Minterms and Maxterms - Karnaugh map - Don't care conditions - Design of adder and Subtractor - Multiplexers - Demultiplexers - Encoder and Decoders - Parity generator - Code converters and BCD to seven segment display driver.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. J. B. Gupta, "Electronic Devices and Circuits", S.K. Kataria and Sons, 6th Edition, 2022.
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson Education, 9th Edition, 2007.
3. Floyd and Jain, "Digital Fundamentals", Pearson Education, 11th Edition, 2015.

Dr. P. Jamuna

Reference Books

1. Dr. R. S. Sedha, "A Textbook of Applied Electronics", S. Chand Publications, Multicolor Edition, 2019.
2. David A. Bell, "Electronic devices and circuits", Oxford University higher education, 5th Edition, 2008.
3. Thomas L. Floyd, "Electronic Devices", Conventional current version, Pearson Prentice Hall, 10th Edition, 2017.
4. Morris. M. Mano and Michael. D. Ciletti, "Digital Design", Pearson Education, 5th Edition, 2013.
5. A. Anand Kumar, "Fundamentals of Digital Circuits", PHI Learning Pvt. Ltd, 4th Edition, 2022.

Web References

1. https://nptel.ac.in/courses/117107095
2. https://nptel.ac.in/courses/108107142
3. https://nptel.ac.in/courses/115102014
4. https://onlinecourses.nptel.ac.in/noc21_ee80/preview
5. https://nptel.ac.in/courses/106108099

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	3	2	3	-	-	-	-	-	-	-	3	3	3
2	2	2	3	2	3	-	-	-	-	-	-	-	3	3	3
3	2	2	3	2	3	-	-	-	-	-	-	-	3	3	3
4	2	2	3	2	3	-	-	-	-	-	-	-	3	3	3
5	2	2	3	2	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**English**	Programme: **B. Tech.**						
Semester	**I**	Course Category: **HS**			End Semester Exam Type: **TE**			
Course Code	**U23ENBC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**COMMUNICATIVE ENGLISH – I**	**2**	**0**	**2**	**3**	**50**	**50**	**100**

(Common to ALL Branches except CSBS)

Prerequisite	**Basics of English Language**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the communication flow in organization and its objectives	**K2**
	CO2 Write the technical contents with grammatically precise sentences	**K2**
	CO3 Articulate with correct pronunciation and overcome vernacular impact in speaking	**K3**
	CO4 Express opinions confidently in formal and informal communicative contexts	**K2**
	CO5 Attend interview with assertiveness	**K3**

UNIT – I	**Workstead Communication**	**Periods:10**
Communication, Definition, Process, Channels, Barriers, Strategies for Effective Communication, Verbal and Nonverbal Communication - Listening, Types, Barriers, Enhancing Listening Skills - Bibliography: Book, Journal and Internet References.		**CO1**
UNIT – II	**Common Errors In Writing And Comprehension Strategies**	**Periods:10**
Subject Verb Agreement, Misplaced Modifiers, Squinting Modifiers, Dangling Modifier, Fused Sentence, Comma Splice, Sentence Fragment - Reading Comprehension: Technical passage, Strategies: Skimming, Scanning, Intensive and Extensive Reading, Prediction, and Contextual Meaning		**CO2**
UNIT – III	**Phonetics**	**Periods:10**
Pronunciation Guidelines to consonants and vowels, Sounds Mispronounced, Silent and Non-silent Letters, Intonation, Spelling Rules and Words often misspelled, Mother Tongue Influence (MTI), Various Techniques for Neutralization of Mother Tongue		**CO3**
UNIT – IV	**Communication Practice – I**	**Periods:15**
List of Exercises **Listening**: Self Introduction videos **Speaking**: Self-Introduction, Extempore, and Role Play **Reading**: Non-Technical Comprehension Passage **Writing:** Common Errors in Writing		**CO4**
UNIT – V	**Interpersonal Communication – I**	**Periods:15**
List of Exercises **Listening:** Speech Sounds, Interview Videos **Speaking**: Debate, Structured Group Discussion and Conversation **Reading**: Commonly Confused Words **Writing:** Transcription		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 60**

Text Books

1. Richa Mishra, Ratna Rao, "A textbook of English Language Communication Skills", Macmillan Publishers India Private Ltd., Revised Edition, 2021.
2. Rizvi M. Ashraf, "Effective Technical Communication", Tata-McGraw-Hill Publishing Company Limited, 4th Edition, 2010.
3. T. Balasubramanian, "English Phonetics for Indian students workbook", Trinity Press, 2nd Edition, 2016.

Reference Books

1. N. P. Sudharshana, C. Savitha, "English for Engineers", Cambridge University Press, 2018.
2. Raman, Meenakshi, and Sharma, Sangeetha, "Technical Communication - Principles and Practice", Oxford University Press, 3rd Edition, 2017.
3. Comfort, Jeremy, Etal, "Speaking Effectively: Developing Speaking Skills for Business English", Cambridge University Press, Cambridge, Reprint, 2011.
4. Wren & Martin, "High School English Grammar and Composition", S Chand & Co. Ltd, 2015.
5. Boove, Courtland L, "Business Communication Today", Pearson Education, New Delhi, 2002

Dr. P. Jamuna

Web References

1. https://lemongrad.com/subject-verb-agreement-rules/
2. https://opentextbc.ca/advancedenglish/chapter/misplaced-and-dangling-modifiers/
3. https://www.hitbullseye.com/Reading-Comprehension-Tricks.php
4. https://www.softwaretestinghelp.com/how-to-crack-the-gd/
5. https://worldscholarshipvault.com/neutralize-mother-tongue-interference/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
5	1	-	-	-	-	-	-	-	1	3	-	1	1	-	-

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Theory						
Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Attendance		
Marks	5	5	5	5	75	60
	20 (to be weighted for 10 marks)				(To be weighted for 50 marks)	

Practical				
Continuous Assessment Internal Evaluation		End Semester Internal Evaluation		Total Marks
30 (to be weighted for 10 marks)		30 marks		40
Listening (L)*	10	Listening (L)*	10	
Speaking(S)	5	Speaking(S)	5	
Reading(R)*	10	Reading(R)*	10	
Writing(W)*	5	Writing(W)*	5	

***LRW components of Practical can be evaluated through Language Lab Software**

Dr. P. Jamuna

Department	**Mechanical Engineering**	Programme: **B. Tech.**						
Semester	**I / II**	Course Category: **ES**			End Semester Exam Type: **LE**			
Course Code	**U23ESPC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DESIGN THINKING AND IDEA LAB**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to all Branches)								
Prerequisite	**Basic Knowledge of Science**							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Demonstrate a comprehensive understanding of the tools and inventory associated with the IDEA Lab.	**K2**
	CO2	Develop proficiency in ideation techniques to generate creative and innovative solutions for various design challenges and problems	**K3**
	CO3	Acquire practical knowledge of mechanical and electronic fabrication processes, including hands-on experience with machinery, tools, and techniques used in the manufacturing and assembly of physical components.	**K3**
	CO4	Cultivate the skills necessary for developing innovative and desirable products, including the ability to integrate user needs, market trends, and technological advancements into the design process.	**K4**
	CO5	Apply iterative design methodologies to refine and improve solutions based on feedback, user testing, and evaluation of functional, aesthetic, and usability aspects	**K4**

List of Experiments:

Design process: Traditional design, Design thinking, Existing sample design projects, Study on designs around us, Compositions/structure of a design, Innovative design: Breaking of patterns, Reframe existing design problems, Principles of creativity Empathy: Customer Needs, Insight-leaving from the lives of others/standing on the shoes of others, Observation

Design team-Team formation, Conceptualization: Visual thinking, Drawing/sketching, New concept thinking, Patents and Intellectual Property, Concept Generation Methodologies, Concept Selection, Concept Testing, Opportunity identification Prototyping: Principles of prototyping, Prototyping technologies, Prototype using simple things, Wooden model, Clay model, 3D printing; Experimenting/testing.

Sustainable product design, Ergonomics, Semantics, Entrepreneurship/business ideas, Product Data Specification, Establishing target specifications, Setting the final specifications. Design projects for teams.

1. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
2. Machining of 3D geometry on soft material such as softwood or modelling wax.
3. 3D scanning of computer mouse geometry surface. 3D printing of scanned geometry using FDM or SLA printer.
4. 2D profile cutting of press fit box/casing in acrylic (3 or 6 mm thickness)/cardboard, MDF (2 mm) board using laser cutter & engraver.
5. 2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
6. Familiarity and use of welding equipment.
7. Familiarity and use of normal and wood lathe.
8. Embedded programming using Arduino and/or Raspberry Pi.
9. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure.
10. Discussion and implementation of a mini project.
11. Documentation of the mini project (Report and video).

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Tim Brown, “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, HarperCollins Publishers Ltd.
2. “Workshop / Manufacturing Practices (with Lab Manual)”, Khanna Book Publishing.
3. Ulrich and Eppinger, “Product Design and Development”, McGraw Hill, 3rd Edition, 2004.
4. Chris Hackett. Weldon Owen, “The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects”, 2018.
5. Sean Michael Ragan, Weldon Owen, “The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product”, 2017.
6. Paul Horowitz and Winfield Hill, “The Art of Electronics”, Cambridge University Press, 3rd Edition.
7. Paul Sherz and Simon Monk, “Practical Electronics for Inventors”, McGraw Hill, 4th Edition.

8. Simon Monk and Duncan Amos, “Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards”, McGraw Hill Education.
9. Simon Monk, “Programming Arduino: Getting Started with Sketches”, McGraw Hill, 2nd Edition.
10. Venuvinod, PK., MA. W., “Rapid Prototyping - Laser Based and Other Technologies”, Kluwer.
11. Chapman W.A.J, “Workshop Technology - Volume I, II, III”, CBS Publishers and Distributors, 5th Edition, 2002.

Web References

1. https://onlinecourses.nptel.ac.in/noc23_mg72

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	2	-	-	2	-	3	2	2	2	3
2	3	3	3	2	2	2	-	-	2	-	3	2	2	2	3
3	3	3	3	2	3	2	-	-	2	-	3	2	2	2	3
4	3	3	3	2	3	2	-	-	2	-	3	2	2	2	3
5	3	3	3	2	3	2	-	-	2	-	3	2	2	2	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**I**	Course Category: **PC**			End Semester Exam Type: **LE**			
Course Code	**U23EEP101**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL ENGINEERING LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

EEE

Prerequisite	**Physics**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Acquire knowledge on safety protocols and procedures for working with electricity.	**K2**
	CO2 Gain hands on experience in using various electrical tools and equipments.	**K3**
	CO3 Develop skills in designing line diagram and construct wiring for domestic and industrial applications.	**K4**
	CO4 Use protection circuits for electrical networks and measure insulation resistance using megger.	**K3**
	CO5 Analyze and troubleshoot the electrical circuits of various domestic appliances.	**K4**

List of Experiments:

1. Study of electrical tools, accessories, joints, symbols and safety precautions.
2. Study of different types of Fuses, Circuits breakers, AC and DC meters.
3. Testing of series and parallel lamp circuits.
4. Domestic Wiring Practice
   a. Staircase wiring
   b. Doctor's room wiring
   c. Bed room wiring
   d. Godown wiring
   e. Ceiling fan, LED Lamps and Iron box.
5. Design of Domestic power distribution.
6. Estimation of material requirement for Residential building/Flat wiring
7. Estimation of material requirement for industrial wiring
8. Measurement of Insulation resistance using Megger.
9. Characteristics of Incandescent lamp and CFL.
10. To study and measure the inductance of choke coil.
11. Study of Electric shock phenomenon, precautions, preventions and earthing
12. Study and Troubleshooting of electrical equipments (Fan, Iron box, Mixer)

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. B. L. Thereja, A. K. Thereja, "A text book of Electrical Technology- Basic Electrical Engineering – Volume - I", S. Chand & Co. Ltd., 13th Edition, 2020.
2. D. P. Kothari and I.J. Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, 3rd Reprint, 2016.
3. R. Muthusubramaniam, S. Salivahanan and K. A. Mureleedharan, "Basic Electrical Electronics and Computer Engineering", Tata McGraw Hill, 2018
4. Del Toro, "Electrical Engineering Fundamentals", Pearson Education India, New Delhi, 2nd Edition, 2015.
5. David Herres, "The Homeowner's DIY Guide to Electrical Wiring", McGraw Hill Professional, 7th Edition, 2015.
6. Stephen L. Herman, "Electrical Wiring", Cengage Learning India, 15th Edition, 2014.

Web References

1. https://www.electrical4u.com/
2. https://www.allaboutcircuits.com/
3. https://nptel.ac.in/courses/108105112/
4. https://nptel.ac.in/courses/108108076/
5. https://demonstrations.wolfram.com/

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	-	-	-	2	-	-	2	3	2	2
2	3	3	3	3	2	-	-	-	2	-	-	2	3	2	2
3	3	3	3	3	2	-	-	-	2	-	-	2	3	2	2
4	3	3	3	3	2	-	-	-	2	-	-	2	3	2	2
5	3	3	3	3	2	-	-	-	2	-	-	2	3	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**I**	Course Category: **PC**			End Semester Exam Type: **LE**			
Course Code	**U23EEP102**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRONICS – I LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
EEE								

Prerequisite	**Physics**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Analyze the characteristics of diodes, current controlled and voltage-controlled power switches.	**K4**
	CO2 Design and implement clippers, clampers, rectifiers and regulator circuits using diodes.	**K3**
	CO3 Analyze the characteristics of photodiodes, LEDs and able to investigate their behavior under different operating conditions.	**K3**
	CO4 Gain knowledge in design and implemention of digital logic circuits in order to validate their functionality.	**K3**
	CO5 Develop skills to simplify the hardware requirements of digital circuits for real time applications.	**K4**

List of Experiments:

1. V-I characteristics of PN junction diode.
2. Clipping and clamping circuits.
3. Half wave and full wave rectifier circuits with and without filters.
4. V-I characteristics of zener diode and design of voltage regulator circuits.
5. Input and output characteristics of BJT for CB, CC and CE configurations.
6. Design of biasing circuits for BJT.
7. Transfer and drain characteristics of JFET and MOSFET.
8. V - I characteristics of SCR and TRIAC.
9. V - I characteristics of Photodiode and LED.
10. Study and implementation of logic gates and verification of De Morgan laws using basic gates.
11. Design and verification of adder and Subtractor.
12. Design and verification of Encoder and Decoder.
13. Design of Multiplexer and Demultiplexer using gates and ICs.
14. Design of Parity generator and Checker using gates and ICs.
15. Design of Code Converters: BCD to Binary, Binary to BCD using logic gates.
16. Design of BCD to Seven Segment Display using ICs.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Paul Scherz and Simon Monk, “Practical Electronics for Inventors”, Mc Graw Hill Education, 4th Edition, 2016.
2. Satya Sai Srikant, Prakash Kumar Chaturvedi, “Basic Electronics Engineering Including Laboratory Manual”, Springer Nature Singapore Pvt Ltd., 2020.
3. J. B. Gupta, “Electronic Devices and Circuits”, S.K. Kataria and Sons, 6th Edition Reprint, 2022.
4. A. Anand Kumar, “Fundamentals of Digital Circuits”, PHI Learning Pvt. Ltd, 4th Edition, 2022.
5. L. K. Maheswari, M.M.S. Anand, “Laboratory Manual for Introductory Electronics Experiments”, New Age International (p) Limited, 1980.

Web References

1. http://vlabs.iitkgp.ernet.in/be/
2. https://be-iitkgp.vlabs.ac.in/
3. https://electricvlab.com/
4. https://iotdunia.com/basic-electronics-virtual-lab-for-teachers-and-students/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	-	-	-	-	-	-	-	3	2	2
2	3	3	2	3	2	-	-	-	-	-	-	-	3	2	2
3	3	3	2	3	2	-	-	-	-	-	-	-	3	2	2
4	3	3	2	3	2	-	-	-	-	-	-	-	3	2	2
5	3	3	2	3	2	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**I**	Course Category: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23EEC1XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - I**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
EEE								
Prerequisite	**-**							

Students shall choose an international certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass / Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	**10**	**90**	**100**

Department	**Electrical and Electronics Engineering**				Programme: **B. Tech.**			
Semester	**I**				Course Category: **MC**	End Semester Exam Type: **-**		
Course Code	**U23EEM101**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INDUCTION PROGRAMME**	**2 Weeks**			**Non-Credit**	**-**	**-**	**-**

(Common to ALL Branches)

Prerequisite	**Basic Mathematics**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Develop holistic attitude and harmony in the individual, family, and Society	**K2**
	CO2 Acquire grammar skills and capable to write and speak English confidently	**K2**
	CO3 Understand the basic concepts in Mathematics and Programming	**K2**
	CO4 Know about the art and culture, language and literature of this vast secular nation	**K2**
	CO5 Identify the inherent talent and develop it professionally	**K3**

UNIT – I	**Universal Human Values**	**Periods:12**
Welcome and Introductions - Getting to know each other, Aspirations and Concerns - Individual Academic and Career, Expectations of Family, Peers, Society, Nation, Fixing one's Goals, Self-Management - Self-confidence, Peer Pressure, Time Management, Anger, Stress Personality Development, Self-improvement, Health - Health issues, Healthy diet, Healthy lifestyle, Hostel life, Relationships - Home sickness, Gratitude towards Parents, Teachers and others Ragging and interaction, Competition and Cooperation, Peer Pressure, Society - Participation in Society, Natural Environment - Participation in Nature, Sum Up - Role of Education, Need for a Holistic Perspective, Self-evaluation and Closure - Sharing and feedback.		**CO1**

UNIT – II	**Proficiency in English**	**Periods:12**
Communication skills - Prognostic test on Grammar -Synonyms, Antonyms, Tenses, Sentence Completion, Idioms and Phrases, One-word Substitution, Homophones, Homonyms, Use of Prepositions, Subject-verb Agreement - Writing - Paragraph writing, Letter writing, Essay writing, Story Development.		**CO2**

UNIT – III	**Bridge Course in Mathematics and C Programming**	**Periods:12**
Mathematics: Fundamentals of differential and integral calculus: Theory and Practice, Limit of function - Fundamental results on limits - Continuity of a function - Concept of differentiation - Concept of derivative - Slope of a curve - Differentiation Techniques - Derivatives of elementary functions from first principle - Derivatives of inverse functions - Logarithmic differentiation - Method of substitution - Differentiation of parametric functions -Differentiation of implicit functions - Higher order derivatives. Integrals of functions containing linear functions -Method of integration (Decomposition method, method of substitution, integration by parts) - Definite integrals. Simple definite integrals - Properties of Definite integrals - Reduction formulae - Area and volume - Length of curve - surface area of a solid. **C Programming:** Features of C and its basic Structure - Keywords - constants - variables - operators - Data types - Formatted input and output statements - Control and Looping statement - Arrays - Functions - Strings - writing simple C programs.		**CO3**

UNIT – IV	**Literary Activities**	**Periods:12**
Team building activities - Quiz - Oral Exercises - Group discussion, Debate, Extempore, Role play, சிறப்பு ச ொற்சொழிவு - தமிழர் மரபு மற்றும் தமிழர் சதொழில்நுட்பம்.		**CO4**

UNIT – V	**Creative Arts**	**Periods:12**
Introduction to painting and renowned artworks -Documentary and Short films - Music -Vocal, Instrumental - Dance - Classical, Cinematic - Mimicry - Mime.		**CO5**

Lecture Periods: 60	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 60**

Dr. P. Jamuna

Reference Books

1. R.R Gaur, R. Asthana, G.P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, 2nd Revised Edition, 2019.
2. R. Kumar Mohan, "English Grammar for all (Functional and Applied Grammar)", Unicare Academy, 2022.
3. Seely, John, "Oxford A-Z of Grammar and Punctuation", Oxford Publication, 2013.
4. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw – Hill, New Delhi, 6th Edition, 2018.
5. Dr. A. Singaravelu, "Engineering Mathematics - I", Meenakshi Publications, 2019.
6. E. Balagurusamy, "Programming in ANSI C", McGraw Hill, 8th Edition, 2019.
7. Dr.K. K. Pillay, "Social Life of Tamils", A Joint Publication of TNTB and ESC and RMRL.
8. R. Balakrishnan, "Journey of Civilization", Roja muthiah Research Publishers, 1st Edition 2019.
9. கே. கே. பிள்ளை, "தமிழே வரலொறு - மக்ேஞும் ண்ாெொடும்", ச ன்ளை: உலேத் தமிழொரொய்ச்சி நிறுவைம், 2002.
10. முளைவர் இல. சுந்தரம், "ேணினித்தமிழ்", விேடன் பிரசுரம்.
11. கீழடி - ளவளே நதிக்ேளரயில் ங்ே ேெொல நேர நொேரிேம், தமிழே சதொல்லியல் துளற

Web References

1. http://www.newsociety.com/Books/S/Slow-isBeautiful
2. https://www.aplustopper.com/formal-letter/
3. https://www.javatpoint.com/c-programming-language-tutorial
4. http://www.math.cum.edu/~wn0g/2ch6a.pdf
5. https://education.nsw.gov.au/teaching-and-learning/curriculum/creative-arts

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	2	1	-	1	2	-	1	1	-	-
2	1	-	-	-	-	2	1	-	1	3	-	1	1	-	-
3	1	-	-	-	-	2	1	-	1	1	-	1	1	-	-
4	1	-	-	-	-	2	1	-	3	3	-	1	1	-	-
5	1	-	-	-	-	2	1	-	3	1	-	1	1	-	-

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Dr. P. Tamuna

Department	**Mathematics**			Programme: **B. Tech.**			
Semester	**II**			Course Category: **BS**		End Semester Exam Type: **TE**	
Course Code	**U23MATC02**	Periods/Week			Credit	Maximum Marks	
		L	T	P	C	CAM	ESE	TM
Course Name	**ENGINEERING MATHEMATICS – II**	**3**	**1**	**0**	**4**	**25**	**75**	**100**

(Common to ALL Branches Except CSBS, FT)

Prerequisite	**Basic Mathematics**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Convert a periodic function into series form.	**K2**
	CO2 Compute Fourier transforms of various functions.	**K3**
	CO3 Solve Differential Equations using Laplace transforms.	**K3**
	CO4 Apply inverse Laplace transform of simple functions.	**K3**
	CO5 Solve difference equations using Z - transforms.	**K3**

UNIT – I	**Fourier Series**	**Periods:12**
Dirichlet's conditions - General Fourier series - Odd and Even functions - Half-Range sine series and cosine series - Change of intervals - Parseval's Identity.		**CO1**

UNIT – II	**Fourier Transforms**	**Periods:12**
Fourier Transforms and its inverse – Properties of Fourier Transform (without proof) – Fourier sine and cosine Transforms and their properties (excluding proof).		**CO2**

UNIT – III	**Laplace Transforms**	**Periods:12**
Laplace transforms of elementary functions and Periodic functions - Basic properties (excluding proof) - Laplace transforms of derivatives and integrals - Initial and final value theorems.		**CO3**

UNIT – IV	**Inverse Laplace Transforms**	**Periods:12**
Definition of inverse Laplace Transforms - Convolution theorem (excluding proof) - Solutions of Linear Ordinary Differential Equations of second order with constant coefficients.		**CO4**

UNIT – V	**Z – Transforms**	**Periods:12**
Z-transforms - Elementary Properties - Inverse Z-transforms (using partial fraction and Residues) - Solution of difference equations using Z - transform.		**CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. T. Veerarajan, "Engineering Mathematics", Tata McGraw Hill, New Delhi, 3rd Edition, 2011.
2. C. P. Gupta, Shree Ram Singh. M. Kumar, "Engineering Mathematics for semester I & II", Tata McGraw Hill, New Delhi, 2nd Edition, 2016.
3. H.K. Dass, "Advanced Engineering Mathematics", S. Chand, New Delhi, 22nd Edition, 2019.

Reference Books

1. N.P. Bali and Dr. Manish Goyal, "A Textbook of Engineering Mathematics", University Science Press, India, 8th Edition, 2016.
2. P. Sivaramakrishna Das and C. Vijayakumari, "Engineering Mathematics", Pearson India Education services Pvt. Ltd, India, 1st Edition, 2017.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New Delhi, 10th Edition, 2019.
4. G. Balaji, "Engineering Mathematics - Transforms and Partial Differential Equations", G. Balaji Publishers, 18th Edition, 2022.
5. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 2017.

Dr. P. Jamuna

Web References

1. https://nptel.ac.in/courses/111105121/
2. https://nptel.ac.in/courses/111105035/
3. https://nptel.ac.in/courses/11110711
4. https://swayam.gov.in/nd1_noc20_ma17/preview
5. https://nptel.ac.in/courses/111/103/111103021/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	1	-	-	-	-	-	1	3	1	1
2	3	2	1	1	-	1	-	-	-	-	-	1	3	1	1
3	3	2	1	1	-	1	-	-	-	-	-	1	3	1	1
4	3	2	1	1	-	1	-	-	-	-	-	1	3	1	1
5	3	2	1	1	-	1	-	-	-	-	-	1	3	1	1

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Computer Science and Engineering**	Programme: **B. Tech.**						
Semester	**I / II**	Course Category: **ES**			End Semester Exam Type: **TE**			
Course Code	**U23CSTC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN C**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to ALL Branches)

Prerequisite	Nil	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Comprehend the basics of Computers.	**K2**
	CO2 Illustrate the concepts of control structures and looping.	**K2**
	CO3 Implement programs using arrays and functions.	**K3**
	CO4 Demonstrate programs using Structure and Pointers.	**K3**
	CO5 Build the programs using Union and File management Operations.	**K3**

UNIT – I	**Introduction**	**Periods:09**
Generation and Classification of Computers - Block Diagram of a Computer -Categories of Software – Network Structure - Number System – Binary – Decimal – Conversion – Algorithm – Pseudo code – Flow Chart		**CO1**
UNIT – II	**C Programming Basics**	**Periods:09**
Introduction to 'C' Programming – Basic structure of a 'C' program – compilation and linking processes – Constants, Variables - Data Types - Expressions using operators in 'C' - Managing Input and Output operations - Decision Making and Branching – Looping statements.		**CO2**
UNIT – III	**Arrays and Functions**	**Periods:09**
Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching - matrix operations- Function – definition of function – Declaration of function - Pass by value – Pass by reference – Recursion		**CO3**
UNIT – IV	**Structure and Pointers**	**Periods:09**
Structure Introduction - Structure definition – Structure declaration - Structure within a structure -Self Referential Structure. Pointers - Definition - Initialization - Pointers arithmetic - Pointers and arrays -Pointer to Function -Pointer and Structure- Simple programs		**CO4**
UNIT – V	**Unions and Files**	**Periods:09**
Union Introduction - Programs Using Structures and Unions – Introduction to File - File Operations - File Input and Output Functions - Random Access to Files - File System Functions - Command Line Arguments- Storage Classes - Pre-Processor Directives- Dynamic Memory Functions.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. E. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, 8th Edition, 2019.
2. Yashvant Kanetkar, "Let us C", BPB Publications, 16th Edition, 2017.
3. Herbert Schildt, "C: The Complete Reference", McGraw Hill, 4th Edition, 2014.

Reference Books

1. Vikas B. Agarwal, Jyoti P. Mirani, "Computer Fundamentals", Nirali Prakashan, 2019.
2. Ashok N Kamthane, "Computer Programming", Pearson Education, 2nd Edition, 2012.
3. Vikas Verma, "A Workbook on C", Cengage Learning, 2nd Edition, 2012.
4. P. Visu, R.Srinivasan, S.Koteeswaran, "Fundamentals of Computing and Programming", Sri Krishna Publications, 4th Edition, 2012.
5. Pradip Dev, Manas Ghoush, "Programming in C", Oxford University Press, 2nd Edition, 2011.

Web References

1. https://www.programiz.com/c-programming
2. https://www.geeksforgeeks.org/c-language-set-1-introduction/
3. https://www.tutorialspoint.com/cprogramming
4. https://www.assignment2do.wordpress.com/.../solution-programming-in-ansi-c
5. https://nptel.ac.in/courses/106/104/106104128/

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	1	2	2
2	2	1	-	-	3	-	-	-	-	-	-	-	1	2	2
3	3	2	1	1	3	-	-	-	-	-	-	-	1	2	2
4	3	2	1	1	3	-	-	-	-	-	-	-	1	2	2
5	3	2	1	1	3	-	-	-	-	-	-	-	1	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Civil / Mechanical**	Programme: **B. Tech.**						
Semester	**I / II**	Course Category: **ES**			End Semester Exam Type: **TE**			
Course Code	**U23ESTC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**BASICS OF CIVIL AND MECHANICAL ENGINEERING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to EEE, ECE, ICE, MECH, Civil, Mechatronics Branches)

Prerequisite	**Basic Science**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Understand the types of buildings and materials.	**K2**
	CO2 Summarize on the various components of buildings and surveying concepts	**K2**
	CO3 Identify the various infrastructure facilities	**K2**
	CO4 Familiarize the working principles of IC engines and automobile systems	**K2**
	CO5 Understand about the power generation systems and its components	**K2**
	CO6 Acquire knowledge about the various machining process.	**K2**

SECTION A - CIVIL ENGINEERING

UNIT – I	**Buildings and Buildings Materials**	**Periods:08**
Buildings – Definition – Classification according to NBC-plinth area, Floor area, carpet area, floor space index - Development of Smart cities - Green building, Benefits from green building. Building Materials - stone, brick, cement, cement mortar, concrete, steel, Timber - their properties and uses		**CO1**
UNIT – II	**Buildings Components and Surveying**	**Periods:08**
Various Buildings Components and their functions. Foundation: function and types - Brick masonry, Stone Masonry and its types - Floors, Roofs and its types. **Surveying:** Objects - Classification - Principles - Measurements of Distances and areas – Leveling		**CO2**
UNIT – III	**Basic Infrastructure**	**Periods:07**
Roads and Bridges – types, components advantage and disadvantages. Railways - Permanent way and its elements. Sources of Water - Quality of Water – Domestic sewage Treatment - Rain Water harvesting - Dams - site selection for dam construction, types of dams.		**CO3**

SECTION B – MECHANICAL ENGINEERING

UNIT – IV	**Internal and External Combustion Systems**	**Periods:08**
IC engines - Classification - Working principles - Diesel and Petrol Engines: Two stroke and four stroke engines - merits and demerits. Steam generators (Boilers) - Classification - Constructional features (of only low-pressure boilers) - Boiler mountings and accessories - Merits and demerits - Applications.		**CO4**
UNIT – V	**Power Generation Systems, Refrigeration and Air Conditioning System**	**Periods:07**
Power plants: Thermal – Nuclear, Hydraulic, Solar, Wind, Geothermal, Wave, Tidal and Ocean Thermal Energy Conversion systems - Functions, Applications - Schemes and layouts (Description only) **Refrigeration and Air Conditioning System:** Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system - Layout of typical domestic refrigerator - Window and Split type room Air conditioner.		**CO5**
UNIT – VI	**Manufacturing Process**	**Periods:07**
Lathe - types, Specifications, Operations of a centre lathe. Casting - Pattern making, Allowances, Green sand and dry sand moulding, casting defects. Welding - Arc and Gas welding process, brazing and soldering (process description only).		**CO6**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. G. Shanmugam, M.S. Palanichamy, "Basic Civil and Mechanical Engineering", McGraw Hill Education, 1st Edition, 2018.
2. S.C. Sharma, M.P Poonia, "Basic Mechanical Engineering", Khanna Books Publication, 2019.
3. Dr. S. Jayakumar, "Basic Civil Engineering", Aagash Nekaa Publications, 2011

Dr. P. Jamuna

Reference Books

1. Sen Mohan, "Basic Mechanical Engineering", Khanna Books Publication, 2019
2. S. S. Bhavikatti, "Basic Civil Engineering", New Age International Ltd., 2018.
3. V. Rameshbabu, "Basic Civil & Mechanical Engineering", VRB Publishers Private Limited, 2017.
4. Serope Kalpakjian, Steven Schmid, "Manufacturing Engineering and Technology", Pearson Publication, 7th Edition, 2014.
5. Gopi Satheesh, "Basic Civil Engineering", Pearson Publications, 3rd Edition, 2015.

Web References

1. https://nptel.ac.in/courses/112107291/
2. https://nptel.ac.in/courses/112/103/112103262/
3. https://ocw.mit.edu/courses/mechanical-engineering/2-61-internal-combustion-engines-spring-2017/ lecture-notes/
4. https://nptel.ac.in/courses/105102088/
5. https://nptel.ac.in/courses/105104101/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	-	1	2	-	1
2	3	1	1	-	1	-	-	-	-	-	-	1	2	-	1
3	3	1	1	-	1	-	-	-	-	-	-	1	2	-	1
4	3	1	-	-	-	-	-	-	-	-	-	1	2	3	1
5	3	1	-	-	-	-	-	-	-	-	-	1	2	3	1
6	3	1	-	-	-	-	-	-	-	-	-	1	2	2	1

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**II**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23EET203**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRONICS II**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								

Prerequisite	**Electronics I**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Gain knowledge about small signal and large signal amplifier circuits for audio and radio frequency applications.	**K4**
	CO2 Comprehend the operation of tuned amplifiers in frequency selective circuits and analyze time base circuits for oscillator applications.	**K2**
	CO3 Analyze the performance of oscillators and feedback amplifiers for signal generation and processing.	**K4**
	CO4 Develop the ability to use flip-flops in counters and shift registers to build complex digital circuits.	**K3**
	CO5 Apply state reduction techniques to simplify and design synchronous and asynchronous sequential circuits.	**K3**

UNIT – I	**Small Signal and Large Signal Amplifiers**	**Periods:09**
Small Signal Amplifiers: Transistor hybrid model and H-parameters - Graphical determination of h-parameters - Analysis and comparison of CB, CE and CC amplifier using h-parameter model - CE amplifier with unbiased emitter resistance - Transistor Re model. **Large Signal Amplifiers:** High frequency transistor model - Class A amplifier - Direct coupled and transformer coupled - Class B amplifier - Push-pull arrangement and complementary symmetry amplifier - Conversion efficiency calculations - Distortion in Power amplifier - Class AB amplifier - Class C amplifier.		**CO1**

UNIT – II	**Multistage Amplifiers and Time Base Circuits**	**Periods:09**
Multistage Amplifiers: Cascade amplifier - Direct and RC coupled two stage CE amplifiers - Darlington pair - Cascode amplifier. **Tuned amplifier:** Single tuned - Double tuned - Stagger tuned amplifiers. **Time Base Circuits:** UJT sweep circuits - Voltage and current saw tooth sweeps - Fixed amplitude sweep - Miller and bootstrap time base. Schmitt trigger and multi-vibrators circuits using BJT - Multivibrators using negative resistance devices (UJT and Tunnel diodes).		**CO2**

UNIT – III	**Feedback Amplifiers and Oscillators**	**Periods:09**
Feedback Amplifiers: Feedback concept - Gain with feedback - General characteristics of negative feedback amplifiers - Four basic types of feedback and the effect on gain, input and output resistances. **Oscillators:** Conditions for sustained oscillations – Barkhausen criterion. Tuned oscillators: Hartley, Colpitt, Armstrong and Crystal Oscillators. RC Oscillators: Phase shift and Wien-bridge. UJT relaxation oscillator – Frequency stability.		**CO3**

UNIT – IV	**Counters and Shift Registers**	**Periods:09**
Flip flops: SR, D, JK, T and Master Slave – Edge and level triggered. **Counters:** Design of Synchronous counters – Design Asynchronous counter – UP/Down counter – Decade counter – Modulo - n counter – Ring counter – Johnson counter – BCD counters. **Registers**: Registers – Shift register – Types – Parallel/serial converter – Bi directional shift registers.		**CO4**

UNIT – V	**Design of Sequential Circuits**	**Periods:09**
Synchronous sequential circuits: Model Selection - State transition diagram - State synthesis table - Design equations and circuit diagram - State reduction technique. **Asynchronous sequential circuits:** Design and analysis of asynchronous sequential circuits - State transition diagram, Primitive table, State reduction, state assignment and design equations - Transition stability - Flow stability - race conditions, hazards and errors in digital circuits.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. J. B. Gupta, “Electronic Devices and Circuits”, S.K. Kataria and Sons, 6th Edition Reprint 2022.
2. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit theory”, Pearson Education, 9th Edition, 2007.
3. Floyd and Jain, “Digital Fundamentals”, Pearson Education, 11th Edition, 2015.

Dr. P. Jamuna

Reference Books

1. Dr. R. S. Sedha, “A textbook of Applied Electronics”, S. Chand Publications, Multicolor Edition, 2019.
2. David A. Bell, “Electronic devices and circuits”, Oxford University higher education, 5th Edition, 2008.
3. G.S. Tomar, Ashish Bagwari, “Fundamentals of Electronic Devices and Circuits”, Springer Nature, 2019.
4. A. Anand Kumar, “Fundamentals of Digital Circuits”, PHI Learning Pvt. Ltd, 4th Edition, 2022.
5. Morris. M. Mano and Michael. D. Ciletti, “Digital Design”, Pearson Education, 5th Edition, 2013.

Web References

1. https://www.allaboutcircuits.com/textbook/semiconductors/chpt-4/the-h-parameter-model/
2. https://nptel.ac.in/courses/108102097
3. https://nptel.ac.in/courses/108106188
4. https://nptel.ac.in/courses/108105158
5. https://archive.nptel.ac.in/courses/106/105/106105185/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
2	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
3	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
4	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
5	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**II**	Course Category: **HS**			End Semester Exam Type: **TE**			
Course Code	**U23HSTC01**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**UNIVERSAL HUMAN VALUES - II**	**2**	**0**	**0**	**2**	**25**	**75**	**100**
(Common to all Branch)								
Prerequisite	**UHV - I**							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Evaluate the significance of value inputs in formal education and start applying them in their life and profession	**K2**
	CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	**K2**
	CO3	Analyze the value of harmonious relationship based on trust and respect in their life and profession	**K2**
	CO4	Examine the role of a human being in ensuring harmony in society and nature.	**K2**
	CO5	Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.	**K2**

UNIT - I	**Introduction to Value Education**	**Periods: 06**
Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) - Understanding Value Education - Self-exploration as the Process for Value Education - Basic Human Aspirations - Happiness and Prosperity - Current Scenario- Method to Fulfil the Basic Human Aspirations.		**CO1**
UNIT - II	**Harmony in the Human Being**	**Periods: 06**
Understanding Human being as the Co-existence of the Self and the Body-Distinguishing between the Needs of the Self and the Body-The Body as an Instrument of the Self-Understanding Harmony in the Self-Harmony of the Self with the Body-Programme to ensure self-regulation and Health.		**CO2**
UNIT - III	**Harmony in the Family and Society**	**Periods: 06**
Harmony in the Family - Basic Unit of Human Interaction- 'Trust' - Foundational Value in Relationship - 'Respect' - as the Right Evaluation - Other Feelings, Justice in Human-to-Human Relationship - Understanding Harmony in the Society-Vision for the Universal Human Order.		**CO3**
UNIT - IV	**Harmony in the Nature / Existence**	**Periods: 06**
Understanding Harmony in the Nature-Interconnectedness, Self-regulation and Mutual Fulfilment among the Four Orders of Nature - Realizing Existence as Co-existence at All Levels - Holistic Perception of Harmony in Existence.		**CO4**
UNIT - V	**Implications of the Holistic Understanding - A Look at Professional Ethics**	**Periods: 06**
Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Universal Human Order-Competence in Professional Ethics-Holistic Technologies, Production Systems and Management Models-Typical Case Studies-Strategies for Transition towards Value - Based Life and Profession		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Text Book

1. R. R. Gaur, R. Asthana, G. P. Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books, 2nd Revised Edition, New Delhi, 2019.

Reference Books

1. A Nagraj, Jeevan Vidya Prakashan, Amarkantak, "Jeevan Vidya: EkParichaya", 2013.
2. A.N. Tripathi, "Human Values", New Age International Publishers, New Delhi, 3rd Edition, 2019.
3. Annie Leonard, "The Story of Stuff", Free Press, Reprint Edition, 2011.
4. Mohandas Karam chand Gandhi, "The Story of My Experiments with Truth – Mahatma Gandhi Autobiography", Finger print Publisher, 2009.
5. E. F Schumacher, "Small is Beautiful", Vintage Publisher, 1993.
6. Cecile Andrews, "Slow is Beautiful", New Society Publishers, 2006.
7. J. C. Kumarappa, "Economy of Permanence", Sarva Seva Sangh Prakashan, 2017.

Dr. P. Jamuna

8. Pandit Sunderlal, “Bharat Mein Angreji Raj”, Prabhat Prakashan Publisher, 2021.
9. Dharampal, “Rediscovering India”, Stosius Inc/Advent Books Division Publisher, 1983.
10. Mohandas K. Gandhi, “Hind Swaraj or Indian Home Rule”, Gyan Publishing House, 2023.
11. Maulana Abdul Kalam Azad, “India Wins Freedom”, Orient Black Swan Publisher, 1st Edition, 1988.
12. Life of Vivekananda, **“**Romain Rolland (English)”, Advaita Ashrama Publisher, India, 4th Edition, 2010.
13. Mahatma Gandhi, “Romain Rolland (English)”, Srishti Publishers & Distributors, 2020.

Web References

1. https://www.uhv.org.in/uhv-ii
2. http://www.storyofstuff.com
3. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
4. https://fdp-si.aicte-india.org/8dayUHV_download.php
5. https://www.youtube.com/watch?v=8ovkLRYXIjE

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	2	3	2	2	-	-	3	1	-	-
2	-	-	-	-	-	2	3	2	2	-	-	3	1	-	-
3	-	-	-	-	-	3	3	2	2	-	-	3	1	-	-
4	-	-	-	-	-	2	3	2	2	-	-	3	1	-	-
5	-	-	-	-	-	2	3	2	2	-	-	3	1	-	-

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**English**	Programme: **B. Tech.**						
Semester	**II**	Course Category: **CC**			End Semester Exam Type: **TE**			
Course Code	**U23ENBC02**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**COMMUNICATIVE ENGLISH - II**	**2**	**0**	**2**	**3**	**50**	**50**	**100**

(Common to all Branch except CSBS)

Prerequisite	**Basics of English Language, Communicative English - I**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Draft effective written communication in professional environment	**K2**
	CO2 Apply the mechanics of creative writing with precision and clarity	**K3**
	CO3 Acquire language skills professionally to groom the overall personality through sensitizing various etiquettes in real time situation	**K2**
	CO4 Develop language fluency and gain self-confidence	**K3**
	CO5 Express thoughts and ideas with clarity and focus	**K2**

UNIT – I	**Business Correspondence**	**Periods: 10**	
Business Writing: Circular, Agenda, Memoranda, Notice, Instruction, Minutes, Email Writing, Report Writing- Official and Demi Official Letters: Applying for Educational / Car / Home Loans / Joining Report, Leave Letter, Industrial Visit, In plant Training, Letter to the Editor, Calling for a quotation, Placing Order, Letter of Complaints, Letter seeking Clarification, Resume', Job Application Letter, Bio-data, CV			**CO1**

UNIT – II	**Functional Writing Skills**	**Periods: 10**	
Four Modes of Writing, Sentence Structure, Art of condensation: Summary Writing and Note Making, Use of phrase and clause in sentence, Principles of paragraph writing, Techniques of Essay Writing, Jumbled Sentence, Paraphrasing			**CO2**

UNIT – III	**Etiquettes**	**Periods: 10**	
Etiquette: Meaning, Kinds: Corporate Etiquette, Meeting Etiquette, Telephone Etiquette, Email Etiquette, Social Media Etiquette, Dining Etiquette, Communication Etiquette			**CO3**

UNIT – IV	**Communication Practice – II**	**Periods: 15**	
List of Exercises **Listening:** Letter writing tips **Speaking:** Just a Minute, Impromptu Speech, Contemporary Issues **Reading:** Variety of examples for Modes of Writing **Writing:** Different types of letters			**CO4**

UNIT – V	**Interpersonal Communication – II**	**Periods: 15**	
List of Exercises **Listening:** Videos on different types of Etiquettes **Speaking:** Team Presentation, Negotiation Skills **Reading:** Phrases and Clauses **Writing:** Free writing on any given topic, Paraphrasing Practice			**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 60**

Text Book

1. PC Das, "Letter Writing including Official and Business Letters", New Central Book Agency, 2020.
2. Kumar, Sanjay, Pushpalatha, "Communication Skills", Oxford University Press, 2018.
3. Raman, Meenakshi and Sangeetha Sharma, "Communication Skills", Oxford University Press, 1st Edition, 2019.

Reference Books

1. Sahukar, Nimeran, Bhalla, Prem, "The book of Etiquettes and Manners", Pustak Mahal Publisher, 1st Edition, 2009.
2. Gerson Sharon J, Steven M. Gerson, "Technical Writing Process and Product", Pearson Education Pvt. Ltd. 3rd Edition, 2009.
3. Grussendorf, Marion, "English for Presentations". Oxford University Press, 2007.
4. Seely John, "The Oxford Guide to Writing and Speaking", Oxford University Press, 2006.
5. R.C. Sharma, Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw Hill &Co. Ltd., 2001.

Dr. P. Jamuna

Web References

1. https://www.indeed.com/career-advice/finding-a-job/how-to-write-an-application-letter
2. https://owlcation.com/humanities/Four-Types-of-Writing
3. https://targetstudy.com/languages/english/paragraph-writing.html
4. https://www.businessnewsdaily.com/8262-email-etiquette-tips.html
5. https://www.youtube.com/watch?v=UOceysteIjo

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	-

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Theory						
Assessment	Continuous Assessment Marks (CAM)				End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Attendance		
Marks	5	5	5	5	75	60
	20 (to be weighted for 10 marks)				(To be weighted for 50 marks)	

Practical				
Continuous Assessment Internal Evaluation		End Semester Internal Evaluation		Total Marks
30 (to be weighted for 10 marks)		30 marks		40
Listening (L)*	10	Listening (L)*	10	
Speaking(S)	5	Speaking(S)	5	
Reading(R)*	10	Reading(R)*	10	
Writing(W)*	5	Writing(W)*	5	

***LRW components of Practical can be evaluated through Language Lab Software**

Dr. P. Jamuna

Department	**Mechanical**	Programme: **B. Tech.**						
Semester	**I / II**	Course Category: **ES**			End Semester Exam Type: **LE**			
Course Code	**U23ESPC03**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ENGINEERING GRAPHICS USING AUTOCAD**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to all Branches)

Prerequisite	**Nil**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Familiarize with the fundamentals and standards of engineering graphics.	**K3**
	CO2 Perform drawing of basic geometrical constructions and multiple views of objects.	**K2**
	CO3 Visualize the isometric and perspective sections of simple solids.	**K3**
	CO4 Connect side view associate on front view.	**K4**
	CO5 Correlate sectional views and lateral surface developments of various solids.	**K4**

List of Experiments:

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing a Title Block with necessary text and projection symbol.
3. Drawing 2D sketch by applying modify tools like fillet, mirror, array, etc.,
4. Drawing front view and top view of simple solids like prism, pyramid, cylinder, cone, etc., and Dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. Simple stool, V-block, Mixie Base).
6. Drawing a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
8. Drawing lateral surface development of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creating 3D model of simple object and obtaining 2D multi-view drawings.

Note: Plotting of drawings must be made for each exercise and attached to the records written by Students.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. James D. Bethune, “Engineering Graphics with AutoCAD - A Spectrum book”, Macromedia Press, Pearson, 1st Edition, 2020.
2. NS Parthasarathy and Vela Murali, “Engineering Drawing”, Oxford university press, 2015.
3. M.B Shah, “Engineering Graphics”, ITL Education Solutions Limited, Pearson Education Publication, 2011.
4. N.D. Bhatt and V.M. Panchal, “Engineering Drawing: Plane and Solid Geometry”, Charotar Publishing House, 2017.
5. T. Jeyapoovan, “Engineering Drawing and Graphics Using AutoCAD”, Vikas Publishing House Pvt. Ltd., 7th Edition, 2016.
6. C M Agrawal, Basant Agrawal, “Engineering Graphics”, McGraw Hill, 2017.
7. Dhananjay A. Jolhe, “Engineering Drawing: With an Introduction To CAD”, McGraw Hill, 1st Edition, 2016.
8. James Leach, “AutoCAD 2017 Instructor”, SDC Publications, 2016.

Web References

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/egraphics_lab/labs/index.php
2. http://www.nptelvideos.in/2012/12/computer-aided-design.html
3. https://mech.iitm.ac.in/meiitm/course/cad-in-manufacturing/
4. https://autocadtutorials.com
5. https://dwgmodels.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	-	-	3	-	-	-	3	-	-	2	1	1	1
2	3	1	-	-	3	-	-	-	3	-	-	3	1	1	1
3	3	1	-	-	3	-	-	-	3	-	-	3	1	1	1
4	3	1	-	-	3	-	-	-	3	-	-	3	1	1	1
5	3	1	-	-	3	-	-	-	3	-	-	3	1	1	1

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Computer Science and Engineering**	Programme: **B. Tech.**						
Semester	**I / II**	Course Category: **ES**			End Semester Exam Type: **LE**			
Course Code	**U23CSPC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN C LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
(Common to all Branches)								
Prerequisite	**Nil**							

Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Implement logical formulations to solve simple problems leading to specific applications.	**K3**
	CO2	Execute C programs for simple applications making use of basic constructs, arrays and strings.	**K3**
	CO3	Experiment C programs involving functions, recursion, pointers, and structures.	**K3**
	CO4	Demonstrate applications using sequential and random-access file processing.	**K3**
	CO5	Build solutions for online coding challenges.	**K3**

List of Experiments:

1. Write a C program to find the Area of the triangle.
2. Develop a C program to read a three-digit number and produce output like
   1 hundreds
   7 tens
   2 units
   For an input of 172.
3. Write a C program to check whether a given character is vowel or not using Switch – Case statement.
4. Write a C program to print the numbers from 1 to 10 along with their squares.
5. Demonstrate do–While loop in C to find the sum of 'n' numbers.
6. Find the factorial of a given number using Functions in C.
7. Write a C program to check whether a given string is palindrome or not?
8. Write a C program to check whether a value is prime or not?
9. Develop a C program to swap two numbers using call by value and call by reference.
10. Construct a C program to find the smallest and largest element in an array.
11. Implement matrix multiplication using C program.
12. Write a C program to perform various string handling functions like strlen, strcpy, strcat, strcmp.
13. Develop a C program to remove all characters in a string except alphabets.
14. Write a C program to find the sum of an integer array using pointers.
15. Write a C program to find the Maximum element in an integer array using pointers.
16. Construct a C program to display Employee details using Structures
17. Write a C program to display the contents of a file on the monitor screen.
18. Write a File by getting the input from the keyboard and retrieve the contents of the file using file operation commands.
19. Write a C program to create two files with a set of values. Merge the two file contents to form a single file
20. Write a C program to pass the parameter using command line arguments.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Zed A Shaw, "Learn C the Hard Way: Practical Exercises on the Computational Subjects You Keep Avoiding (Like C)", Addison Wesley, 2016.
2. Anita Goel and Ajay Mittal, "Computer Fundamentals and programming in C", Pearson Education, 1st Edition, 2011.
3. Maureen Sprankle, Jim Hubbard, "Problem Solving and Programming Concepts", Pearson, 9th Edition, 2011.
4. Yashwanth Kanethkar, "Let us C", BPB Publications, 13th Edition, 2008.
5. B. W. Kernighan and D.M. Ritchie, "The C Programming Language", Pearson Education, 2nd Edition, 2006.

Web References

1. https://alison.com/course/introduction-to-c-programming
2. https://www.geeksforgeeks.org/c-programming-language/
3. http://cad-lab.github.io/cadlab_data/files/1993_prog_in_c.pdf
4. https://www.tenouk.com/clabworksheet/clabworksheet.html
5. https://fresh2refresh.com/c-programming/

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	1	-	1
2	2	1	-	-	3	-	-	-	-	-	-	-	1	-	1
3	3	2	1	1	3	-	-	-	-	-	-	-	1	-	1
4	3	2	1	1	3	-	-	-	-	-	-	-	1	-	1
5	3	2	1	1	3	-	-	-	-	-	-	-	1	-	1

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**II**	Course Category: **PC**			End Semester Exam Type: **LE**			
Course Code	**U23EEP203**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRONICS II LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
EEE								

Prerequisite	**Electronics I Laboratory**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Analyze frequency response of the transistor amplifiers and the concept of bandwidth.	**K4**
	CO2 Design and implement multivibrator circuits for PWM and clock generation.	**K3**
	CO3 Implement oscillator circuits for signal generation and sweep circuits for testing electronic components.	**K3**
	CO4 Develop proficiency in utilizing flip flops for effective design and implementation of sequential logic circuits for various digital applications.	**K4**
	CO5 Acquire the skills to construct shift registers for efficient storage and shifting of datas in digital circuits.	**K4**

List of Experiments:

1. Design and analysis of frequency response characteristics of common emitter BJT amplifier.
2. Implementation of two stage RC coupled CE amplifier.
3. Design and implementation of Schmitt trigger.
4. Design and implementation of Astable Multivibrator.
5. Design and implementation of Monostable Multivibrator.
6. Implementation of a Sweep Circuit.
7. Design and implementation of RC phase shift oscillator.
8. Design and implementation of Wien bridge oscillator.
9. Implementation of SR, D, JK and T flip-flops using universal gates.
10. Design and implementation of 4-bit shift registers in SISO, SIPO, PISO and PIPO modes using ICs.
11. Design and implementation of synchronous Counters using ICs.
12. Design and implementation of Asynchronous Counters using ICs.
13. Implementation of Ring and Johnson counters using ICs.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Paul Scherz and Simon Monk, “Practical Electronics for Inventors”, Mc Graw Hill Education, 4th Edition, 2016.
2. Satya Sai Srikant, Prakash Kumar Chaturvedi, “Basic Electronics Engineering Including Laboratory Manual”, Springer Nature Singapore Pvt. Ltd., 2020.
3. L. K. Maheswari, M.M.S. Anand, “Laboratory Manual for Introductory Electronics Experiments”, New Age international (p) Limited, 1980.

Web References

1. http://vlabs.iitkgp.ernet.in/be/
2. https://be-iitkgp.vlabs.ac.in/
3. https://electricvlab.com/
4. https://www.circuitlab.com/editor/#?id=7pq5wm&from=homepage

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	3	3	2	3	2	-	-	-	-	-	-	-	2	2	2
2	3	3	2	3	2	-	-	-	-	-	-	-	2	2	2
3	3	3	2	3	2	-	-	-	-	-	-	-	2	2	2
4	3	3	2	3	2	-	-	-	-	-	-	-	2	2	2
5	3	3	2	3	2	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Dr. P. Jamuna

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**II**	Course Category: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23EEC2XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE – II**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
EEE								
Prerequisite	**-**							

Students shall choose an international certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass / Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	**10**	**90**	**100**

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**II**	Course Category: **MC**			End Semester Exam Type: **-**			
Course Code	**U23EEM202**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SPORTS YOGA AND NSS**	**0**	**0**	**2**	**Non-Credit**	**100**	**-**	**100**
Prerequisite	**-**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility and relaxation.	**K2**
	CO2 Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.	**K2**
	CO3 Develop understanding of psychological problems associated with age and lifestyle.	**K2**
	CO4 Recognize the importance of national service in community development.	**K2**
	CO5 Convert existing skills into socially relevant life skills.	**K2**

UNIT – I	**Introduction to Physical Education**	**Periods: 06**
Definition, Aims and Objectives of Physical Education - Changing trends in Physical Education **Physical Fitness, Wellness and Lifestyle:** Importance of Physical Fitness and Wellness - Components of Physical fitness - Components of Health-related fitness - Components of wellness - Preventing Health Threats through Lifestyle Change - Concept of Positive Lifestyle.		**CO1**
UNIT – II	**Yoga and Lifestyle**	**Periods: 06**
Importance of Yoga - Elements of Yoga - Introduction - Asanas, Pranayama, Meditation and Yogic Kriyas - Yoga for concentration and related Asanas (Sukhasana, Tadasana, Padmasana and Shashankasana) - Relaxation Techniques for improving concentration - Yog-nidra. Asanas as preventive measures - Hypertension - Obesity - Back Pain-Diabetes - Asthema.		**CO2**
UNIT – III	**Training and Planning in Sports**	**Periods: 06**
Training - Warming up and limbering down-Skill, Technique and Style - Objectives of Planning – Tournament - Knock-Out, League/Round Robin and Combination. **Psychology and Sports**: Important of Psychology in Physical Education and Sports - Differentiate Between Growth and Development - Adolescent problems and their Management - Emotion: Concept, Type and Controlling of emotions - Concepts and Types of Aggressions in Sports - Psychological benefits of exercise - Anxiety and Fear and its effects on Sports Performance - Motivation, its type and techniques - Understanding Stress and Coping strategies.		**CO3**
UNIT – IV	**Introduction to National Service Scheme**	**Periods: 06**
Orientation of NSS volunteers: History, motto, symbol, awards, structure and activities of NSS - Days of National and International Importance - Sensitizing about the thrust areas and awareness activities - Importance of tree plantation and voluntary blood donation - The role of SHGs and NGOs in community development – CSR - Life skills and youth development-extension activities in HEIs - various clubs and schemes like RRC, ELC, YRC, UBA, SBA, etc.,		**CO4**
UNIT – V	**Community Issues and the Use of Technology**	**Periods: 06**
Common Problems of rural India - Technology development and its suitability – Sustainability - Value addition to agricultural products - Service learning and youth volunteering – Shramdaan - Campus cleaning - Field visit to nearby communities - village survey - Initiatives to clean and green environment - preservation of water bodies in adopted villages.		**CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Brar Ajmer Singh, Gill Jagtar Singh, Bains Jagdish, “Modern Textbook of Physical Education Health and Sports- I”, Kalyani Publishers, 6th Edition, 2014.
2. B.K.S. Iyengar, “Light on Yoga: The Definitive Guide to Yoga Practice”, Thorsons Publishers, Thorsons Classics Edition, 2015.
3. Joseph, Siby K, Mahodaya, “Bharat Essays on Conflict Resolution”, Institute of Gandhian Studies Publishers, 2007.
4. Barman Prateeti, Goswami, “Document on Peace Education”, Triveni Akansha Publishing House, New Delhi, 2009.
5. Prof R.B.S. Verma, “Field Work Practicum in Social Work-Emerging Concerns”, Rapid Publisher, Lucknow, 2020.
6. Sibereisen, K, Richard M, “Lerner Approaches to Positive Youth Development”, Sage Publications, New Delhi, 2007.
7. Hoshiar Singh, “Administration of Rural Development in India”, Sterling Publisher, 2009.

Web References

1. http://www.thebetterindia.com/140/national-service-scheme-nss
2. http://en.wikipedia.org/wiki/national-service-scheme 19=http://nss.nic.in/adminstruct
3. http://nss.nic. in
4. http://socialworknss.org/about.html
5. http://you.sagepub.com

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	-	-	2	3	-	-	2	1	-	-
2	-	-	-	-	-	-	-	2	3	-	-	2	1	-	-
3	-	-	-	-	-	-	-	2	3	-	-	2	1	-	-
4	-	-	-	-	-	-	-	2	3	-	-	2	1	-	-
5	-	-	-	-	-	-	-	2	3	-	-	2	1	-	-

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **BS**			End Semester Exam Type: **TE**			
Course Code	**U23MATC03**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROBABILITY AND STATISTICS**	**3**	**1**	**0**	**4**	**25**	**75**	**100**

(Common to all Branches Except CSBS)

Prerequisite	**Basic Probability**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Apply the concept of probability	**K3**
	CO2 Solve the problem on Random variables	**K3**
	CO3 Evaluate the correlation and Regression	**K3**
	CO4 Find Correlation between variables	**K3**
	CO5 Analyze the problems in small samples	**K3**

UNIT – I	**Theory of Probability**	**Periods: 12**	
Random Experiments - Sample Space - Exhaustive events- Axioms of probability – Conditional probability – Total probability – Bayes theorem.			**CO1**
UNIT – II	**Random Variables**	**Periods: 12**	
Moments-Moment generating functions and their properties. Binomial distribution - Poisson distribution - Exponential distribution – Normal distribution (Excluding Derivation of Mean, Variance and MGF)			**CO2**
UNIT – III	**Design of Experiments**	**Periods: 12**	
Analysis of variance: One way and two-way classifications. Correlation – Rank correlation and Regression.			**CO3**
UNIT – IV	**Large Samples**	**Periods: 12**	
Large Samples: Single Propositions - Difference of Proportions – Single Mean - Difference of Mean - Difference of Standard Deviations			**CO4**
UNIT – V	**Small Samples**	**Periods: 12**	
Test for Mean - Test for Ratio of Variances - Chi-Square test for Goodness of Fit and Independence of Attributes.			**CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. B. S. Grewal, “Higher Engineering Mathematics”, Khanna publishers, 3rd Edition, 2017.
2. T. Veerarajan, “Probability, Statistics and Random Processes”, Tata McGraw-Hill, 3rd Edition, 2008.
3. A. Singaravelu, “Probability and Statistics”, Meenakshi Agency, 2019.

Reference Books

1. Ravish R. Singh, Mukul Bhatt, “Engineering Mathematics”, McGraw-Hill, 1st Edition, 2017.
2. William Mendenhall, Robert J. Beaver and Barbara M. Beaver, “Introduction to Probability & Statistics”, Cengage Learning, 15th Edition, 2019.
3. Richard. A. Johnson, Irwin Miller and John E. Freund, “Probability and Statistics for Engineers”, Pearson Education, 9th Edition, 2018.
4. Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh, “An Introduction to Probability and Statistics”, Wiley, 3rd Edition, 2008.

Web References

1. www.stat110.net
2. http://www.nptel.ac.in/courses/111105035 (R.V)
3. http:// www.probabilitycourse.com.
4. www.edx.org/Probability
5. http://www2.aueb.gr/users/demos/pro-stat.pdf

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	1	1	1	1
2	3	2	1	1	-	-	-	-	-	-	-	1	1	1	1
3	2	2	-	-	-	1	-	-	-	-	-	1	1	1	1
4	3	2	1	1	-	1	-	-	-	-	-	1	1	1	1
5	3	2	1	1	-	1	-	-	-	-	-	1	1	1	1

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Artificial Intelligence and Data Science**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **ES**			End Semester Exam Type: **TE**			
Course Code	**U23ADTC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN PYTHON**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
(Common to ALL Branches)								
Prerequisite	Nil							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret the basic concepts of Python programs.	**K2**
	CO2 Articulate the concepts of Sets, Dictionaries and Object-Oriented concepts.	**K2**
	CO3 Experiment with Numpy package.	**K3**
	CO4 Apply and analyze Data Manipulation with Pandas.	**K3**
	CO5 Illustrate programming concept for Visualization with Matplotlib.	**K3**

UNIT – I	**Introduction to Python**	**Periods:09**
Structure of Python Program - Underlying mechanism of Module Execution - Branching and Looping - Problem Solving Using Branches and Loops – Functions – Lambda Functions – Lists and Mutability – Problem Solving Using Lists and Functions.		**CO1**
UNIT – II	**Sequence Data types and Object-Oriented Programming**	**Periods:09**
Sequences - Mapping and Sets - Dictionaries. Classes: Classes and Instances - Inheritance - Exception Handling - Introduction to Regular Expressions using "re" module.		**CO2**
UNIT – III	**Using Numpy**	**Periods:09**
Basics of NumPy - Computation on NumPy - Aggregations - Computation on Arrays - Comparisons - Masks and Boolean Arrays - Fancy Indexing - Sorting Arrays - Structured Data: NumPy's Structured Array.		**CO3**
UNIT – IV	**Data Manipulation with Pandas**	**Periods:09**
Introduction to Pandas Objects - Data indexing and Selection - Operating on Data in Pandas - Handling Missing Data - Hierarchical Indexing - Combining Data Sets. Aggregation and Grouping - Pivot Tables - Vectorized String Operations - Working with Time Series - High Performance Pandas - eval() and query().		**CO4**
UNIT – V	**Visualization With Matplotlib**	**Periods:09**
Basic functions of Matplotlib - Simple Line Plot - Scatter Plot - Density and Contour Plots - Histograms - Binnings and Density - Customizing Plot Legends - Colour Bars - Three-Dimensional Plotting in Matplotlib.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Jake Vander Plas, "Python Data Science Handbook - Essential Tools for Working with Data", O'Reily Media Inc, 2016.
2. Y. Zhang, "An Introduction to Python and Computer Programming", Springer Publications, 2016.
3. Wesley J Chun, "Core Python Programming", Pearson Education, 2nd Edition, 2006.

Reference Books

1. John Paul Mueller, Luca Massaron, "Python for Data Science for Dummies", John Wiley & Sons, 2nd Edition, 2019.
2. Jesus Rogel-Salazar, "Data Science and Analytics with Python", CRC Press Taylor and Francis Group, 2017.
3. Brian Draper, "Python Programming A Complete Guide for Beginners to Master and Become an Expert in Python Programming Language", CreateSpace Independent Publishing Platform, 2016.
4. Mark Lutz, Laura Lewin, Frank Willison, "Programming Python", O'Reilly Media, 3rd Edition, 2006.
5. S. Gowrishankar, A. Veena, "Introduction to Python Programming", CRC Press, 2018.

Web References

1. https://nptel.ac.in/courses/106/106/106106212/
2. https://www.geeksforgeeks.org/data-analysis-visualization-python/
3. https://www.coursera.org/learn/python-data-analysis
4. https://www.python.org/
5. https://www.programiz.com/python-programming

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	-	-	3	-	-	-	-	-	-	-	3	-	3
2	2	2	1	3	-	-	-	-	-	-	-	2	2	2	3
3	3	2	2	3	-	-	-	-	-	-	-	2	3	2	3
4	3	3	2	3	-	-	-	-	-	-	-	3	3	3	3
5	3	3	2	3	-	-	-	-	-	-	-	2	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23EET304**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTROMAGNETIC THEORY**	**2**	**1**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	**Mathematics, Physical Science for Engineers, Electrical Engineering**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret the basic mathematical concepts related to electrostatic and electromagnetic fields.	**K2**
	CO2 Explain the basic concepts of electrical potential, electric dipole, energy density and their applications.	**K2**
	CO3 Predict the magnetic field for the analysis of electrical machines.	**K3**
	CO4 Illustrate the behaviour of magnetic fields at the interface of two different materials and their applications to electrical engineering	**K3**
	CO5 Gain knowledge about the relation between electric and magnetic fields with help of Maxwell's Equation and analyze Electromagnetic Wave propagation, Poynting Vector and Poynting Theorem.	**K2**

UNIT – I	**Electrostatic Field**	**Periods:09**
Review of Scalar and Vector Fields: Cartesian, Cylindrical and Spherical – Scalar and vector product. Del Operator: Divergence, Curl and Gradient -Divergence Theorem – Stoke's Theorem. Electrostatics: Coulomb's law -Electric field – Electric field intensity(E) due to point, line, surface and volume charge distribution - Electric flux density (D), Gauss's Law and its applications.		**CO1**
UNIT – II	**Electric Fields in Material Space**	**Periods:09**
Electric potential and potential gradient - Electric dipole and dipole moment - Nature of Dielectrics and Conductors - Polarization in dielectrics - Electric field in multiple dielectrics - Boundary conditions for electrostatic field - Poisson's and Laplace's Equations – Capacitance-Energy density. Applications: Electrostatic Precipitators, Xerography.		**CO2**
UNIT – III	**Magnetostatic Field - I**	**Periods:09**
Biot-Savart law - Magnetic field intensity (H) and magnetic flux density (B) - Ampere's Circuital Law, magnetic flux density in a finite and infinite conductor, solenoid and toroid - Magnetic dipole - Scalar and vector magnetic potential. Application: LF Magnetic shielding.		**CO3**
UNIT – IV	**Magnetostatic Field - II**	**Periods:09**
Boundary condition for magneto static fields - Magnetic field in matter and magnetic circuits. Lorentz Force – Force Between Two Parallel Current Carrying Conductors – potential energy and force on magnetic energy - Inductance of solenoid, toroid and transmission lines – Application of magnetic field in induction heating.		**CO4**
UNIT – V	**Electromagnetic and Wave Propagations**	**Periods:09**
Maxwell's equation: displacement current - continuity equation, Differential and integral forms. Wave parameters: velocity, intrinsic impedance, wavelength, propagation constant-Wave propagation in lossless media, good conductor and dielectrics. Flow of electromagnetic Power and Poynting vector: instantaneous and average power densities. Applications: Electromagnetic interference in high voltage transmission line		**CO5**

Lecture Periods: 30	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Mathew N. O. Sadiku & S. V. Kulkarni, "Principles of Electromagnetics", Oxford University Press Inc., 6th Edition, 2015.
2. Ashutosh Pramanik, "Electromagnetism Applications - Vol. 2: Magnetic Diffusion and Electromagnetic Waves", PHI Learning Private Limited, New Delhi, 2014.
3. William H. Hayt and John A. Buck, "Engineering Electromagnetics", Tata McGraw Hill, 9th Edition, 2018.

Reference Books

1. Joseph. A. Edminister, Schaum's, "Outline of Electromagnetics", (Schaum's Outline Series), Tata McGraw Hill, 4th Edition, 2014
2. Kraus and Fleish, "Electromagnetics with Applications", McGraw Hill International Editions, 5th Edition, 2010.
3. Bhag Singh Guru and Hüseyin R. Hiziroglu, "Electromagnetic field theory Fundamentals", Cambridge University Press, 2nd Revised Edition, 2009.

Dr. P. Jamuna

Web References

1. http://hyperphysics.phy-astr.gsu.edu/hbase/emcon.html#emcon
2. https://www.youtube.com/watch?v=9Tm2c6NJH4Y
3. https://www.youtube.com/watch?v=HcPDc23ZLEs
4. http://scienceworld.wolfram.com/physics/ElectromagneticForce.html
5. https://www.witpress.com/contents/c40637.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	-	1	-	-	-	-	1	3	2	2
2	3	3	3	2	1	-	1	-	-	-	-	1	3	2	2
3	3	3	3	2	1	-	1	-	-	-	-	1	3	3	3
4	3	3	3	2	1	-	1	-	-	-	-	1	3	3	3
5	3	3	3	2	1	-	1	-	-	-	-	1	2	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23EET305**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL MACHINES – I**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	**Physical Science for Engineers, Electrical Engineering**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the magnetic circuit calculations and principles of Electromechanical energy conversion	**K2**
	CO2 Predict the performance of DC machines under various operating conditions using their characteristics.	**K3**
	CO3 Interpret the efficiency of DC machines by conducting Suitable tests.	**K2**
	CO4 Illustrate the performance of transformers by equivalent circuits.	**K3**
	CO5 Summarize the efficiency of Transformers by conducting Suitable tests and analyze the characteristics of special transformers.	**K2**

UNIT – I	**Magnetic Circuits and Electromechanical Energy Conversion**	**Periods:09**
Basic magnetic circuit analysis - B-H Relationship - Magnetically induced emf and force - Faraday's law of electromagnetic induction - Hysteresis and Eddy current losses. Electromechanical energy conversion concept - Single and multiple excited systems.		**CO1**
UNIT – II	**DC Generators**	**Periods:09**
DC Generators: Construction of DC Machine - Principle of operation - Types of Windings - EMF equation - Armature Reaction – Commutation - methods of improving commutation – DC Generator types – magnetization and load characteristics - Losses - efficiency - Condition for maximum efficiency - Power stages - Applications.		**CO2**
UNIT – III	**DC Motors**	**Periods:09**
DC Motors: Principle of operation - Back emf - Torque equation – types - Performance characteristics. Starters: Need for starter – types – two, three, four-point starters. Speed control: Armature and field control. Electric braking - Power stages - Applications. **Testing of DC Machines:** Load test - Swinburne's test - Hopkinson's test - Retardation test.		**CO3**
UNIT – IV	**Single Phase Transformers**	**Periods:09**
Single Phase Transformers: Construction - Types – Principle of operation - EMF equation - Equivalent circuit - phasor diagram - Parallel operation - Losses - Efficiency - Condition for maximum efficiency - all day efficiency - voltage regulation. **Auto transformer:** Principle of operation - copper savings. Applications. **Testing:** Load test - OC and SC test - Sumpner's test.		**CO4**
UNIT – V	**Polyphase Transformers and Special Transformers**	**Periods:09**
Three Phase Transformers: Construction - Principle of operation - Types of connections - Open delta - Scott connection - three phases to two phase conversion - Tap changing transformers. **Testing:** Load test - OC and SC test. Applications. **Special Transformers:** Variable frequency transformer- audio frequency Transformer - Pulse transformer - Isolation transformer - Instrument Transformer.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. A. E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi, 7th Edition, 2017.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, New Delhi, 7th Edition, 2018.
3. B. L. Theraja and A. K. Theraja, "A Textbook of Electrical Technology-Vol. II", S. Chand & Co. Ltd., New Delhi, 23rd Multicolor Edition, 2016.

Reference Books

1. Stephen J. Chapman, "Electric Machinery Fundamentals", McGraw Hill Education Pvt. Ltd, 5th Edition, 2012.
2. D. P. Kothari and I.J. Nagrath, "Electric Machines", Tata McGraw Hill, New Delhi, 5th Edition, 2017.
3. Vincent Del Toro, "Basic Electric Machines", Pearson India Education, 1st Edition, 2016.
4. Irving. L. Kosow, "Electrical Machines and Transformers", PHI, 2nd Edition, 2007.
5. Albert E. Clayton, "The performance and design of direct current machines", Tata McGraw Hill Publishing Company Limited, New Delhi, 3rd Edition, 2004.

Dr. P. Jamuna

Web References

1. https://ndl.iitkgp.ac.in
2. https://nptel.ac.in/courses/108/105/108105017/
3. https://www.studocu.com/
4. http://electrical-engineering-portal.com/
5. http://www.electrical4u.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	1	-	-	-	-	-	1	3	3	3
2	3	3	2	2	2	1	-	-	-	-	-	1	3	3	3
3	3	3	2	2	2	1	-	-	-	-	-	1	3	3	3
4	3	3	2	2	2	1	-	-	-	-	-	1	3	3	3
5	3	3	2	2	2	1	-	-	-	-	-	1	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23EET306**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRONICS - III**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	**Electronics**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the IC fabrication process of devices and various logic families.	**K2**
	CO2 Apply OP AMP based circuits for applications like ADC, DAC etc.	**K3**
	CO3 Analyze filters and waveform generator circuits using OP AMP.	**K4**
	CO4 Categorize the regulators for various power supply circuits.	**K4**
	CO5 Illustrate multivibrator circuits using 555 timer and classify memory devices.	**K3**

UNIT – I	**IC Fabrication and Logic Families**	**Periods:09**
IC Fabrication Process: Basic Planar Process - Fabrication of Resistance - Diode - Capacitance - BJT- FET- HFET - CMOS technology. **Logic families:** DTL - HTL- RTL- TTL- I2L - ECL- NMOS - PMOS - CMOS - Performance criteria - Comparison – Applications – Advantages.		**CO1**
UNIT – II	**Operational Amplifiers and Applications**	**Periods:09**
OP-AMP LM741: Block Diagram - Equivalent circuit - AC and DC characteristics - Open and closed loop configuration - **Applications:** Inverting, Non-Inverting amplifier and Voltage Follower - Adder and Subtractor - Integrator, Differentiator and Multiplier - V to I and I to V converter - Comparator - Instrumentation Amplifier - A/D and D/A converter - Properties of practical op-amps (LM124, OP07, TL082).		**CO2**
UNIT – III	**Active Filters and Waveform Generator using OP AMP**	**Periods:09**
First and Second order Active filter - Low pass, high pass, wide band pass and band stop - **Waveform generator:** RC Phase shift and Wien bridge oscillators – Triangular and Saw tooth wave generator - Effect of Slew Rate on waveform generation – Schmitt trigger and Multivibrators.		**CO3**
UNIT – IV	**Analog IC Applications**	**Periods:09**
Series op-amp regulator - **Fixed voltage regulators:** LM78XX, LM79XX - **Adjustable voltage regulators:** LM317 - LM 723 - Dual tracking regulators - SMPS - V/F converter - F/V converter - INA121 Instrumentation Amplifier - Comparator IC LM311- ADC TLC0820 and DAC TLC7524 ICs.		**CO4**
UNIT – V	**555 Timer, Phase Locked Loop and Memories**	**Periods:09**
IC555 timer: Functional diagram – **Applications:** Multivibrators – Schmitt trigger. **PLL:** Functional diagram – Phase Comparator – Application of Motor speed control. Memory structure: RAM – ROM – PROM – EPROM – EEPROM. **Programmable Logic Devices:** Programmable Logic Array (PLA) - Programmable Array Logic (PAL).		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. D. Roy Choudhary, Sheil. B. Jani, "Linear Integrated Circuits", New Age Publication, 5th Edition, 2018.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", McGraw Hill, 1st Edition, 2018.
3. Robin Shannon, "Linear Integrated Circuits", Scientific e-Resources, ISBN - 1839472413, 2019.

Reference Books

1. Shrikrishna Yawale, Sangita Yawale, "Operational Amplifier Theory and Experiments", Springer Nature Singapore, 2022.
2. Bruce Carter, Ron Mancini, "Op Amps for Everyone", Newnes Publication, 5th Edition, 2017.
3. Ramakant A. Gayakward, "Op-amps and Linear Integrated Circuits", Pearson Education, 5th Edition, 2015.
4. J. Michael Jacob, "Applications and Design with Analog Integrated Circuits", Prentice Hall of India, New Delhi, 2nd Edition, 2010.
5. James M. Fiore, "Opamps and Linear Integrated Circuits Concepts and Applications", Cengage learning, 1st Edition, 2010.

Dr. P. Jamuna

Web References

1. https://nptel.ac.in/courses/117103064/
2. https://nptel.ac.in/courses/117/105/117105080/
3. https://nptel.ac.in/courses/117/108/117108040/
4. https://nptel.ac.in/courses/108/108/108108111/
5. https://nptel.ac.in/courses/117/107/117107094/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	-	-	-	-	-	-	1	3	3	3
2	3	3	3	3	3	-	-	-	-	-	-	1	3	3	3
3	3	3	3	3	3	-	-	-	-	-	-	1	3	3	3
4	3	3	3	3	3	-	-	-	-	-	-	1	3	3	3
5	3	3	3	3	3	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23EEB301**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRIC CIRCUIT ANALYSIS**	**2**	**0**	**2**	**3**	**50**	**50**	**100**

EEE

Prerequisite	**Engineering Mathematics, Electrical Engineering**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Solve DC and AC networks using various network theorems.	**K3**
	CO2 Predict the behavior of three phase circuits for different types of load under balanced and unbalanced conditions	**K3**
	CO3 Categorize the steady state and transient response of various circuits with DC and AC excitations.	**K4**
	CO4 Examine various electrical circuits using simulation software	**K3**
	CO5 Demonstrate the behaviour of magnetically coupled circuits for series and parallel connections using simulation software	**K3**

UNIT – I	**Circuit Analysis and Network Theorems**	**Periods:10**
DC and AC Circuits: Review of Mesh and Nodal method - Network Theorems – Superposition, Thevenin's, Norton's, Maximum power transfer and Reciprocity		**CO1**
UNIT – II	**Three Phase Circuits and Transient Analysis**	**Periods:10**
Three Phase Circuits: Three phase balanced - unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected balanced and unbalanced loads. **Transient Analysis:** Transient response of RL, RC and RLC circuits for DC and AC excitation - Natural and forced oscillations - Laplace transform application for transient solution.		**CO2**
UNIT – III	**Resonance, Network Topology and Coupled Circuits**	**Periods:10**
Resonance circuits: Series, parallel and series – parallel circuits – Relationship between Q - factor, resonant frequency and bandwidth. Network Topology: Graph, branch, chord, Tree, incidence matrix, tie-set and cut-set. **Coupled circuits:** Self-inductance, mutual inductance - coefficient of coupling - dot convention - analysis of coupled circuits - single tuned and double tuned circuits.		**CO3**
UNIT – IV	**Electric Circuit Practice - I**	**Periods:15**
1. Verification of Mesh and Nodal method for Electric Circuits 2. Verification of electrical circuits using Superposition theorem 3. Verification of electrical circuits using Thevenin's and Norton's theorem 4. Verification of electrical circuits using Compensation theorem 5. Verification of electrical circuits using Millman's theorem 6. Verification of electrical circuits using Tellegan's theorem		**CO4**
UNIT – V	**Electric Circuit Practice - II**	**Periods:15**
1. Verification of voltage, current and power in three phase balanced star and delta connected loads. 2. Verification of time response of R - L and R - C circuit for DC and AC excitation 3. Verification of time response of RLC circuit 4. Verification of Series and Parallel Resonance circuit 5. Verification of self-inductance and mutual inductance 6. Verification of Single and Double tuned circuit for electrical network		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 60**

Text Books

1. William H. Hayt Jr., Jack E. Kemmerly, Jamie D. Phillips and Steven M. Durbin, "Engineering Circuit Analysis", McGraw Hill, 9th Edition, 2020.
2. Charles K. Alexander and Matthew N. Q. Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill International Edition, 7th Edition, 2022.
3. Dr. M.Arumugam, Dr. N. Premkumaran, "Electric Circuit Theory", Khanna Publishers, 5th Edition, 2015.

Dr. P. Jamuna

Reference Books

1. J. Nagrath and Kothari, "Theory and Problems of Basic Electrical Engineering", PHI Learning Private Limited, Delhi, 2nd Edition, 2016.
2. A. Sudhakar, Shyammohan S. Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill Publications, 5th Edition, 2017.
3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 5th Edition, 2013.
4. Mahmood Nahvi, Joseph Edminister, "Electric Circuits (Schaum's Easy Outline series)", McGraw-Hill Publications,1st Edition, 2020.
5. Sukhija and Nagsarkar, "Circuits and Networks", Oxford University Press, 2nd Edition, 2016.

Web References

1. https://nptel.ac.in/courses/108/108/108108076/
2. https://www.electronics-tutorials.ws/accircuits/series-circuit.html
3. https://www.youtube.com/watch?v=83IVK6i8EB0&list=PLX2gX-ftPVXUkVZ2eafafDwcs5nDldeBD
4. https://www.youtube.com/watch?v=zDcXt9Vx34o
5. https://www.youtube.com/watch?v=YLGrugmDvc0

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	2	-	-	2	3	3	3
2	3	3	3	2	3	-	-	-	2	-	-	2	3	3	3
3	3	3	3	2	3	-	-	-	2	-	-	2	3	2	3
4	3	3	3	2	3	-	-	-	2	-	-	2	3	2	3
5	3	3	3	2	3	-	-	-	2	-	-	2	3	2	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM) – Maximum 50 Marks										End Semester Examination (ESE) Marks (Theory)	Total Marks
	Continuous Assessment (Theory)					Continuous Assessment (Practical)						
	CAT 1	CAT 2	Model	Attendance	Total	Conduction of Practical	Report	Viva	Total	#End Semester Examination (ESE) Marks (Practical – Internal Evaluation)		
Marks	5	5	5	5	20*	15	10	5	30*		75**	-
*To be weighted for 10 Marks					10	*To be weighted for 10 Marks			10	30	**To be weighted for 50 Marks	100

*Final End semester practical exam to be conducted with internal and external examiner assigned by Head of the Institution and HoD.*

Dr. P. Jamuna

Department	**English**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **HS**			End Semester Exam Type: **LE**			
Course Code	**U23ENPC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**GENERAL PROFICIENCY- I**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to ALL Branches except CSBS)

Prerequisite	**Basics of English Language**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret meaning and apply reading strategies in technical and non-technical context	**K3**
	CO2 Develop interpersonal communication skills professionally	**K4**
	CO3 Demonstrate various forms of formal writing	**K3**
	CO4 Decode graphical data coherently	**K2**
	CO5 Apply the techniques of verbal aptitude in competitive exams	**K3**

UNIT – I	**Comprehension Analysis**	**Periods:06**
Listening: Dialogue based on social contexts (IELTS based) - **Speaking:** Break the iceberg (IELTS based) Submitting Video Recording - **Reading:** Reading technical passage (IELTS based) - **Writing:** Writing Task: 2 (IELTS Academic) - Vocabulary: Synonyms (IELTS).		**CO1**
UNIT – II	**Personality Development**	**Periods:06**
Listening: Monologue about the everyday social issues (IELTS based) - Interview Videos - **Speaking:** Speak about the topic in the Flash Card (IELTS based) - **Reading:** British & American Vocabulary - **Writing:** SWOT Analysis - **Vocabulary:** Idioms and Phrases (IELTS).		**CO2**
UNIT – III	**Inferential Learning**	**Periods:06**
Listening: Conversation between 4 people regarding education (IELTS based), Anecdotes - **Speaking:** Structure Discussion (IELTS based) - **Reading:** Distinguish between facts & opinions (IELTS based), - **Writing:** Writing Conversation to different context - **Vocabulary:** Phrasal Verbs (IELTS).		**CO3**
UNIT – IV	**Interpretation and Functional Writing**	**Periods:06**
Listening: Monologue on an academic subject (IELTS based), Group Discussion videos - **Speaking:** Group Discussion Practice - **Reading:** Read and review (Books, Magazines) - **Writing:** Writing Task 1: (IELTS Academic: Graph/ chart/tables description) - **Vocabulary:** Collocations (IELTS)		**CO4**
UNIT – V	**Verbal Aptitude - I**	**Periods:06**
Language Enhancement: Articles, Preposition, Conjunction **Verbal Ability Enhancement:** Ordering of sentences, Blood Relation, Completing Statements- Cloze test, Spotting Errors - Sentence Improvement, Word Analogy, Word Groups (GATE)		**CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Lewis, Norman, "Word Power Made Easy", Goyal Publishers and Distributors Pvt. Ltd., Latest Edition, 2020.
2. Patterson, Kerry, Joseph Grenny, Ron McMillan, Al Switzler, "Crucial Conversation Tools for talking when Stakes are High", Kindle Publication, 2nd Edition, 2011.
3. Comfort, Jeremy, et.al. "Speaking Effectively: Developing Speaking Skills for Business English", Cambridge University Press, Cambridge: Reprint 2011.
4. Agarwal, R. S. "A Modern Approach to Verbal & Non-Verbal Reasoning". S. Chand, 2010.
5. Wren, Percival Christopher, and Wren Martin. "High School English Grammar and Composition". S Chand, 2005.

Web References

1. https://www.ielts-exam.net/grammar/
2. https://ieltsfocus.com/2017/08/02/collocations-ielts/
3. https://www.fresherslive.com/online-test/blood-relations-questions-and-answers
4. https://www.toppr.com/guides/english-language/reading-comprehension/cloze-test/
5. https://www.examsbook.com/word-analogy-test-questions-with-answers

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
2	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
3	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
4	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
5	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Practical				
Continuous Assessment Internal Evaluation		**End Semester External Evaluation**		**Total Marks**
50 marks		**50 marks**		100
Conduction of Practical (Assignment 1 & 2 -10 Marks Performance in practical classes - 5 Marks)	15	Listening (L)	20	
Record	5	Speaking(S)	10	
Viva	5	Reading(R)	10	
Model Practical Examination (Model Exam is conducted for 50 Marks that will be converted to 15 Marks)	15	Writing(W)	10	
Attendance	10			

Dr. P. Jamuna

Department	**Mathematics**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **BS**			End Semester Exam Type: **LE**			
Course Code	**U23MAPC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ENGINEERING MATHEMATICS LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to ALL Branches except CSBS)

Prerequisite	**Matrices, Fourier Transforms, Laplace Transforms**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Perform and evaluate Matrix Operations	**K3**
	CO2 Solve Differential and Integral Equations	**K3**
	CO3 Construct Fourier series and Fourier Transforms of the given function	**K3**
	CO4 Find the Measures of Central tendency	**K3**
	CO5 Analyze Correlation and Regression lines	**K3**

List of Experiments:

1. Find the Inverse, Rank, Eigen values and Eigen Vectors of the matrix.
2. Solve the first order differential equation.
3. Find the integration of $\int_a^b f(x)dx$
4. Find the Fourier series of f(x).
5. Find the Fourier Transform of f(x).
6. Find the Laplace Transform of f(x).
7. Find the Mean, Median and Mode.
8. Construct the Pie and Bar Diagram.
9. Find the Correlation coefficient.
10. Find the Regression lines.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. T. Veerarajan, “Engineering Mathematics”, Tata McGraw Hill Education (India) Private Limited, Chennai, 2nd Edition, 2018.
2. M. K. Venkataraman, “Engineering Mathematics”, The National Publishing Company, Madras, 2016.
3. Dr. A. Singaravelu, “Probability and Statistics”, Meenakshi Agency, 2019.

Web References

1. https://www.mccormick.northwestern.edu/documents/students/undergraduate/introduction-to-matlab.pdf
2. https://www.nrigroupindia.com/niist/wp-content/uploads/sites/6/2022/02/lab-manual-it406matlab.pdf
3. https://www.studocu.com/row/document/comsats-university-islamabad/signals-and-systems/lab-lab-manual/38332410

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	1	1	-	1	-	-	-	-	-	1	1	1	1
2	3	2	1	1	-	1	-	-	-	-	-	1	1	1	1
3	2	1	-	-	-	1	-	-	-	-	-	1	1	1	1
4	2	1	-	-	-	1	-	-	-	-	-	1	1	1	1
5	3	2	1	1	-	1	-	-	-	-	-	1	1	1	1

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Dr. P. Jamuna

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Artificial Intelligence and Data Science**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **ES**			End Semester Exam Type: **LE**			
Course Code	**U23ADPC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN PYTHON LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to ALL Branches)

Prerequisite	**Nil**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe common Python functionality and features used for data science.	**K3**
	CO2 Query Data Frame structures for cleaning and processing.	**K3**
	CO3 Configure your programming environment	**K3**
	CO4 Experiment the concept using data visualization.	**K3**
	CO5 Analyze real time datasets.	**K3**

List of Experiments:

1. Build a python program to implement Fibonacci series.
2. Build a python program to get a range of numbers from user and to separate even numbers and odd numbers respectively.
3. Build a function in Python to check duplicate letters. It must accept a string, i.e., a sentence. The function should return True if the sentence has any word with duplicate letters, else return False.
4. Build a program to perform arithmetic operations using lambda function.
5. Build a Python program that takes a list of numbers as input and returns a new list containing only the even numbers from the input list.
6. Build a python program to create a class called Car with attributes Company, model, and year. Implement a method that returns the age of the car in years.
7. Build a python program to create a base class called Shape that has a method called area which returns the area of the shape (set it to 0 for now). Then, create two derived classes Rectangle and Circle that inherit from the Shape class to calculate the area of derived classes.
8. Build a python program to implement aggregation using Numpy.
9. Build a python program to perform Indexing and Sorting.
10. Build a python program to perform Handling of missing data.
11. Build a python program to perform usage of Pivot table using Titanic datasets
12. Build a python program to perform use of eval () and query ()
13. Build a python program to perform Scatter Plot
14. Build a python program to perform 3D plotting
15. Implement an application to process a real time data.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Chirag Shah, “A Hands-On Introduction to Data Science”, Cambridge University Press, 2020.
2. Siddhartha Chatterjee, Michal Krystyanczuk, “Python Social Media Analytics”, Packt Publishing, 2017.
3. Jake VanderPlas, “Python Data Science Handbook - Essential Tools for Working with Data”, O’Reily Media Inc, 2016.
4. Y.Zhang, “An Introduction to Python and Computer Programming”, Springer Publications, 2016.
5. Wesley J Chun, “Core Python Programming”, Pearson Education, 2nd Edition, 2006.

Dr. P. Jamuna

Web References

1. https://nptel.ac.in/courses/106/106/106106212/
2. https://www.geeksforgeeks.org/data-analysis-visualization-python/
3. https://www.coursera.org/learn/python-data-analysis
4. https://www.python.org/
5. https://www.programiz.com/python-programming

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	1	3	-	-	-	-	-	-	-	2	2	2
2	2	3	2	2	3	-	-	-	-	-	-	-	2	3	2
3	3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
4	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
5	3	3	3	3	3	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **PC**			End Semester Exam Type: **LE**			
Course Code	**U23EEP304**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL MACHINES – I LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

EEE

Prerequisite	**Electrical Engineering Laboratory**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Test the performance of DC machines and transformers by conducting suitable experiments	**K3**
	CO2 Predetermine the different performance characteristics of DC machines and transformers.	**K3**
	CO3 Analyze the various speed control techniques and electrical braking of DC shunt motor.	**K3**
	CO4 Infer the load sharing of single-phase transformers by parallel operation.	**K3**
	CO5 Experiment the performance of DC machine for various applications.	**K3**

List of Experiments:

DC Machines

1. Load test on DC Series Motor
2. Load test on DC Shunt / Compound Motor
3. Speed control of DC Shunt Motors: Field control, Armature control
4. Open Circuit Characteristics and Load test on self / separately excited DC Generator
5. Load test on DC series Generator
6. Swinburne's Test
7. Electrical Braking in DC shunt motor
8. Assembling and Testing of DC machines

Transformers

9. Load test on single phase transformer
10. O.C and S.C test on single phase transformer
11. Parallel operation of single phase transformers
12. Load test on three phase transformer
13. O.C and S.C test on three phase transformer

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. D. P. Kothari, B. S. Umre, "Laboratory Manual for Electrical Machines", I.K. International Publishing House, New Delhi, 2nd Edition, 2017.
2. D. R Kohli and S.K Jain, "A laboratory course in electrical machines", New Chand and Bros, Roorkee, 2nd Edition, 2000.
3. Dr. D. K. Chaturvedi, "Electrical Machines Lab Manual with MATLAB Programs", Laxmi Publications Pvt. Limited, 1st Edition, 2015.
4. A. E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi, 7th Edition, 2013.
5. Albert E. Clayton, "The performance and design of direct current machines", Tata McGraw Hill Publishing Company Limited, New Delhi, 3rd Edition, 2004.

Web References

1. http://em-coep.vlabs.ac.in/
2. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/index.php
3. http://em-iitr.vlabs.ac.in/
4. https://ndl.iitkgp.ac.in
5. https://nptel.ac.in/courses/108/105/108105017/

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3
2	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3
3	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3
4	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3
5	2	2	1	3	2	-	-	-	2	-	-	-	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23EEC3XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - III**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
EEE								
Prerequisite	**-**							

Students shall choose an international certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass / Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	10	90	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23EES301**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SKILL ENHANCEMENT COURSE - I**	**0**	**0**	**2**	**-**	**100**	**-**	**100**

EEE

(Choose anyone of the below three courses)

1. TESTING OF ELECTRONIC DEVICES AND PCB BOARD DESIGNING

Course Contents:

Testing of Electronics Devices:

1. Identification of components and its symbols
2. Testing of semiconductor devices (Diodes, BJT, SCR, DIAC, TRIAC, MOSFET and IGBT)
3. Testing of multimeter, function generator and regulated power supply
4. Identification and testing of resistors, capacitors and inductors

PCB -Through Hole Technology Mounting (THT):

5. Schematic capture of Electronic Circuits and PCB Design
6. Fabrication of PCB for Clapping and IR switching circuits
7. Fabrication of PCB for cell, battery and mobile charger

PCB - Surface Mount Technology:

8. Calculation of Surface mounts device (SMD) resistor values.
9. Identification and testing of SMD Components (Capacitor, Fuse, Coil, Diode, Transistor and Crystals)
10. Practice of SMT Integrated Circuits-package types (SOIC, SOP, QFP, PLCC and BGA)
11. Practice of different SMT solder joints and soldering methods
12. Assembling Process of SMT
13. Design and implementation of Microcontroller Development board using SMT

2. DESIGN OF SOLAR POWER PLANT AND INSTALLATION

Course Contents:

1. Familiarization of Subsidy scheme for Solar Photovoltaic in Urban sector, water pumping system and house rooftop.
2. Selection of PV module technology
3. Design of solar PV system for fan and LED lamps.
4. Connection of PV Module (Series and Parallel Circuit)
5. Preparation of single line diagram and plant array layout diagram.
6. Calculation of battery capacity for household appliance
7. Selection and sizing of Inverter and controller
8. Selection and sizing of AC and DC Cables
9. Net Metering and Introduction to Smart grid
10. Cost estimation and payback period calculation for solar power plant

3. DEMONSTRATION / TROUBLESHOOTING OF ELECTRICAL AND ELECTRONICS EQUIPMENTS

Course Contents:

1. Demonstration of electrical safety and electricity tariff calculation for household appliances.
2. Single phase house wiring, Fuse calculation and Extension box fitting
3. Demonstration of electrical measuring instruments (Ammeter, Voltmeter, CRO, DSO and Multimeter)
4. a) Electrical wiring for fan and tube light
   b) Demonstration of coil rewinding of ceiling fan
5. Troubleshooting of electrical and electronic home appliances - (Electric water heater, Iron box)
6. Troubleshooting of electrical and electronic home appliances - (Rice cooker, Vacuum cleaner)
7. Troubleshooting of electrical and electronic home appliances -(Washing machine, Mixer)
8. Troubleshooting of electrical and electronic home appliances-(Air conditioner, Grinder)
9. Troubleshooting of electrical and electronic home appliances- Induction stove
11. Demonstration of water level indicator for domestic purpose.
12. Troubleshooting Steps for Common TV Problems
13. Construction of series and parallel connection of LED for decoration purpose.
14. Demonstration and design of inductive coil for required specification

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	Report	Presentation / Demo / Skill Test	
Marks	10	40	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**III**	Course Category: **MC**			End Semester Exam Type: **-**			
Course Code	**U23EEM303**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CLIMATE CHANGE**	**2**	**0**	**0**	**-**	**100**	**-**	**100**

(Common to all Branches except CSBS)

Prerequisite	**Nil**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Inspect the characteristics and Temperature profile of the atmosphere	**K2**
	CO2 Analyze past climate, human influence on global warming, and predict future climates	**K3**
	CO3 Analyze the impact of climate change and the risk of Irreversible Changes	**K3**
	CO4 Outline the carbon credits and evidences of changes in Environment	**K2**
	CO5 Acquire knowledge on clean development mechanism and mitigation technologies	**K2**

UNIT – I	**Atmosphere and its Components**	**Periods:06**
Importance of Atmosphere - Physical Chemical Characteristics of Atmosphere - Vertical structure of the atmosphere- Composition of the atmosphere - Atmospheric stability - Temperature profile of the atmosphere - Lapse rates - Temperature inversion - effects of inversion on pollution dispersion.		**CO1**
UNIT – II	**Global Climate**	**Periods:06**
Account of past climate - Environmental indicators and instrumental records – Human Footprints on global warming - Predicting future climates - Temperature regime – Extreme climate events.		**CO2**
UNIT – III	**Impacts of Climate Change**	**Periods:06**
Causes of Climate change: Change of Temperature in the environment - Melting of ice Pole - sea level rise - Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions - Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.		**CO3**
UNIT – IV	**Observed Changes and its Causes**	**Periods:06**
Climate change and Carbon credits - Initiatives in India-Kyoto Protocol - Intergovernment Panel on Climate change - Climate Sensitivity and Feedbacks - The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India.		**CO4**
UNIT – V	**Climate Change and Mitigation Measures**	**Periods:06**
Clean Development Mechanism - Carbon Trading - examples of future Clean Technology – Biodiesel – Natural Compost - Eco- Friendly Plastic - Alternate Energy – Hydrogen - Bio-fuels - Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices- Carbon sequestration – Carbon capture and storage (CCS) - International and Regional cooperation- Remedial measures.		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Text Books

1. Joan Fitzgerald, “Greenovation: Urban Leadership on Climate Change”, Oxford University Press, 2020.
2. J. David Neelin, “Climate change and climate modelling”, Cambridge University press, 2011.
3. Robin Moilveen, “Fundamentals of weather and climate”, Oxford University Press, 2nd Edition, 2010.
4. Andrew Dessler and Edward A. Parson, “The Science and Politics of Global Climate Change”, Cambridge University press, 3rd Edition, 2019.
5. Dash Sushil Kumar, “Climate Change - An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007.

Reference Books

1. Bill McKibben, “The Global Warming Reader: A Century of writing about Climate Change”, Penguin, 2012.
2. Jason Smerdon, “Climate Change: The Science of Global Warming and our Energy Future”, Columbia University, 2009
3. Adaptation and mitigation of climate change-Scientific Technical Analysis, Cambridge University Press, 2006.
4. J.M. Wallace and P.V. Hobbs, “Atmospheric Science”, Elsevier/ Academic Press, 2006.
5. Jan C. van Dam, Impacts of “Climate Change and Climate Variability on Hydrological Regimes”, Cambridge University Press, 2003

Dr. P. Jamuna

Web References

1. https://nptel.ac.in/courses/105102089/
2. https://www.warmheartworldwide
3. https://nptel.ac.in/content/storage

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	-	-	2	1	1	1
2	1	-	-	-	-	-	-	-	-	-	-	2	1	1	1
3	1	-	-	-	-	-	-	-	-	-	-	2	1	1	1
4	1	-	-	-	-	-	-	-	-	-	-	2	1	1	1
5	1	-	-	-	-	-	-	-	-	-	-	2	1	1	1

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

Dr. P. Jamuna

Department	**Mathematics**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **BS**			End Semester Exam Type: **TE**			
Course Code	**U23MATC04**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**NUMERICAL METHODS AND OPTIMIZATION**	**3**	**1**	**0**	**4**	**25**	**75**	**100**

(Common to EEE, ECE, ICE, BME, MECH, CIVIL & MECHATRONICS)

Prerequisite	Basic Mathematics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Solve Algebraic and Transcendental equations	**K3**
	CO2 Solve Simultaneous Equations by various Numerical Techniques.	**K3**
	CO3 Apply the Numerical Techniques of interpolation in various Intervals.	**K3**
	CO4 Solve Linear programming problems by using Optimization Techniques.	**K3**
	CO5 Find the solution of Transportation and Assignment Problems.	**K3**

UNIT – I	**Solution of Algebraic and Transcendental Equations and Eigen Value Problems**	**Periods:12**
Solution of Algebraic and Transcendental equations – Bisection method - Method of False position – Newton Raphson method – Eigen value and Eigen vector by Power method.		**CO1**
UNIT – II	**Linear Simultaneous Equations**	**Periods:12**
Solutions of Linear simultaneous equations and Matrix Inversion – Gauss Elimination and Gauss - Jordan methods – Iterative methods – Gauss Jacobi – Gauss Seidel.		**CO2**
UNIT – III	**Interpolation and Solution of Ordinary Differential Equations**	**Periods:12**
Interpolation by Newton's Forward and Backward Difference formula for equal intervals – Lagrange's method for unequal intervals – Integration by Trapezoidal and Simpson's rules (Single integration only) – Fourth order Runge-Kutta method for solving first order Differential Equations.		**CO3**
UNIT – IV	**Linear Programming Problems**	**Periods:12**
Linear Programming Problems - Graphical Method – Simplex Method – Big M method.		**CO4**
UNIT – V	**Transportation and Assignment Problems**	**Periods:12**
Transportation Problems – Initial basic feasible solution using North-West Corner rule, Least Cost Method, Vogel's Approximation Method – Optimality in Transportation Problem by Modified Distribution (MODI) Method. Assignment Problems – Solutions of Assignment Problems by Hungarian Method – Unbalanced Assignment Problems.		**CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, "Numerical Methods", S. Chand Limited, 2008.
2. R. Panneerselvam "Operations Research", Prentice Hall of India, 2nd Edition,2004.
3. P.K. Gupta, D.S. Hira, "Operations Research", S. Chand, 5th Edition, 2018.

Reference Books

1. Atul Goyal, Madhuchanda Rakshit Suchet Kumar, "Numerical Methods", New India publishing Agency, 1st Edition, 2019.
2. Rajesh Kumar Gupta, "Numerical Methods - Fundamental and Applications", Cambridge University Press, 1st Edition, 2019.
3. S. Kalavathy, "Operation Research", Vikas Publishing house,4th Edition,2012.
4. Kevin J. Hastings, "Introduction to the Mathematics of Operations Research with Mathematica", Taylor and Francis, 2nd Edition, 2019.
5. T. Veerarajan, "Operations Research", McGraw Hill, 1st Edition, 2018.

Dr. P. Jamuna

Web References

1. https://nptel.ac.in/courses/111106101/
2. https://www.geektonight.com/operation-research-notes-pdf/#.XrXzoP8za00
3. https://freecomputerbooks.com/Numerical-Methods-with-Applications.html
4. https://www.pphmj.com/journals/IJNMA.htm
5. https://nptel.ac.in/courses/106/108/106108056/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	1	-	1	-	-	-	-	-	1	1	1	1
2	3	3	3	2	-	1	-	-	-	-	-	1	1	1	1
3	3	3	3	2	-	1	-	-	-	-	-	1	1	1	1
4	3	3	3	2	1	1	1	-	-	-	1	1	1	1	1
5	3	3	3	2	1	1	1	-	-	-	1	1	1	1	1

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Computer Science and Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **ES**			End Semester Exam Type: **TE**			
Course Code	**U23CSTC03**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DATA STRUCTURES**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

(Common to all Branches)

Prerequisite	Any Programming Knowledge	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Compute time and space complexity for given problems	**K3**
	CO2 Demonstrate stack, queue and its operation.	**K3**
	CO3 Illustrate the various operations of linked list.	**K3**
	CO4 Use the concepts of tree for various applications.	**K3**
	CO5 Outline the various Tables, Graphs and Sets techniques.	**K3**

UNIT – I	**Basic Terminologies of Data Structures**	**Periods:09**
Introduction: Basic Terminologies - Asymptotic Notations: Complexity analysis. Array and its operations - **Searching:** Linear Search and Binary Search Techniques. **Sorting:** Bubble Sort - Selection Sort - Insertion Sort - Heap Sort - Shell Sort. Performance and Comparison among the sorting methods.		**CO1**

UNIT – II	**Stack and Queue Operations**	**Periods:09**
Stacks and Queues: ADT Stack and its operations. Applications of Stacks: Expression Conversion and evaluation. ADT Queue and its operations. **Types of Queues:** Simple Queue – Circular Queue – Priority Queue – Deque.		**CO2**

UNIT – III	**Linked List Operations**	**Periods:09**
Linked Lists: Singly linked list: Representation in memory. Algorithms of several operations: Traversing – Searching – Insertion – Deletion. Linked representation of Stack and Queue. Doubly linked list: operations. Circular Linked Lists: operations.		**CO3**

UNIT – IV	**Trees**	**Periods:09**
Trees: Basic Tree Terminologies. Different types of Trees: Binary Tree - Threaded Binary Tree - Binary Search Tree - Trees: Binary Tree Traversals - AVL Tree - Red Black Tree.		**CO4**

UNIT – V	**Graphs, Tables and Sets**	**Periods:09**
Graph: Basic Terminologies and Representations – Graph traversal algorithms. **Tables:** Different types of tables – Hash Table and its operations - Applications. **Sets:** Representation of Sets- Operations and its applications.		**CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. Ellis Horowitz, Sartaj Sahni, “Fundamentals of Data Structures”, Computer Science Press, Illustrated Edition, 2018.
2. Thomas H. Coreman, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, PHI, 3rd Edition, 2010.
3. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, “Data Structures and Algorithms”, 4th Edition, 2009.

Reference Books

1. D. Samanta, “Classic Data Structures”, Prentice-Hall of India, 2nd Edition, 2012.
2. Robert Kruse, C.L. Tondo and Bruce Leung, “Data Structures and Program Design in C”, Prentice-Hall of India, 2nd Edition, 2007.
3. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Pearson Education, 2nd Edition, 2006.
4. Mark Allen Weiss, “Algorithms, Data Structures and Problem Solving with C++”, Addison-Wesley Publishing Company, Illustrated Edition, 1995.

Dr. P. Jamuna

Web References

1. https://www.geeksforgeeks.org/data-structures/
2. https://www.javatpoint.com/data-structure-tutorial/
3. https://www.studytonight.com/data-structures/
4. https://www.tutorialspoint.com/data_structures_algorithms/
5. https://www.w3schools.in/data-structures-tutorial/intro/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
3	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
5	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23EET407**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL MACHINES - II**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Electrical Engineering, Electromagnetic Theory, Electrical Machines - I	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Predict the performance of induction motor using equivalent circuits and circle diagram.	**K3**
	CO2 Apply suitable starting and speed control methods to enhance the performance of three phase induction motors.	**K3**
	CO3 Examine the performance characteristics of alternator and compute voltage regulation with different methods.	**K3**
	CO4 Illustrate the characteristics of synchronous motor and its performance with effect of varying load and excitation.	**K3**
	CO5 Differentiate the characteristics of special machines as well as choose an appropriate motor for industrial application.	**K2**

UNIT – I	**Induction Motor**	**Periods:09**
Single phase Induction Motors: Construction - Principle of operation - Double revolving field theory - Torque-speed characteristics – starting methods – Applications. **Three phase Induction Motors:** Construction – principle of operation – Types - Effect of slip on rotor parameters - Torque equation - phasor diagram - effect of voltage variation and rotor resistance on torque slip characteristics - Power Stages - equivalent circuit - Circle diagram – Separation of no-load losses - Losses and efficiency – Applications		**CO1**
UNIT – II	**Starters and Speed Control of Three Phase Induction Motor**	**Periods:09**
Starters: Need for starters – Starting methods. **Speed control:** Stator side - Rotor side. Cogging and Crawling - Electric Braking - deep bar and double cage rotor – Synchronous induction motor – Induction generator - DFIG – Applications.		**CO2**
UNIT – III	**Alternator**	**Periods:09**
Alternator: Construction – Principle of operation – EMF equation – Synchronous reactance – Armature reaction - Alternator on load – phasor diagram. **Voltage regulation:** EMF, MMF, ZPF. Synchronizing and parallel operation- Two reaction theory of Salient pole machines – slip test - power angle diagram – Applications.		**CO3**
UNIT – IV	**Synchronous Motor**	**Periods:09**
Construction - principle of operation - starting methods - Torque and power equations - speed control – phasor diagram - effect of varying load and excitation - 'V' and inverted 'V' curves - hunting – synchronous condenser – Applications.		**CO4**
UNIT – V	**Special Machines**	**Periods:09**
Stepper motors - Reluctance motor - Hysteresis motor- Servo motor- Linear induction motor- AC series motor - switched reluctance motor – BLDC motor and its types – PMSM – Applications (Qualitative approach only).		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. A. E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi, 7th Edition, 2017.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, New Delhi, 7th Edition, 2018.
3. B. L. Theraja and A. K. Theraja, "A Textbook of Electrical Technology", Vol. II, S. Chand & Co. Ltd., New Delhi, 23rd Edition, 2016.

Reference Books

1. R. K. Rajput, "Electrical Machines", Laxmi publications Pvt. Ltd, New Delhi, 6th Edition, 2008.
2. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 3rd Edition, 2013.
3. Alexander S. Langsdorf, "Theory of Alternating-Current Machinery", McGraw Hill Publications, 2nd Edition, 2001.
4. D. P. Kothari and I. J. Nagrath, "Electric Machines", Tata McGraw Hill, New Delhi, 5th Edition, 2017.
5. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Education, 6th Edition, 2006.

Dr. P. Jamuna

Web References

1. https://ndl.iitkgp.ac.in
2. https://nptel.ac.in/courses/108/105/108105131/
3. http://electrical-engineering-portal.com/
4. http://shodhganga.inflibnet.ac.in/
5. http://www.electrical4u.com

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	1	-	-	-	-	-	1	3	3	3
2	3	3	3	2	1	1	-	-	-	-	-	1	3	3	3
3	3	3	3	2	1	1	-	-	-	-	-	1	3	3	3
4	3	3	3	2	1	1	-	-	-	-	-	1	3	3	3
5	3	3	3	2	1	1	-	-	-	-	-	1	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23EET408**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**TRANSMISSION AND DISTRIBUTION**	**2**	**1**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Electrical Engineering, Electromagnetic Theory, Electric Circuit Analysis	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Calculate the line parameters and interpret the effects in the transmission system	**K3**
	CO2 Model on different types of transmission lines (short, medium, long) and its performance.	**K3**
	CO3 Use the adaptable types of insulators and cables for distribution systems.	**K3**
	CO4 Categorize and gain knowledge on High Voltage AC and DC systems	**K3**
	CO5 Describe various schemes of electrification and recent trends in transmission line.	**K2**

UNIT – I	**Line Parameters and Effects on Transmission System**	**Periods:09**
Structure of electric power systems - Single Line Diagram. **Transmission System:** Resistance, inductance and capacitance of single and three phase transmission lines - symmetrical and unsymmetrical spacing – transposition - single and double circuits - stranded and bundled conductors - application of self and mutual GMD- Introduction to Skin, Proximity and Corona effect - inductive and radio interference.		**CO1**
UNIT – II	**Performance Analysis on Transmission Systems**	**Periods:09**
Development of equivalent circuits for short, medium and long lines – Calculation of efficiency and voltage regulation – Tuned power lines - Power circle diagrams for sending and receiving ends - transmission capacity, steady state stability limit – voltage control of lines.		**CO2**
UNIT – III	**Insulators and Cables for Distribution Systems**	**Periods:09**
Insulators: types and comparison - voltage distribution in string insulator - string efficiency - Methods of improving string efficiency - Stress and sag calculations - effect of wind and ice - supports at different levels. **Cables:** types - capacitance of cables - insulation resistance - dielectric stress and grading - dielectric loss - thermal characteristics - capacitance of three core cables.		**CO3**
UNIT – IV	**Distribution Systems**	**Periods:09**
Need for power system interconnections systems - Components of a HVDC system - Types of DC links – Comparison of HVDC and HVAC Transmission - Comparison of distribution systems - Radial and Ring main - DC two wire, AC single phase and three phase systems – Selection of Feeders and Distributors – secondary distribution system - Kelvin's law and its limitations. Isolation and service restoration, Outage management.		**CO4**
UNIT – V	**Recent Trends in Transmission**	**Periods:09**
Transmission Automation, Distribution Automation, Estimating and mitigating blackout, Design of Rural distribution, planning and design of town electrification schemes - Modern trends in DC Transmission systems - Introduction to FACTS - Grounding methods in power stations.		**CO5**

Lecture Periods: 45	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods: 60**

Text Books

1. V. K. Metha and Rohit Metha, "Principles of Power System", S. Chand, 3rd Edition, 2023.
2. C. L. Wadhwa, "Electrical Power Systems", New Age International (P) Limited, New Delhi, 6th edition, 2018.
3. R. Padiyar, "HVDC Power Transmission Systems - Technology and System Interactions", New Age International Publishers, 2012.

Reference Books

1. Hadi Saadat, "Power System Analysis", PSA Publishing, 3rd Edition, 2010.
2. J. Brian, Hardy and Colin R. Bayliss, "Transmission and Distribution in Electrical Engineering", Newnes, 4th Edition, 2012.
3. Luces M. Fualken berry Walter Coffer, "Electrical Power Distribution and Transmission", Pearson Education, 2007.
4. A. K. Theraja and B. L. Theraja, "Text Book of Electrical Technology: Volume 3: Transmission, Distribution and Utilization", S. Chand, 23rd Edition, 2022.

Dr. P. Jamuna

Web References

1. https://swayam.gov.in/nd1_noc20_ee39/preview
2. https://swayam.gov.in/nd1_noc20_ee86/preview
3. https://www.eei.org/ourissues/ElectricityTransmission/Documents/
4. https://www.osha.gov/SLTC/etools/electric_power/illustrated_glossary/index.html
5. http://solareis.anl.gov/documents/docs/APT_61117_EVS_TM_08_4.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	-	-	-	-	-	-	3	3	2	3
2	3	3	3	2	2	-	-	-	-	-	-	3	3	2	3
3	3	3	3	2	2	-	-	-	-	-	-	3	3	2	3
4	3	3	3	2	2	-	-	-	-	-	-	3	3	2	3
5	3	3	3	2	2	-	-	-	-	-	-	3	3	2	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23EEB402**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CONTROL SYSTEMS**	**2**	**0**	**2**	**3**	**50**	**50**	**100**

EEE

Prerequisite	Electrical Engineering, Engineering Mathematics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret different electrical and mechanical systems with its modelling	**K2**
	CO2 Predict the time and frequency domain parameters for stability	**K3**
	CO3 Demonstrate with the tuning procedures of P/I/D controllers for various applications	**K3**
	CO4 Determine the transfer function of control systems and verification through simulation	**K3**
	CO5 Evaluate the stability of the systems by various plots through simulation	**K5**

UNIT – I	**Modeling of Linear Time Invariant Systems**	**Periods:10**
Control Systems: Open loop and Closed loop – Transfer functions – Feedback control system characteristics - Mathematical modelling of Electrical and Electro-Mechanical systems - Electrical analogues systems - Block diagrams - Reduction Techniques - Signal flow graphs		**CO1**
UNIT – II	**Time and Frequency Domain Analysis**	**Periods:10**
Time Domain Analysis: Standard test signals - Transient analysis of first order systems using step input - Time responses - Time domain specifications - Stability analysis - Concept of stability - Routh Hurwitz stability criterion. **Frequency Domain Analysis:** Frequency response analysis - Correlation between frequency response and time-response analysis - frequency domain specifications - Bode plot, Nyquist stability criterion.		**CO2**
UNIT – III	**Controller Design and State Variable Analysis**	**Periods:10**
Controller Design: Introduction - P-I-D controllers - Tuning methods - Ziegler-Nichol's Tuning - Performance criteria **State Space Representation:** Concept of state variables - State models for linear and time invariant Systems - Jordan Canonical Forms - Solution of State Equation - Transfer function to State space model.		**CO3**
UNIT – IV	**Control Systems Practice - I**	**Periods:15**
1. Simulation of Mechanical physical systems 2. Simulation for Time domain analysis of First order system 3. Simulation for Time domain analysis of Second order system 4. Simulation for Stability analysis using Routh- Hurwitz method 5. Simulation Analysis of Root Locus plot 6. Simulation for Frequency Domain Analysis using Polar Plot		**CO4**
UNIT – V	**Control Systems Practice - II**	**Periods:15**
1. Simulation of Open loop and closed loop control of Single-Phase Half Wave Controlled Rectifier 2. Simulation and Analysis of Time Response of Systems with P and PI Controllers 3. Simulation and Analysis of Time Response of Systems with PID Controllers 4. Simulation of Controllability and Observability of a system 5. Simulation of State space model for classical transfer function 6. State space analysis of second order system by simulation method		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 60**

Text Books

1. I. J. Nagarath and M. Gopal, "Control Systems Engineering", New Age International Publishers, 6th Edition, 2018.
2. Katsuhiko Ogata, "Modern Control Engineering", Pearson, 5th Edition, 2015.
3. Hasan Saeed, "Automatic Control Systems (With MATLAB Programs)", S. K. Kataria & Son, 6thEdition, 2010

Dr. P. Jamuna

Reference Books

1. M. Gopal, "Control Systems- Principles and Design", Tata McGraw Hill, 4th Edition, 2016.
2. Benjamin C. Kuo, "Automatic Control Systems", PHI Learning Private Ltd, 9th Edition, 2014.
3. John J. D'Azzo, Constantine H. Houpis and Sttuart N. Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor and Francis Reprint, 6th Edition, 2014.
4. R. Anandha Natarajan and B. Ramesh Babu, "Control System Engineering" Scitech Publication, 3rd Edition, 2009.

Web References

1. http://saadat.us/control_systems_labs.html
2. https://www.quanser.com/solution/control-systems/
3. http://ncr.mae.ufl.edu/papers/te02.pdf
4. https://futureengineering.in/control-system-lab/
5. http://vlabs.iitb.ac.in/vlab

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	2	-	-	2	3	3	3
2	3	3	3	2	3	-	-	-	2	-	-	2	3	3	3
3	3	3	3	2	3	-	-	-	2	-	-	2	3	2	3
4	3	3	3	2	3	-	-	-	2	-	-	2	3	2	3
5	3	3	3	2	3	-	-	-	2	-	-	2	3	2	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM) – Maximum 50 Marks										End Semester Examination (ESE) Marks (Theory)	Total Marks
	Continuous Assessment (Theory)					Continuous Assessment (Practical)						
	CAT 1	CAT 2	Model	Attendance	Total	Conduction of Practical	Report	Viva	Total	#End Semester Examination (ESE) Marks (Practical – Internal Evaluation)		
Marks	5	5	5	5	20*	15	10	5	30*		75**	-
*To be weighted for 10 Marks					10	*To be weighted for 10 Marks			10	30	**To be weighted for 50 Marks	100

*Final End semester practical exam to be conducted with internal and external examiner assigned by Head of the Institution and HoD*

Dr. P. Jamuna

Department	**English**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **HS**			End Semester Exam Type: **LE**			
Course Code	**U23ENPC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**GENERAL PROFICIENCY- II**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to ALL Branches except CSBS)

Prerequisite	Basics of English Language	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Infer ideas to attend international standardized test by broadening receptive and productive skills	**K2**
	CO2 Interpret the types of writing in different state of affairs	**K3**
	CO3 Acquire meticulous exposure in speaking and get rid of performance anxiety	**K2**
	CO4 Articulate the ideas and opinions effectively and coherently	**K2**
	CO5 Progress the skills to compete in various competitive exams like GATE, GRE, UPSC, etc.	**K4**

UNIT – I	**Career Skills**	**Periods:06**
Listening: Listening at specific contexts - **Speaking:** Demonstrative speaking practice using visual aids (charts, graphs, maps) - **Reading:** Read and Review - Newspaper, Advertisement, Company Handbooks, and Guidelines (IELTS based) - **Writing:** Integrated Writing Task (TOEFL) - **Vocabulary:** Synonyms and Antonyms (IELTS)		**CO1**
UNIT – II	**Corporate Skills**	**Periods:06**
Listening: Listening English news and reproducing in own words - **Speaking:** Team Presentation - **Reading:** Short texts and Longer Passages (cloze reading) - **Writing:** Analytical Writing: Analyzing an issue and Argument task (GRE based) - **Vocabulary:** Prefix and Suffix		**CO2**
UNIT – III	**Functional Skills**	**Periods:06**
Listening: Listening TED Talks - **Speaking:** Brainstorming and Individual Presentation - **Reading:** Text Completion (GRE Based) - **Writing:** Picture Inference - **Vocabulary:** Word Formation		**CO3**
UNIT – IV	**Transferrable Skills**	**Periods:06**
Listening: Listening Documentaries and making notes - **Speaking:** Mock Interview - **Reading:** Read texts on emerging trends - **Writing:** Agreeing & Disagreeing Essay (IELTS) - **Vocabulary:** Euphemism, Redundancy, Clichés and Intensifiers		**CO4**
UNIT – V	**Verbal Aptitude - II**	**Periods:06**
Transformational Grammar: Tenses, Change of Voice, Concord **Verbal Ability Enhancement:** Letter Series, Coding & Decoding, Sentence Equivalence (GRE) Analytical Reasoning and Logical Reasoning (GATE), Syllogism, One-word Substitution, Jumbled Sentences		**CO5**

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Cullen, Pauline, Amanda French and Vanessa Jakeman, “The official Cambridge guide to IELTS for academic & general training”, Cambridge, 2014.
2. Prasad, Hari Mohan, Sinha, Uma Rani, “Objective English for Competitive Examinations”, Tata Mc Graw Hill, Noida, 2010.
3. Lougheed, Lin., “Barron's Writing for the TOEFL IBT: With Audio CD”, Barron's Educational series, 2008.
4. Grussendorf, Marion, “English for Presentations”, Oxford University Press, Oxford, 2007.
5. Murphy, Raymond, “English Grammar in Use with answers: Reference and Practice for Intermediate students”, Cambridge, 2004.

Web References

1. https://www.englishclub.com/grammar/nouns-compound.htm
2. https://lofoya.com/Verbal-Test-Questions-and-Answers/Sentence-Completion/l3p1
3. https://www.grammarwiz.com/phrases-and-clauses-quiz.html
4. https://www.clarkandmiller.com/25-english-euphemisms-for-delicate-situations/
5. http://www.englishvocabularyexercises.com/general-vocabulary/

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
2	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
3	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
4	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1
5	1	-	-	-	-	-	-	1	-	3	-	2	1	1	1

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Practical				
Continuous Assessment Internal Evaluation		**End Semester External Evaluation**		**Total Marks**
50 marks		**50 marks**		100
Conduction of Practical (Assignment 1 & 2 -10 Marks Performance in practical classes - 5 Marks)	15	Listening (L)	20	
Record	5	Speaking(S)	10	
Viva	5	Reading(R)	10	
Model Practical Examination (Model Exam is conducted for 50 Marks that will be converted to 15 Marks)	15	Writing(W)	10	
Attendance	10			

Dr. P. Jamuna

Department	**Computer Science and Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **ES**			End Semester Exam Type: **LE**			
Course Code	**U23CSPC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DATA STRUCTURES LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

(Common to all Branches)

Prerequisite	**Basic Programming Knowledge**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Analyse the algorithm's / program's efficiency in terms of time and space complexity.	**K3**
	CO2 Solve the given problem by identifying the appropriate Data Structure.	**K3**
	CO3 Solve the problems of searching and sorting techniques.	**K3**
	CO4 Solve problems in linear Data Structures.	**K4**
	CO5 Solve problems in non-linear Data Structures.	**K4**

List of Experiments:

1. Write a C program to implement recursive and non-recursive i) Linear search ii) Binary Search.
2. Write a C program to implement i) Bubble sort ii) Selection sort iii) Insertion sort iv) Shell sort v) Heap sort.
3. Write a C program to implement the following using an array. a) Stack ADT b) Queue ADT
4. Write a C program to implement list ADT to perform following operations a) Insert an element into a list. a) Delete an element from list b) Search for a key element in list c) count number of nodes in list.
5. Write a C program to implement the following using a singly linked list. a) Stack ADT b) Queue ADT.
6. Write a C program to implement the dequeue (double ended queue) ADT using a doubly linked list and an array.
7. Write a C program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.
8. Write a C program that use recursive functions to traverse the given binary tree in
   a) Preorder b) Inorder c) Postorder.
9. Write a C program to perform the AVL tree operations.
10. Write a C program to implement Graph Traversal Techniques.
11. Write a C program to implement the Set operations.
    a) Union b) Intersection c) Difference

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Yashavant Kanetkar, "Data Structures through C", BPB Publications, 3rd Edition, 2019.
2. Tenebaum Aaron M, "Data Structures using C", Pearson Publisher, 1st Edition, 2019.
3. Manjunath Aradhya M and Srinivas Subramiam, "C Programming and Data Structures", Cengage India, 1st Edition, 2017.
4. Reema Thareja, "Data structures using C", Oxford University, 2nd Edition, 2014.
5. Gav. pai, "Data Structures and Algorithms", McGraw-Hill India, 1st Edition, 2013

Web References

1. https://www.tutorialspoint.com/data_structures_algorithms/
2. https://www.w3schools.in/data-structures-tutorial/intro/
3. https://nptel.ac.in/courses/106103069/
4. https://swayam.gov.in/nd1_noc20_cs70/preview
5. https://nptel.ac.in/courses/106103069/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
2	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
3	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
4	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3
5	3	2	1	1	-	-	-	-	-	-	-	-	3	2	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **PC**			End Semester Exam Type: **LE**			
Course Code	**U23EEP405**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL MACHINES - II LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

EEE

Prerequisite	Electrical Engineering, Electrical Machines	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Assess the performance of induction and synchronous machines by conducting suitable experiments.	**K5**
	CO2 Predetermine the performance characteristics of a three-phase induction motor.	**K3**
	CO3 Analyse the various strategies for controlling speed and electrical braking systems for induction motors.	**K4**
	CO4 Examine the performance of Universal motor by conducting suitable test.	**K4**
	CO5 Develop prototype modules in Induction and Synchronous machines for various applications.	**K6**

List of Experiments:

1. Load test on single phase induction motor
2. Load test on three phase squirrel cage / slip ring induction motor
3. No load and blocked rotor tests on three phase induction motor and separate it's no load losses.
4. Speed control of slip ring induction motor
   (i). Stator voltage control
   (ii). Rotor resistance control
5. Load test on induction generator
6. Load test on Single phase alternator
7. Voltage regulation of alternator using EMF and MMF methods
8. Voltage regulation of alternator using ZPF method
9. Slip test on three phase salient pole alternator
10. V and inverted V curves of synchronous motor
11. Performance Characteristics of Universal Motor
12. Electrical Braking of Induction Motor (i) Dynamic Braking, (ii) Plugging (iii) Regenerative Braking
13. Assembling and Testing of AC machines

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. D. P. Kothari, B. S. Umre, "Laboratory Manual for Electrical Machines", I.K. International Publishing House, New Delhi, 2nd Edition, 2017.
2. D.R. Kohli and S.K Jain, "A laboratory course in electrical machines", New Chand & Bros, Roorkee, 2nd Edition, 2000.
3. Dr. D. K. Chaturvedi, "Electrical Machines Lab Manual with MATLAB Programs", Laxmi Publications Pvt Limited, 1st Edition, 2015.
4. E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, "Electric Machinery", Tata McGraw Hill, New Delhi, 7th Edition, 2013.
5. M. G. Say, "Alternating Current Machines", Pitman Publishing, 5th Edition, 2002.
6. P.C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 3rd Edition, 2013.
7. Alexander S. Langsdorf, "Theory of Alternating-Current Machinery", McGraw Hill Publications, 2nd Edition, 2001.
8. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Education, 6th Edition, 2006.

Dr. P. Jamuna

Web References

1. http://em-coep.vlabs.ac.in/
2. http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/index.php
3. http://em-iitr.vlabs.ac.in/
4. http://vem-iitg.vlabs.ac.in/
5. https://nptel.ac.in/courses/108/105/108105131

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	1	-	-	-	3	-	-	1	3	3	3
2	3	2	2	3	1	-	-	-	3	-	-	1	3	3	3
3	3	2	2	3	1	-	-	-	3	-	-	1	3	3	3
4	3	2	2	3	1	-	-	-	3	-	-	1	3	3	3
5	3	2	2	3	1	-	-	-	3	-	-	1	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **PC**			End Semester Exam Type: **LE**			
Course Code	**U23EEP406**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRONICS - III LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

EEE

Prerequisite	Electronics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Demonstrate the application circuits like ADC, DAC and amplifiers using OPAMP.	**K3**
	CO2 Experiment various waveform generation circuits using OPAMP.	**K3**
	CO3 Design and test regulator circuits for power supplies using voltage regulator ICs	**K6**
	CO4 Determine the frequency response of active filters.	**K3**
	CO5 Illustrate the output waveforms and timing characteristics of multivibrator circuits using IC555.	**K4**

List of Experiments:

1. Determination of DC characteristics of OPAMP 741.
2. Design and verification of Inverting, non-inverting amplifiers and Voltage follower using OPAMP 741.
3. Design and verification of Adder and Subtractor using OPAMP 741.
4. Design and verification of Integrator and Differentiator using OPAMP 741.
5. Design and verification of V to I converter and I to V converter using OPAMP 741.
6. Design and verification of Instrumentation amplifier and comparator circuits using OPAMP 741.
7. Design and verification of wein-bridge oscillator using OPAMP 741.
8. Design and verification of RC phase shift oscillator using OPAMP 741.
9. Design and analysis of Triangular wave generator using OPAMP 741.
10. Design and analysis of filter circuit (First order& Second order) using OPAMP 741.
11. Design and analysis of voltage regulators using
    a) Fixed Voltage Regulator LM7805
    b) Adjustable Voltage Regulator LM317
12. Design and verification of low and high voltage regulators using IC 723.
13. Design and analysis of Monostable and Astable multivibrator using IC555.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. R. M. Marston, “Op-Amp Circuits Manual”, Elsevier, 2016.
2. Ron Mancini, “Op Amps for Everyone: Design Reference”, Newnes, 2nd Edition, 2003.
3. Walt Jung, “Op Amp Applications Handbook”, Newnes, 1st Edition, 2005.
4. Shrikrishna Yawale, Sangita Yawale, “Operational Amplifier Theory and Experiments”, Springer Nature Singapore, 2022.
5. Ramakant A. Gayakward, “Op-amps and Linear Integrated Circuits”, Pearson Education, 5th Edition, 2015.
6. James M. Fiore, “Opamps and Linear Integrated Circuits Concepts and Applications”, Cengage learning, 1st Edition, 2010.
7. Floyd, Buchla, “Fundamentals of Analog Circuits”, Pearson Education, 2nd Edition, 2013.

Web References

1. https://nptel.ac.in/courses/108/108/108108114/
2. http://musicfromouterspace.com/analogsynth_new/ELECTRONICS/TECHBENCH/TECHBENCH.php
3. https://www.circuitlab.com/circuit/bkg2qg/op-amp-inverting-amplifier/
4. https://electrosome.com/723-voltage-regulator/
5. https://www.electronicshub.org/how-555-timer-ic-testing-circuit-works/
6. http://www.infocobuild.com/education/audio-video-courses/electronics/op-amp-practical-applications-iiscbangalore.html

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	-	-	-	3	-	-	1	3	3	3
2	3	3	3	2	1	-	-	-	3	-	-	1	3	3	3
3	3	3	3	2	1	-	-	-	3	-	-	1	3	3	3
4	3	3	3	2	1	-	-	-	3	-	-	1	3	3	3
5	3	3	3	2	1	-	-	-	3	-	-	1	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23EEC4XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - IV**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
EEE								
Prerequisite	**-**							

Students shall choose an international certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass / Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	**10**	**90**	**100**

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23EES402**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SKILL ENHANCEMENT COURSE - II**	**0**	**0**	**2**	**-**	**100**	**-**	**100**

EEE

(Choose anyone of the below three courses)

1. MOBILE PHONE SERVICING

Course Contents:

1. Fundamentals of Mobile Phone Technology.
2. Addressing Mobile phone charging issues.
3. Assembling and disassembling of various models of mobile phones.
4. Practice of various tools and equipment used in mobile phone repairs.
5. Practice of Printed Circuit Board (Motherboard) and various components on PCB.
6. Reheating and mounting of various BGA and SMD chips.
7. Addressing Phone Freezing or Apps Crashing issues.
8. Introduction of various flasher boxes and software.
9. Unlocking of handsets through codes or software.
10. Water damaged repair techniques.
11. Addressing Quick Battery Drain problem
12. Addressing Overheating problem

2. AUTONOMOUS ROBOTICS

Course Contents:

1. Introduction, features and applications to Robotics
2. Building the PC Controlled Robot
3. Programming the PC Controlled Robot
4. Building the Line Follower Robot
5. Programming and testing of Line Follower Robot
6. Building the Obstacle Avoiding Robot
7. Programming and testing of Obstacle Avoiding Robot
8. Building the Pit Avoiding Robot
9. Programming and testing of Pit Avoiding Robot
10. Building the Light Following Robot
11. Programming and testing of Light Following Robot

3. REPAIR AND MAINTENANCE OF POWER SUPPLY, INVERTER AND UPS

Course Contents:

1. Practice of appropriate repair tools and Equipments
2. Identify, place, solder, de-solder and test different SMD discrete components
3. Rework on PCB after identifying defects from SMD soldering and de-soldering
4. Identify different front panel controls and connectors of the given power supply.
5. Open the power supply and identify major sections and power components with heat sinks.
6. Identify various input and output sockets/ connectors of the given SMPS and measure its outputs using a multimeter
7. Identify and replace the faulty components in SMPS used in TVs and PCs
8. Identify front panel control and indicators of Inverter and also understand the use of back panel sockets and connections.
9. Testing of battery mode (Battery – Inverter – Load) in interconnected system
10. Open Top cover and identify various circuit boards in Inverter and also monitor voltages at various test points.
11. Troubleshooting of inverter
12. Identify front and back panel control, indicators, sockets and connections of UPS
13. Identify various circuit boards in UPS and monitor voltages at various test points
14. Troubleshooting of UPS
15. Calculation of C rating of battery

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	Report	Presentation / Demo / Skill Test	
Marks	10	40	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **MC**			End Semester Exam Type: **-**			
Course Code	**U23EEM404**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**RIGHT TO INFORMATION AND GOOD GOVERNANCE**	**2**	**0**	**0**	**-**	**100**	**-**	**100**

(Common to ALL Branches except CSBS)

Prerequisite	**Nil**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe and analyze concept and legislative provisions related to RTI	**K2**
	CO2 Develop critical thinking skills to identify instances where public authorities have failed to meet their obligations	**K3**
	CO3 Critically assess the challenges and limitations faced by Central and State Information Commissions	**K2**
	CO4 Analyze the structure and functioning of the judiciary at different levels - local, regional, national.	**K2**
	CO5 Analyze the impact of the RTI Act on promoting transparency, accountability, and citizen empowerment in India	**K2**

UNIT – I	**Introduction**	**Periods:06**
Conceptual background - Right to know - Open Government - Transparency in governance and accountability - Right to information under the Indian Constitution - Article 19(1)(a) and Article 21 of the Constitution - Role of NGOs and movement for right to information - Right to Information Act, 2005- Scope and objectives.		**CO1**
UNIT – II	**Obligation of Public Authorities**	**Periods:06**
Obligations of public authorities: Section 4 - Designation of Public Information Officers: Section 5 - Disposal of request: Section 7 -Exemption from disclosure of information: Section 8 - Grounds for rejection to access in certain cases: Section 9 - Severability: Section 10 - Third party information: Section 11		**CO2**
UNIT – III	**Central and State Information Commission**	**Periods:06**
Constitution of Central and State Information Commissions - Terms of office and conditions of service - Removal of Chief Information Commissioner or Information Commissioner - Powers and functions of Information Commissions.		**CO3**
UNIT – IV	**Judiciary and Right to Information Act**	**Periods:06**
Protection of right to access the information- Role of the Supreme Court and High Courts – Recent attempts of dilution of the right to information Law		**CO4**
UNIT – V	**Right to Information Act 2005 and its relevance to other laws**	**Periods:06**
Public Records Act, 1993 - Whistle Blowers Protection Act, 2014 - Official Secrets Act, 1923		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Text Books

1. Virender Negi, Monika Negi, “Right to Information: Key to Good Governance”, Indu Book Services Pvt. Limited, 2019.
2. R. M. Pal, Somen Chakraborty, “Human Rights Education in India”, Indian Social Institute, 2000.
3. Sairam Bhat, “Right to Information and Good Governance - Volume 3 of NLSIU book series”, National Law School of India University, 2016.

Reference Books

1. Sairam Bhat [ed], “Right to Information and Good Governance”, NLSIU Book Series-3, 2016.
2. Sairam Bhat, “Right to Information”, Eastern Book House, 2012.
3. Praveen Dala, “Consumer Protection and Right to Information”, Central Information Commission, 2007.

Web References

1. https://archive.nptel.ac.in/courses/129/106/129106001/
2. https://onlinecourses.nptel.ac.in/noc20_lw01/preview
3. https://www.classcentral.com/course/swayam-right-to-information-and-good-governance-19988

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
2	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
3	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
4	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-
5	1	-	-	-	-	-	-	-	-	3	-	1	-	-	-

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

Dr. P. Jamuna

Department	**Management Studies**	Programme: **B. Tech.**						
Semester	**V**	Course Category Code: **HS**			*End Semester Exam Type: **TE**			
Course Code	**U23HSTC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**RESEARCH METHODOLOGY**	**2**	**0**	**0**	**2**	**25**	**75**	**100**

Common to ALL Branches

Prerequisite	Nil	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret the different types of research and explain how research methods can be used to address engineering problems	**K2**
	CO2 Discuss the research problems, conduct comprehensive literature reviews, and utilize tools and services for effective information retrieval.	**K2**
	CO3 Apply appropriate methods to design experiments, analyze data, and interpret results using both numerical and graphical techniques.	**K3**
	CO4 Analyze and apply ethical guidelines to structure and write research papers and dissertations, ensuring academic integrity and avoiding plagiarism.	**K4**
	CO5 Examine the fundamentals of intellectual property rights to protect and enforce them, with emphasis on their role in fostering innovation and entrepreneurship in engineering.	**K3**

UNIT- I	**Introduction to Research**	**Periods:06**
Meaning and Importance of Research, Types of Research: Overview of Basic, Applied, and Developmental Research, Overview of the Research Process, Defining a Research Problem: Key Considerations, Setting Research Objectives and Research Questions, Introduction to Research Design: Basic Concepts, Approaches to Research: Quantitative vs. Qualitative.		**CO1**
UNIT- II	**Problem Formulation and Literature Review**	**Periods:06**
Identifying and Formulating Research Problems, conducting a Literature Review: Essential Steps, Referencing and Citation Methods: Basic Techniques. Sources of Information: Overview of Libraries and Online Databases.		**CO2**
UNIT- III	**Research Methods and Data Analysis**	**Periods:06**
Introduction to Experimental Research, Developing Hypotheses: Basic Approach. Data Collection Methods: Sampling and Surveys, Basics of Data Analysis: Numerical and Graphical Analysis, Introduction to Inferential Statistics		**CO3**
UNIT- IV	**Writing and Presenting Research**	**Periods:06**
Preparing a Research Report: Key Sections (Abstract, Introduction, Methodology, Results, Discussion, and Conclusion). Referencing and Citation: Brief Overview.		**CO4**
UNIT-V	**Ethics and Legal aspects in research**	**Periods:06**
Ethical Considerations in Research: Introduction to Scientific Misconduct. Basics of Intellectual Property Rights - Introduction to Patents, Copyrights, and Trademarks – Case studies on ethical dilemmas in research.		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Text Books

1. Kumar, R. “Research Methodology: A Step-by-Step Guide for Beginners”, SAGE Publications, 5th Edition, 2019.
2. Ram Ahuja, “Research methods”, Rawat Publications, 2nd Edition, 2022.
3. Creswell, J. W., and Creswell, J. D. “Research Design: Qualitative, Quantitative, and Mixed Methods Approaches”, SAGE Publications, 5th Edition, 2018.

Reference Books

1. DV. Thiel, “Research methods for engineers”, Cambridge University Press, 1st Edition, 2014.
2. R. Ganesan, “Research methodology for engineers”, MJP Publishers, 2024.
3. C.Agarwal, V.Sharma, “Research methodology in sociology”, Commonwealth Publishers, 2012.
4. A. Thody, “Writing and presenting research”, SAGE Publications, 2nd Edition, 2006.
5. C.R.Kothari, “Research methodology - methods and techniques”, New Age International Publishers, 5th Edition, 2023.

Web References

1. https://conjointly.com/kb/
2. https://owl.purdue.edu/owl/research_and_citation/conducting_research/writing_a_literature_review.html
3. https://files.eric.ed.gov/fulltext/ED536788.pdf
4. https://researcheracademy.elsevier.com/
5. https://www.wipo.int/
6. https://www.scholastic.com /7-steps-to-successful-research-report.html
7. https://www.futurelearn.com/info/courses/business-research-methods- investigation.
8. https://articles.manupatra.com/article-details/Patent-Types-Laws-related-to-them-in-India

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	-	2	-	-	2	2	3	1	1	1
2	3	1	1	3	1	-	2	-	-	1	2	-	1	1	1
3	1	3	3	1	3	-	2	-	-	2	2	-	1	1	1
4	-	-	1	2	-	-	2	3	2	2	-	2	1	1	1
5	2	2	2	2	2	2	3	3	2	2	3	2	1	1	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Information Technology**	Programme: **B. Tech.**						
Semester	**V**	Course Category Code: **ES**			*End Semester Exam Type: **TE**			
Course Code	**U23ITTC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN JAVA**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Common to ALL Branches

Prerequisite	Basic knowledge of Object-Oriented Programming Principles	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Articulate the concept of Java fundamentals, OOPs and Strings	**K2**
	CO2 Demonstrate the principles of inheritance, packages and interfaces with real time applications	**K2**
	CO3 Create real time applications using exception handling and thread programming.	**K3**
	CO4 Build distributed applications using Collections and IO streams	**K3**
	CO5 Design and build simple GUI programs using AWT, Swings and build database applications	**K3**

UNIT- I	**Introduction**	**Periods:09**

Introduction: Java: History - Features - JVM - JRE - JDK - Java Compilation and Execution - Data Types - Variables, Types, Expressions, Assignment Statements, Input / Output Statements: Scanner/System class, Type Casting (Primitives to Primitives), Conditional and Iterative Control Structures - Arrays
OOPs with Java: Introduction to OOPs Concepts - Class – Objects – Methods - Access Modifiers – Creating Class and Objects, Object Life-Cycle - Garbage Collection-Constructors - this - static - Array of Objects - Nested Classes.
String: String Class- Built-in Methods - String Builder - String Buffer — **CO1**

UNIT- II	**Inheritance, Interfaces and Packages**	**Periods:09**

Inheritance: Types of Inheritance - is-a Relationship, has-a Relationship - super keyword - final keyword - Polymorphism - Method overloading and Method overriding - Abstract Class
Interfaces: Define - Extend - Implement - Access - Interfaces vs Abstract classes, Type Conversions (Primitives to Objects vice-versa) Autoboxing and Auto unboxing
Packages: Define - Create - Access - Import — **CO2**

UNIT- III	**Exception Handling and Multithreading**	**Periods:09**

Exception Handling: Exception Hierarchy - Checked and Unchecked Exceptions - try, catch, throws, throw and finally - User Defined Exceptions.
Multithreading: Thread – Life cycle – Defining and Running – Implementation Types – Thread Priorities – Thread Synchronization - Inter-Thread Communication — **CO3**

UNIT- IV	**Collections and I/O Streams**	**Periods:09**

Collections: List: Array List and Linked List. Set: Hash Set and Tree Set. Map: Hash Map – Stack – Queue. Lambda Expressions.
I/O Streams: Streams - Byte Streams and Character Streams - File Input Stream and File Output Stream - File Reader and File Writer. Object Serialization: Object Input Stream and Object Output Stream — **CO4**

UNIT-V	**GUI and JDBC**	**Periods:09**

AWT: Components - Controls - Event Handling
SWING: Swing Components - Layout Management.
JDBC: JDBC Architecture - JDBC Driver Types - Implementation of JDBC. — **CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Allen B. Downey and Chris Mayeld, “Think Java - How to Think Like a Computer Scientist”, Green Tea Press, 2nd Edition, 2020.
2. Herbert Schildt, “Java: The Complete Reference”, TMH Publishing Company Ltd, 11th Edition, 2018.
3. H.M.Dietel and P.J.Dietel, “Java How to Program”, Pearson Education/PHI, 11th Edition, 2017

Reference Books

1. Cay S. Horstmann, Gary Cornell, “Core Java Volume - I Fundamentals”, Prentice Hall, 9th Edition, 2013.
2. Sagayaraj, Denis, Karthik, Gajalakshmi, “JAVA Programming for core and advanced learners”, Universities Press Private Ltd, 2018.
3. Poaul Deitel, Harvey Deitel, “Java SE 8 for programmers”, Pearson, 3rd Edition, 2015.
4. P.J. Dietel and H.M Dietel, “Java for Programmers”, Pearson Education, 9th Edition, 2011.
5. Steven Holzner, “Java 2 Black book”, Dreamtech Press, 2011.

Web References

1. https://www.javatpoint.com/java-tutorial
2. https://docs.oracle.com/en/java/
3. https://www.studytonight.com/java/
4. https://onlinecourses.nptel.ac.in/

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	1	-	1	-	-	-	-	-	-	2	2	2	1
2	3	3	3	-	3	-	-	-	-	-	-	2	2	2	1
3	3	3	3	1	3	-	-	-	-	-	-	2	2	2	1
4	3	3	3	1	3	-	-	-	-	-	-	2	2	2	1
5	3	3	3	1	3	-	-	-	-	-	-	2	2	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**V**	Course Category Code: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23EET509**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL MEASUREMENTS AND INSTRUMENTATION**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Electrical Machines, Electronics, Electric Circuit Analysis	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the characteristics of measuring instruments and their errors.	**K2**
	CO2 Demonstrate the construction, working of analog meters and their proficient use.	**K3**
	CO3 Differentiate the various types of digital meters and its measurement.	**K2**
	CO4 Illustrate the construction and working principle of various types of display units and bridges for R, L and C measurement.	**K3**
	CO5 Apply the various types of transducers used for physical measurements.	**K3**

UNIT- I	**Introduction to Measurement and Error**	**Periods:09**
Functional elements of Generalized measurement system - Types of measurement - Classification of instruments - Static and Dynamic characteristics of instruments - Mean, Standard Deviation - Error - Accuracy, Precision, Sensitivity, Linearity, Resolution, Hysteresis, Threshold, Input impedance - loading effects - Probability of errors - Errors in Measurements.		**CO1**
UNIT- II	**Analog Instruments**	**Periods:09**
Essential requirements of an instrument - Ammeter and Voltmeter - Moving coil - Moving Iron - Extension of voltmeter and ammeter range - Electro dynamo meter type Wattmeter - Induction type Energy meter - Instrument Transformers: Construction, phasor diagrams - Magnetic measurements – Determination of B-H curve and measurements of iron loss.		**CO2**
UNIT- III	**Digital Instruments**	**Periods:09**
Digital Voltmeter and its design - Digital multimeter - Digital ohmmeter, Capacitance meter - Impedance meters (Polar and Cartesian types) - Digital Frequency Meter – Introduction to Phasor Measurement Units (PMU).		**CO3**
UNIT- IV	**Bridges and Display Units**	**Periods:09**
Bridges: Measurement of resistances – D.C potentiometer - Wheat stone, Kelvin and Kelvin's Double bridge - A.C bridges for measurement of L and C - Maxwell, Anderson, Hay, Wein and Schering bridges – Measurement of earth resistance. **Display Units:** CRO, DSO, LED, and LCD.		**CO4**
UNIT-V	**Transducers**	**Periods:09**
Transducers - Definition and classification - **Linear Displacement**: Resistive Potentiometers, Strain gauge, LVDT, Capacitive, Piezoelectric - **Position:** Synchro Transmitter and receiver – **Speed:** Magnetic and photo electric pickup transducer - **Temperature:** Thermistors, thermocouple - **Flow:** Electromagnetic, Ultrasonic - **Density:** Hydrometer - **Voltage, Current and Power:** Hall Effect transducer.		**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. A.K. Sawhney, "A Course in Electrical & Electronic Measurements and Instrumentation", Dhanpat Rai and Co., New Delhi, 21st Edition, 2023.
2. J. B. Gupta, "A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, Delhi, 20th Edition, 2018.

Reference Books

1. David Bell, "Electronic Instrumentation and Measurements", Oxford University Press, 3rd Edition, 2013.
2. A. J. Bouwens, "Digital Instrumentation", Tata McGraw Hill Publications, 16th Reprint Edition, 2008.
3. H.S. Kalsi, "Electronic Instrumentation", Tata McGraw Hill Education, 4th Edition, 2019.
4. C.S. Rangan, G.R. Sharma and V. S. V. Mani, "Instrumentation Devices and Systems", Tata McGraw Hill Book Co., 3rd Edition, 2008.

Web References

1. https://www.omega.de/green/pdf/CAP_LEV_MEAS.PDF
2. https://nptel.ac.in/courses/108/105/108105153/
3. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html
4. http://vlabs.iitkgp.ernet.in/asnm/
5. https://www.youtube.com/watch?v=xLjk5DrScEU
6. http://www.wisegeek.com/what-are-transducers.htm

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	1	-	-	-	-	-	-	1	2	3	3
2	3	2	2	2	1	-	-	-	-	-	-	1	2	3	3
3	3	2	2	2	1	-	-	-	-	-	-	1	2	3	3
4	3	2	2	2	1	-	-	-	-	-	-	1	2	3	3
5	3	2	2	2	1	-	-	-	-	-	-	1	2	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**V**	Course Category: **PC**			End Semester Exam Type :**TE**			
Course Code	**U23EET510**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MICROPROCESSOR AND MICROCONTROLLER**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								
Prerequisite	Electronics I, Programming in C							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret the architecture of 8085 microprocessor and write assembly language programs.	**K2**
	CO2 Examine the architecture and functionality of the PIC16F microcontroller.	**K3**
	CO3 Apply embedded C programs for PIC16F microcontroller based applications.	**K3**
	CO4 Demonstrate microcontroller based real-time applications.	**K3**
	CO5 Differentiate ARM7 Processor with PIC 16F Microcontroller on various areas of applications.	**K2**

UNIT – I	**Architecture and Programming Of 8085 Microprocessor**	**Periods:09**
8085 Microprocessor: Architecture, Addressing modes, Instruction set - Assembly language programs - Machine cycles and Timing diagrams. Application: Interfacing of stepper motor control with 8085 microprocessor.		**CO1**
UNIT – II	**PIC16F Microcontroller**	**Periods:09**
Introduction to Microcontroller - RISC and CISC programmer's model - Selection criteria for microcontroller - Overview of PIC family – **PIC16F877A:** Architecture – Pin configuration – Status register – Special function registers – Memory organization - On-Chip peripherals - Fuse bits of PIC.		**CO2**
UNIT – III	**PIC16F Programming**	**Periods:09**
Data types and assembler directives - Addressing modes - Instruction set - Bit addressability - MACROs - Intel HEX file - I/O Port - Timer - PWM - ADC Programming - **Serial Port Communication :** UART, I2C, SPI.		**CO3**
UNIT – IV	**PIC 16F Peripherals**	**Periods:09**
Peripheral Interfacing: LCD and Keyboard - Relay - Stepper and DC Motor control - LM35 Temperature sensor - Ultrasonic sensor – IR sensor – PIR sensor.		**CO4**
UNIT – V	**ARM7 Microcontroller**	**Periods:09**
ARM Programmer's model - Registers - Processor modes - Pipeline - ARM processor families - Instruction sets - Thumb Instruction Set - Instruction Scheduling - GPIO port - Timer - PWM - DAC - Introduction to Raspberry Pi.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Krishnakant, "Microprocessors and Microcontrollers: Architecture, Programming, and System Design 8085, 8086, and PIC Microcontrollers", PHI Learning Pvt. Ltd, 2nd Edition, 2022.
2. Muhammad Ali Mazidi, Rolin McKinlay, and Danny Causey, "PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18", Pearson Education, 2nd Edition, 2021.
3. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide: Designing and Optimizing System Software" Morgan Kaufmann Publishers, 2004

Reference Books

1. Han-Way Huang, "PIC Microcontroller: An Introduction to Software and Hardware Interfacing", Cengage Learning, 2nd Edition, 2021.
2. Muhammad Ali Mazidi, Shujen Chen, and Eshragh Ghaemi, "ARM Microprocessor Systems: Cortex-M Architecture, Programming, and Interfacing "Pearson Education, 1st Edition, 2018
3. Mark Fisher, "ARM Cortex-M Assembly Programming for Embedded Programmers", Newnes (an imprint of Elsevier), 1st Edition, 2022.
4. Eben Upton, Gareth Halfacree "Raspberry Pi User Guide "John Wiley & Sons, 4th Edition , 2016
5. K.U. Nithyananda Shetty, "The 8085 Microprocessor: Architecture, Programming, and Interfacing", Cengage Learning, 1st Edition, 2023.

Dr. P. Jamuna

Web References

1. https://nptel.ac.in/courses/108105102
2. https://pic-microcontroller.com/chapter-1-pic16f887-microcontroller-device-overview/
3. https://deepbluembedded.com/pic-programming-tutorials/
4. https://www.udemy.com/course/programming-on-pic16f877a-microcontroller-from-scratch/
5. https://www.raspberrypi.org/courses/learn-python

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	-	-	-	-	-	-	1	3	3	3
2	3	3	2	2	2	-	-	-	-	-	-	1	3	3	3
3	3	2	3	2	3	-	-	-	-	-	-	1	3	3	3
4	3	3	3	2	3	-	-	-	-	-	-	1	3	3	3
5	3	3	3	2	3	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Information Technology**	Programme: **B.Tech.**						
Semester	**V**	Course Category Code: **ES**			*End Semester Exam Type: **LE**			
Course Code	**U23ITPC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROGRAMMING IN JAVA LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

Common to ALL Branches

Prerequisite	Basic concepts of Object-Oriented Programming Principles	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Apply and practice logical formulations to solve simple problems leading to specific applications.	**K3**
	CO2 Demonstrate the use of inheritance, interface and package in relevant applications	**K3**
	CO3 Implement robust application programs in Java using exception handling and multithreading	**K3**
	CO4 Build java distributed applications using Collections and IO streams.	**K3**
	CO5 Implement Graphical User Interface based application programs by utilizing event handling features and Swing in Java.	**K3**

List of Exercises:

1. Develop simple programs using java
2. Develop a java program that implements class and object.
3. Write a java program to find the frequency of a given character in a string
4. Write a java program to demonstrate inheritance and interfaces.
5. Develop a java program that implements the Packages.
6. Create java applications using Exception Handling for error handling.
7. Develop a simple real life application program to illustrate the use of Multi-Threads.
8. Implement simple applications using Collections.
9. Develop application using the concept of I/O Streams
10. Write a Java Program to demonstrate AWT and Swing Components
11. Develop a simple application and use JDBC to connect to a back-end database.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:30**

Reference Books

1. Allen B. Downey and Chris May eld, “Think Java - How to Think Like a Computer Scientist”, Green Tea Press, 2nd Edition, 2020
2. Sagayaraj, Denis, Karthik, Gajalakshmi, “JAVA Programming for core and advanced learners”, Universities Press Private Limited, 2018
3. Cay. S. Horstmann and Gary Cornell, “Core Java 2”, Vol 2, Advanced Features, Pearson Education, 7th Edition, 2010.

Web References

1. http://www.ibm.com/developerworks/java/
2. http://docs.oracle.com/javase/tutorial/rmi/.
3. IBM’s tutorials on Swings, AWT controls and JDBC.
4. https://www.edureka.co/blog.
5. https://www.geeksforgeeks.org.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
2	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
3	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
4	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1
5	3	2	1	1	3	-	-	-	-	-	-	-	3	2	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Dr. P. Jamuna

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**V**	Course Category Code: **PC**			*End Semester Exam Type: **LE**			
Course Code	**U23EEP507**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
EEE								

Prerequisite	Electrical Machines Laboratory, Electronics Laboratory	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Apply concepts of electrical measurement for practical implementations in engineering applications	**K3**
	CO2 Analyze the magnetization characteristics and hysteresis loss of Iron specimen using BH curve.	**K4**
	CO3 Classify single phase and three phase energy meters used in domestic and commercial applications	**K4**
	CO4 Examine the range of extension of ammeter and voltmeter	**K3**
	CO5 Categorize the use of transducers for the measurements of physical quantities by choosing the right transducers, signal conditioning, and data acquisition methods	**K4**

List of Experiments:

1. (a) Measurement of an unknown resistance using Wheatstone bridge
   (b) Measurement of insulation resistance by Megger
2. (a) Measurement of unknown capacitance and loss angle of capacitor using Schering Bridge.
   (b) Measurement of unknown inductance and Q-factor using Maxwell Bridge.
3. Extension of the ranges of Ammeter and Voltmeter using Shunt / Series resistance
4. Calibration of single-phase Energy meter using direct loading method.
5. Calibration of three-phase Energy meter using direct loading method.
6. Determination of B-H Curve for the magnetic material specimen to obtain its hysteresis loss.
7. (a) Measurement of ratio error and phase error of a Current Transformer.
   (b) Measurement of ratio error and phase error of a potential transformer
8. Characteristics of Temperature Transducers using RTD, Thermistor and Thermocouple
9. Measurement of Displacement using transducers.
10. Measurement of Voltage, Current and Power using Hall Effect transducer.
11. Characteristics of Optical Transducers using LDR and Phototransistor
12. Measurement of Position using Synchro Transmitter and Receiver.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:30**

Reference Books

1. A.K. Sawhney, “A Course in Electrical & Electronic Measurements and Instrumentation”, Dhanpat Rai and Co., New Delhi, 21st Edition, 2023.
2. William D. Coopers and Albert D. Helfrick, “Modern Electronic instrumentation and Measurements Techniques”, Pearson Education India, 1st Edition, January 2015.
3. E. W. Golding and F. C. Widdis, “Electrical Measurements and Measuring Instruments”, Medtech Publication, 6th Edition, 2019.
4. H.S. Kalsi, “Electronic Instrumentation”, Tata McGraw-Hill Education, 4th Edition, 2019.
5. C. D. Johnson, “Process Control Instrumentation Technology”, Pearson Education India, 8th Edition, 2015.
6. Instrumentation and Measurement, IEEE Transactions.
7. Measurement: Journal of the International Measurement Confederation

Web References

1. https://www.omega.de/green/pdf/CAP_LEV_MEAS.PDF
2. https://archive.nptel.ac.in/courses/108/105/108105064/
3. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html
4. http://vlabs.iitkgp.ernet.in/asnm/
5. http://www.wisegeek.com/what-are-transducers.html

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	2	-	-	-	3	-	-	1	3	2	2
2	3	2	2	2	2	-	-	-	3	-	-	1	3	2	2
3	3	2	2	2	2	-	-	-	3	-	-	1	3	2	2
4	3	2	2	2	2	-	-	-	3	-	-	1	3	2	2
5	3	2	2	2	2	-	-	-	3	-	-	1	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**V**	Course Category: **PC**			End Semester Exam Type : **LE**			
Course Code	**U23EEP508**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MICROPROCESSOR AND MICROCONTROLLER LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
	EEE							
Prerequisite	**Electronics I, Programming in C**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Develop assembly language program for microprocessor 8085.	**K3**
	CO2 Design and implement embedded system applications using PIC microcontroller	**K4**
	CO3 Analyze and interface different peripherals with microcontrollers for real-time applications	**K3**
	CO4 Demonstrate the use of on-chip peripherals for efficient data processing and control.	**K4**
	CO5 Interface ARM7 Processor and Raspberry Pi with external Peripheral devices	**K4**

List of Experiments:

Microprocessor Experiments using 8085:

1. 8 bit - Addition, Subtraction, Multiplication and Division
2. Assembly Language Programming: Subroutines, parameter passing to subroutines

Microcontroller Experiments using PIC:

3. a) Timer to generate accurate delay
   b) Timer to generate waveforms
4. Seven Segment LED Display interfacing
5. a) 16x2 LCD interfacing
   b) 4x4 matrix keyboard interfacing
6. DC Motor Interfacing with forward and reverse operation
7. Stepper motor interfacing
8. Relay interfacing
9. PIC on-chip ADC for interfacing analog sensors

Microcontroller Experiments using ARM7:

10. Interfacing with PC via UART interface
11. Interfacing of PWM based LED lighting board
12. ARM7 on-chip DAC interfacing

Microprocessor Experiments using Raspberry Pi:

13. Study on Raspberry Pi

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Ramesh Gaonkar, “Microprocessor Architecture, Programming, and Applications with 8085” , Penram International Publishing, 7th Edition, 2022.
2. Muhammad Ali Mazidi, Rolin McKinlay, and Danny Causey, “PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18" , Pearson Education, 2nd Edition, 2021.
3. Tim Wilmshurst, “Designing Embedded Systems with PIC Microcontrollers: Principles and Applications" , Newnes, 3rd Edition, 2022
4. Lyla B. Das, “Embedded Systems: An Integrated Approach” Pearson Education, 2nd Edition, 2023
5. Han-Way Huang, “PIC Microcontroller: An Introduction to Software and Hardware Interfacing”, Cengage Learning, 2nd Edition, 2021.

Web References

1. https://pic-microcontroller.com/
2. https://www.electronicwings.com/arm7/lpc2148-dac-digital-to-analog-converter
3. https://www.raspberrypi.org/courses
4. https://deepbluembedded.com/creating-new-project-with-mplab/
5. https://circuitdigest.com/microcontroller-projects/interfacing-stepper-motor-with-pic16f877a

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	3	-	-	1	3	3	3
2	3	3	3	2	3	-	-	-	3	-	-	1	3	3	3
3	3	3	3	2	3	-	-	-	3	-	-	1	3	3	3
4	3	3	3	2	3	-	-	-	3	-	-	1	3	3	3
5	3	3	3	2	3	-	-	-	3	-	-	1	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**V**	Course Category Code: **PA**				*End Semester Exam Type: **-**		
Course Code	**U23EEW501**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MICRO PROJECT**	**0**	**0**	**2**	**1**	**100**	**-**	**100**
EEE								
Prerequisite	Electrical Engineering, Electronics							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Identify the problem statement for the micro project work through the literature survey	**K2**
	CO2	Select the proper components as per the requirements of the design/ system**.**	**K4**
	CO3	Apply the acquainted skills to develop final model / system	**K3**

There shall be a Micro Project, which the student shall pursue as a team consists of maximum 4 students during the third year, fifth semester. The aim of the micro project is that the student has to understand the real time hardware / software applications. The student should gain a thorough knowledge in the problem he/she has selected and in the hardware / software he/she using in the Project. The Micro-project is an application that should be formally initiated and should be developed and also to be implemented by the respective team.

The Micro Project shall be submitted in a report form along with the hardware model / software developed, duly approved by the department internal evaluation committee. It shall be evaluated for 100 marks as Continuous Assessment. The department internal evaluation committee shall consist of faculty coordinator, supervisor of the project and a senior faculty member of the department. There shall be two reviews that will be considered for assessing a Micro Project work with weightage as indicated evaluation Methods.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

COs/POs/PSOs Mapping

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	3	2	2	2	-	-	-	-	3	3	-	1	1	1	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	2	2
3	3	2	2	1	-	2	-	-	3	3	3	1	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Method

Assessment	**Review 1**			**Review 2**				**Total Marks**
	Novelty	**Presentation**	**Viva**	**Presentation**	**Demonstration**	**Viva**	**Report**	
Marks	10	20	10	20	20	10	10	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**V**	Course Category: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23EEC5XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - V**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
Prerequisite	**-**							

Students shall choose an International / Reputed organization certification course of 40-50 hours duration specified in the curriculum (It is mandatory to do a minimum of six courses) which will be offered through the Centre of Excellence. These courses have no credit and will not be considered for CGPA calculation.

(i) Certification Courses are required to be completed to fulfil the degree requirements. All Certification courses are assessed internally for 100 marks.

(ii) The Course coordinator handling the course will assess the student through attendance and MCQ test, and declare the student as “pass” on satisfactory completion. A letter grade “P” is awarded to declare pass.

(iii) The marks scored in these courses will not be taken into consideration for the SGPA / CGPA calculations in the grade sheet.

Evaluation Methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	**10**	**90**	**100**

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**V**	Course Category Code: **MC**			*End Semester Exam Type: **-**			
Course Code	**U23EEM505**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**	**2**	**0**	**0**	**-**	**100**	**-**	**100**

Common to ALL Branches

Prerequisite	**-**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Familiarize with the philosophy of Indian culture	**K2**
	CO2 Distinguish the Indian languages and literature	**K2**
	CO3 Describe the philosophy of ancient, medieval and modern India	**K2**
	CO4 Illustrate the information about the fine arts in India	**K2**
	CO5 Describe the contribution of scientists of different eras	**K2**

UNIT- I	**Introduction To Culture**	**Periods:06**
Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India		**CO1**
UNIT- II	**Indian Languages, Culture and Literature**	**Periods:06**
Indian Languages and Literature - I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India Indian Languages and Literature-II: Northern Indian languages & literature		**CO2**
UNIT- III	**Religion and Philosophy**	**Periods:06**
Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)		**CO3**
UNIT- IV	**Fine Arts in India (Art, Technology and Engineering)**	**Periods:06**
Indian Painting, Indian handicrafts, Music, divisions of Indian classical music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India		**CO4**
UNIT-V	**Education System in India**	**Periods:06**
Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India		**CO5**

Lecture Periods:30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:30**

Reference Books

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”, ISBN: 81246033375, 2005
2. “Science in Samskrit”, Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450 494-X, 200
4. S. Narain, “Examinations in ancient India”, Arya Book Depot, 1993
5. M. Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN 13: 978 - 8120810990, 2014

Web References

1. https://nptel.ac.in/courses/109/104/109104102/
2. https://nptel.ac.in/courses/101/104/101104065/
3. https://nptel.ac.in/courses/109/108/109108158/
4. https://nptel.ac.in/courses/109/106/109106059/
5. https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-ae01/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
2	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
3	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
4	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Dr. P. Jamuna

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23EET611**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**POWER SYSTEM ANALYSIS**	**2**	**1**	**0**	**3**	**25**	**75**	**100**
EEE								

Prerequisite	Engineering Mathematics, Electrical Machines, Control Systems, Transmission and Distribution	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret the network matrices in the power systems and apply reduction techniques for network changes.	**K2**
	CO2 Apply the iterative techniques to solve the power flow analysis used in power system planning.	**K3**
	CO3 Explain the Sequence networks using positive, negative and zero sequence network	**K2**
	CO4 Predict appropriate circuit breakers based on short circuit capacity.	**K3**
	CO5 Examine stability problems in power system during pre-fault and post-fault conditions	**K3**

UNIT- I	**Modeling of Power System Components**	**Periods:09**
Need for system planning and operational studies - Power system components – Representation - Single line diagram - Per unit quantities - P.U. impedance / reactance diagram - Formulation of network matrices for the power systems - Bus impedance and bus admittance matrices - Reduction techniques on network matrices for network changes - Z bus Building algorithm.		**CO1**
UNIT- II	**Load Flow Studies**	**Periods:09**
Classification of buses - formulation of load flow problem - Load flow solution by Gauss - Seidal, Newton - Raphson and Fast Decoupled Load Flow (FDLF) Analysis - Comparison - Computation of slack bus power, transmission loss and line flow - Voltage Control Methods - Tap-changing and phase - shifting transformers.		**CO2**
UNIT- III	**Symmetrical Components and Sequence Networks**	**Periods:09**
Symmetrical components – Simple problems to calculate symmetrical voltages and currents - Sequence networks - positive, negative and zero sequence networks - Sequence networks of Series impedance, loads and Rotating machines – Advantages and Limitations.		**CO3**
UNIT- IV	**Fault Analysis**	**Periods:09**
Need for fault analysis - Types of faults - Symmetrical fault analysis through bus impedance matrix - Analysis of unsymmetrical faults- LG, LL and LLG - Analysis of simultaneous unbalanced short circuit and open conductor faults in power systems – short circuit capacity – circuit breaker selection - Representation of various types of faults in sequence networks.		**CO4**
UNIT-V	**Stability Studies**	**Periods:09**
Definition - Importance of stability analysis- classifications - Steady state and transient stability - Angle and voltage stability - Single Machine Infinite Bus (SMIB) system - swing equation – Swing Curve - Equal area criterion - Critical clearing angle and time - Factors affecting stability -Methods of improving transient stability. Introduction to automatic voltage regulator systems.		**CO5**

Lecture Periods:30	**Tutorial Periods: 15**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Hadi Saadat, “Power System Analysis”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 3rd Edition, 2010
2. D. P. Kothari and I. J. Nagrath, “Power System Engineering”, Tata McGraw-Hill Education, 3rd Edition, 2019.
3. P. Kundur, “Power System Stability and Control”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 10th Reprint, 2013

Reference Books

1. J. Duncan Glover, Mulukutla S. Sarma, Thomas J. Overbye, “Power System Analysis and Design”, Cengage Learning, 7th Edition, 2022.
2. John J. Grainger, Jr. William D. Stevenson, “Power System Analysis”, McGraw Hill Education (India) Private Limited, 2nd Edition, 2021.
3. M. A. Pai, “Computer Techniques in Power System Analysis”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2014.

Web References

1. https://nptel.ac.in/courses/108/105/108105067/
2. https://nptel.ac.in/courses/108/107/108107127/
3. https://pserc.wisc.edu/webinars/systems_webinars.aspx
4. https://www.classcentral.com/course/swayam-power-system-analysis-14243
5. https://pypsa.readthedocs.io/en/latest/

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	3	1	-	-	-	-	-	1	3	2	2
2	3	3	2	2	3	1	-	-	-	-	-	1	3	2	2
3	3	3	2	2	3	1	-	-	-	-	-	1	3	2	2
4	3	3	2	2	3	1	-	-	-	-	-	1	3	2	2
5	3	3	2	2	3	1	-	-	-	-	-	1	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23EET612**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**EMBEDDED SYSTEM**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								
Prerequisite	**Programming in C, Microprocessor and Microcontroller**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the basic building process of embedded system.	**K2**
	CO2 Describe any type of Microcontroller Architecture in detail.	**K2**
	CO3 Apply the instruction sets to program STM32 ARM Processor using Embedded C.	**K3**
	CO4 Experiment interfacing the hardware and software for any type of microcontroller-based product design.	**K3**
	CO5 Interpret the concepts of RTOS in accessing shared resources for optimized CPU performance, timing-based operations, video and audio streaming etc.	**K2**

UNIT- I	**Overview of Embedded Systems**	**Periods:09**
Basics of Embedded Systems - Classification - Characteristics and Requirements - Challenges and Design issues - I/O Devices: Types and Examples - Synchronous, ISO-Synchronous and Asynchronous Communication - Parallel Device Ports - Applications.		**CO1**
UNIT- II	**STM32 ARM Processor Architecture**	**Periods:09**
Architecture – Pin configuration - ARM Programmer's model - Processor modes - Core Registers - Memory map - Unaligned Memory Accesses - Bit-banding – Pipeline - ARM Memory Organization		**CO2**
UNIT- III	**STM32 ARM Processor Programming**	**Periods:09**
Thumb-2 Instruction Sets – Programming Tools: STM32 Cube Programmer - GPIO programming - Interrupts and Exceptions Handling - Timer programming -Pulse Width Modulation programming – Direct Memory Access programming		**CO3**
UNIT- IV	**STM32 ARM Processor Peripherals**	**Periods:09**
Introduction - UART, SPI and I2C - LCD and Keyboard Interfacing - Seven segment LED - Relay interfacing - ADC and DAC - Temperature sensor - Stepper and DC Motor control.		**CO4**
UNIT - V	**RTOS for Embedded Systems**	**Periods:09**
Introduction to RTOS - Characteristics - Tasks and Task Scheduler - Task states - Scheduling policies - FreeRTOS - Interrupt Service Routines - Semaphores and its types - Inter process communication mechanisms.		**CO5**

Lecture Periods:45	**Tutorial Periods:-**	**Practical Periods:-**	**Total Periods:45**

Text Books

1. Muhammad Ali Mazidi, Shujen Chen, Eshragh Ghaemi, "STM32 Arm Programming for Embedded Systems: Using C Language with STM32 Nucleo", MicroDigitalEd., 1st Edition, 2020.
2. Majid Pakdel, "Advanced Programming with STM32 Microcontrollers" Elektor International Media BV, United Kingdom, 1st Edition, 2020.
3. Brian Amos, "Hands-On RTOS with Microcontrollers: Building Real-time Embedded Systems Using Free RTOS, STM32 MCUs, and SEGGER Debug Tools", Thomas Learning, 1st Edition, 2020.

Reference Books

1. Yifeng Zhu, "Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language", E-Man Press LLC, 4th Edition, 2023.
2. Iresh A. Dhotre, "Embedded and Real time Systems", Technical Publications, Pune, 2nd Edition, 2023.
3. Raj Kamal, "Embedded system - Architecture, Programming, Design", Tata McGraw Hill, 3rd Edition, 2016.
4. Agus Kurniawan, "Getting Started With STM32 Nucleo Development", Agus Kurni, 1st Edition, 2016.
5. Carmine Noviello, "Mastering STM32", Lean Publishing, 2nd Edition, 2022.

Web References

1. https://developer.arm.com/architectures/learn-the-architecture/introducing-the-arm-architecture/single-page
2. https://nptel.ac.in/courses/108102045/
3. https://www.eeweb.com/app-notes/tags/arm
4. https://en.wikibooks.org/wiki/Embedded_Systems/Real-Time_Operating_Systems
5. https://www.dejazzer.com/coen4720/index.html
6. https://archive.nptel.ac.in/courses/106/105/106105193/

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	3	3	2	-	-	-	-	-	2	3	3	3
2	3	2	3	3	3	2	-	-	-	-	-	2	3	3	3
3	3	2	3	3	3	2	-	-	-	-	-	2	3	3	3
4	3	2	3	3	3	2	-	-	-	-	-	2	3	3	3
5	3	2	3	3	3	2	-	-	-	-	-	2	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VI**	Course Category Code: **PC**			*End Semester Exam Type: **TE**			
Course Code	**U23EET613**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**POWER ELECTRONICS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								
Prerequisite	**Electronics and Electric Circuit Analysis**							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Explain the switching characteristics of Power Devices used for Power Conversion.	**K2**
	CO2	Illustrate the performance of control Rectifiers in continuous and discontinuous modes.	**K3**
	CO3	Interpret the operation and analysis of DC to DC Converters	**K2**
	CO4	Outline the operating principles of various types of DC to AC Converters.	**K2**
	CO5	Apply the concept of AC to AC Converters for the various applications	**K3**

UNIT – I	**POWER SEMI-CONDUCTOR DEVICES**	**Periods: 09**
Switching characteristics of MOSFET, IGBT, SCR, TRIAC and GTO. Turn on and Turn off methods of SCR – Protection circuits – Triggering circuits.		**CO1**
UNIT – II	**AC - DC CONVERTERS**	**Periods: 09**
Operation and analysis of single and three phase controlled rectifiers – half and fully controlled Converters with R, RL and RLE loads - Effect of source inductance on controlled rectifiers - Power factor and harmonic improvement methods - twelve pulse converter, Dual converter- circulating and non-circulating current mode.		**CO2**
UNIT – III	**DC – DC CONVERTERS**	**Periods: 09**
Principles of step down and step up chopper – Class A, B, C, D and E chopper, voltage commutated, current commutated chopper, multi-phase chopper, principle of operation of buck, boost and buck boost regulators - switching schemes.		**CO3**
UNIT – IV	**DC – AC CONVERTERS**	**Periods: 09**
Single phase and three phase voltage source inverters – Voltage control and harmonic reduction techniques – Capacitor commutated current source inverter and auto sequential current source inverter.		**CO4**
UNIT – V	**AC – AC CONVERETERS**	**Periods: 09**
AC Voltage Controllers: Single phase and Three-phase - Control strategy - **Cycloconverters:** Single phase step-up/step-down midpoint and bridge type cyclo-converters – Three phase cyclo-converters. **Applications:** Regulated Power Supply, UPS, Solid-State motor starter.		**CO5**

Lecture Periods: 45	**Tutorial Periods:-**	**Practical Periods:-**	**Total Periods: 45**

Text Books

1. M.H. Rashid, “Power Electronics: Circuits, Devices and Applications”, Pearson Education, New Delhi, 4th Edition, 2023
2. P. S. Bimbhra, “Power Electronics”, Khanna Publishers, New Delhi, 7th Edition, 2022.

Reference Books

1. Ned Mohan, M. Underland, William P. Robbins, “Power Electronics Converters, applications and design”, John Wiley & sons, Singapore, 3rd Edition, 2003.
2. M. D. Singh, K. B. Khanchandani, “Power Electronics”, Tata McGraw Hill, New Delhi, 2nd Edition, 2007.
3. Cyril W. Lander, “Power Electronics”, McGraw Hill Book Company, 3rd Edition, 1993.
4. L. Umanand, “Power Electronics: Essentials and Applications”, Willey Publisher, 2nd Edition, 2019.

Web References

1. https://www.tutorialspoint.com/power_electronics/index.htm
2. https://www.allaboutcircuits.com/technical-articles/a-review-on-power-semiconductor-devices/
3. https://www.electrical4u.com/concept-of-power-electronics/
4. https://nptel.ac.in/courses/108/101/108101038/
5. https://nptel.ac.in/courses/108/102/108102145/

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	1	3	3	3
2	3	3	3	2	3	-	-	-	-	-	-	1	3	3	3
3	3	3	3	2	3	-	-	-	-	-	-	1	3	3	3
4	3	3	3	2	3	-	-	-	-	-	-	1	3	3	3
5	3	3	3	2	3	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VI**	Course Category: **PC**			End Semester Exam Type: **TE**			
Course Code	**U23EEB603**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL MACHINE DESIGN**	**2**	**0**	**2**	**3**	**50**	**50**	**100**

EEE

Prerequisite	Electromagnetic Theory, Electrical Machines	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret the transformer design by considering various factors for real time applications.	**K2**
	CO2 Examine and apply the optimal design for three phase induction motor.	**K3**
	CO3 Apply design principles to develop synchronous machines and turbo alternators for large-scale power generation.	**K3**
	CO4 Demonstrate the transformer design using software simulation.	**K3**
	CO5 Analyze the performance of Induction machine and synchronous machine using software simulation.	**K4**

UNIT – I	**Introduction and Design of Transformers**	**Periods:10**
Major considerations in Electrical Machine Design – Materials for Electrical apparatus – Calculation of Magnetic circuits. **Design of Transformers:** Construction – Output Equation (1-ϕ and 3-ϕ) – Expression for volts/ turn, estimation of no. of turns – choice of specific loadings – Overall dimensions – design of yoke, core, winding for core and shell type transformers – Estimation of No load current and Voltage regulation – Temperature rise in Transformers – Design of Tank and cooling tubes.		**CO1**
UNIT – II	**Design of Three Phase Induction Motors**	**Periods:10**
Construction - Output equation – Main dimensions – choice of specific loadings – **Design of stator:** Design of stator slots and Winding – Length of airgap – **Design of squirrel cage rotor:** Estimation of Number of rotor slots – Design of Rotor Bars and end Ring – wound rotor – **Operating characteristics:** Magnetizing current – Short circuit current.		**CO2**
UNIT – III	**Design of Synchronous Machines**	**Periods:10**
Construction – Output equations – choice of specific loadings – Design of salient pole machines – Short circuit ratio – Armature design – Estimation of air gap length – Design of salient and non-salient pole rotors – Design of damper winding – Determination of full load field MMF – Design of field winding – Design of turbo alternators.		**CO3**
UNIT – IV	**Machine Design Practice I**	**Periods:15**
1. Simulation of Magnetic Circuits 2. Design of solenoid 3. Design of field system 4. Transformer Electrical and Thermal design 5. Complete design of Single phase transformer and performance evaluation 6. Complete design of Three phase transformer and performance evaluation		**CO4**
UNIT – V	**Machine Design Practice II**	**Periods:15**
1. Stator design of AC Machine 2. Rotor design of Induction Motor 3. Analysis of core loss in Induction Motors 4. Complete design of an Induction Motor and performance evaluation 5. Complete design of a Synchronous Machine and performance evaluation 6. Design of PMSM		**CO5**

Lecture Periods: 30	**Tutorial Periods:**	**Practical Periods: 30**	**Total Periods: 60**

Text Books

1. A.K. Sawhney "A Course in Electrical Machine Design", Dhanpat Rai & Sons, New Delhi, 6th Edition, 2016.
2. M. V. Deshpande, "Design and Testing of Electrical Machines", PHI learning Pvt. Ltd, 3rd Edition, 2010.
3. S. K. Sen, "Principles of Electrical Machine Designs with Computer Programmes", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 2nd Edition, 2011.

Dr. P. Jamuna

Reference Books

1. Shanmugasundaram, G. Gangadharan, R. Palani, "Electrical Machine Design Data Book", New Age International Pvt. Ltd., 2nd Edition, 2015.
2. Marius Rosu, Ping Zhou, Dingsheng Lin, Dan Ionel, Mircea Popescu, Frede Blaabjerg, Vandana Rallabandi, and David Staton. "Multiphysics Simulation by Design for Electrical Machines, Power Electronics, and Drives" IEEE Press Series on Power and Energy Systems, Wiley, 1st Edition, 2018
3. A.Nagoor kani, "A Simplified text in Electrical Machine Design", RBA publications, 3rd Edition, 2022.
4. Thomas A. Lipo, "Introduction to AC Machine Design", John wiley & sons inc., 1st Edition, 2017.
5. K. M. Vishnumurthy, "Computer aided design of electrical machines", B S Publications, 1st Edition, 2015.

Web References

1. https://archive.nptel.ac.in/courses/108/105/108105155/
2. https://nptel.ac.in/courses/108/106/108106023.
3. https://www.windings.com/technicalreference/basicmotordesigntutorial.
4. https://ndl.iitkgp.ac.in/homestudy/engineering.
5. http://electricalengineeringportal.com/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
1	3	3	3	2	3	-	-	-	2	-	-	2	3	3	3
2	3	3	3	2	3	-	-	-	2	-	-	2	3	3	3
3	3	3	3	2	3	-	-	-	2	-	-	2	3	2	3
4	3	3	3	2	3	-	-	-	2	-	-	2	3	2	3
5	3	3	3	2	3	-	-	-	2	-	-	2	3	2	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM) – Maximum 50 Marks										End Semester Examination (ESE) Marks (Theory)	Total Marks
	Continuous Assessment (Theory)					Continuous Assessment (Practical)						
	CAT 1	CAT 2	Model	Attendance	Total	Conduction of Practical	Report	Viva	Total	#End Semester Examination (ESE) Marks (Practical – Internal Evaluation)		
Marks	5	5	5	5	20	15	10	5	30	30	75	
To be weighted for 10 Marks					10	*To be weighted for 10 Marks*			10		*To be weighted for* 50 Marks	100

*Final End semester practical exam to be conducted with internal and external examiner assigned by Head of the Institution and HoD.*

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **PC**			*End Semester Exam Type: **LE**			
Course Code	**U23EEP609**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**POWER SYSTEM ANALYSIS LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
		EEE						
Prerequisite	Electromagnetic Theory, Electric Circuit Analysis, Control Systems, Transmission and Distribution							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Determine the reactance values of power system components	**K3**
	CO2	Examine Bus Admittance and Impedance matrices, used in power flow analysis	**K3**
	CO3	Analyze the voltage and power flow condition of power system using Gauss Seidal and Newton Raphson methods.	**K4**
	CO4	Classify Symmetrical and Unsymmetrical faults in power system to aid in the design relays and circuit breakers.	**K4**
	CO5	Calculate the load and load duration curves for average load, unit generated load factor, etc.	**K3**

List of Experiments:

1. Computation of power system components in per units.
2. Modeling and Computation of Transmission Line Parameters
3. Formulation of a bus impedance matrix and admittance Matrix
4. Symmetrical components for different case studies
5. Short circuit studies of Power System.
6. Analysis of power-flow problem using Gauss-Seidel method.
7. Analysis of power-flow problem using Newton Raphson method.
8. Analysis of power-flow problem using Fast Decoupled Load Flow method.
9. Analysis of Economic load dispatch in power system.
10. Load curve and load duration curve
11. Modeling and Analysis of Automatic Voltage Regulator system
12. Stability analysis of SMIB System.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:30**

Reference Books

1. Hadi Saadat, “Power System Analysis”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st Reprint, 2010.
2. M. A. Pai, “Computer Techniques in Power System Analysis”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 3rd Edition, 2014.
3. Prabha S. Kundur and Om P.Malik, “Power System Stability and Control”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2nd Edition, 2022.

Web References

1. https://nptel.ac.in/courses/108/105/108105067/
2. https://nptel.ac.in/courses/108/107/108107127/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	1	3	2	2	1	1	-	-	3	2	1	2	3	2	2
2	1	3	2	2	1	1	-	-	3	2	1	2	3	2	2
3	1	3	2	2	1	1	-	-	3	2	1	2	3	2	2
4	1	3	2	2	1	1	-	-	3	2	1	2	3	2	2
5	1	3	2	2	1	1	-	-	3	2	1	2	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Dr. P. Jamuna

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VI**	Course Category: **PC**			End Semester Exam Type: **LE**			
Course Code	**U23EEP610**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**EMBEDDED SYSTEM LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
EEE								
Prerequisite	Programming in C Laboratory, Microprocessor and Microcontroller Laboratory							

Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Experiment with the STM32 ARM processor to explore its functionalities and capabilities.	**K3**
	CO2	Model the STM32 ARM processor with external peripheral devices.	**K3**
	CO3	Demonstrate the interrupts with real time control applications.	**K4**
	CO4	Analyze PWM signals for motor control applications.	**K4**
	CO5	Illustrate input / output peripheral devices with the STM32 ARM processor and implement advanced communication protocols.	**K4**

List of Experiments:

1. Study on STM32 ARM Processor starter kit

Conduction of following experiments using STM32 ARM Processor

2. GPIO programming and Interfacing
3. Timer programming
4. Interfacing of Relay
5. Interfacing of seven segment LED
6. Interfacing of LCD and Keyboard
7. Interfacing with PC via UART
8. ADC and DAC programming
9. Interfacing of Temperature Sensor
10. Interfacing of Stepper motor
11. Interfacing of DC motor and PWM control
12. Interfacing of Bluetooth and Wi-Fi module
13. Study of FPGA development board for PWM Generation

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Muhammad Ali Mazidi, Shujen Chen, Eshragh Ghaemi, “STM32 Arm Programming for Embedded Systems: Using C Language with STM32 Nucleo”, MicroDigitalEd., 1st Edition, 2020.
2. Majid Pakdel, “Advanced Programming with STM32 Microcontrollers” Elektor International Media BV, United Kingdom, 1st Edition, 2020.
3. Yifeng Zhu, “Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language”, E-Man Press LLC, 4th Edition, 2023.
4. Iresh A. Dhotre, “Embedded and Real time Systems”, Technical Publications, Pune, 2nd Edition, 2023.
5. Agus Kurniawan, “Getting Started With STM32 Nucleo Development”, Agus Kurni, 1st Edition, 2016.
6. Carmine Noviello, “Mastering STM32”, Lean Publishing, 2nd Edition, 2022.

Web References

1. https://developer.arm.com/architectures/learn-the-architecture/introducing-the-arm-architecture/single-page
2. https://nptel.ac.in/courses/108102045/
3. https://www.eeweb.com/app-notes/tags/arm
4. https://en.wikibooks.org/wiki/Embedded_Systems/Real-Time_Operating_Systems
5. https://www.dejazzer.com/coen4720/index.html
6. https://archive.nptel.ac.in/courses/106/105/106105193/

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	3	1	-	-	2	-	-	2	3	2	3
2	3	3	2	2	3	1	-	-	2	-	-	2	3	2	3
3	3	3	2	2	3	1	-	-	2	-	-	2	3	2	3
4	3	3	2	2	3	1	-	-	2	-	-	2	3	2	3
5	3	3	2	2	3	1	-	-	2	-	-	2	3	2	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VI**	Course Category Code: **PC**				*End Semester Exam Type: **LE**		
Course Code	**U23EEP611**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**POWER ELECTRONICS LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
EEE								
Prerequisite	Electronics I and II							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Experiment the I-V characteristics of SCR, MOSFET, IGBT and TRIAC	**K3**
	CO2 Illustrate the functioning of rectifiers and firing circuits.	**K3**
	CO3 Analyze the operation and performance of power converter circuits	**K4**
	CO4 Choose a power converter circuit for specific application	**K5**
	CO5 Distinguish the speed control of motor using converters	**K3**

List of Experiments:

1. Characteristics of SCR and TRIAC,
2. Characteristics of MOSFET and IGBT.
3. Single phase half and fully Controlled Converter
4. Three phase half and fully Controlled converter.
5. Step Down and Step Up Chopper
6. Single phase AC Voltage Controller
7. Single phase Step Down Cycloconverter
8. Single phase and Three phase MOSFET/IGBT based PWM Inverter
9. Three Phase Inverters – 180° and 120° mode of operation.
10. Converter/ Chopper fed DC Motor.
11. Speed Control of Inverter fed Induction Motor.
12. Design for Voltage Regulation of DC Buck Converter

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. M. H. Rashid, “Power Electronics: Circuits, Devices and Applications”, Pearson Education, PHI, New Delhi, 4th Edition, 2023
2. P. S. Bimbhra, “Power Electronics”, Khanna Publishers, New Delhi, 7th Edition, 2022.
3. Joseph Vithayathil, “Power Electronics: Principles and Applications”, McGraw-Hill Education, 1st Edition, 1995.
4. Farzin Asadi, “Power Electronics Laboratory: Theory, Practice, and Organization”, Springer, 1st Edition, 2020.
5. Ned Mohan, Tore M. Undeland, William P. Robbins, “Power Electronics: Converters, Applications, and Design”, John Wiley & Sons, 3rd Edition, 2003.

Web References

1. http://vlabs.iitkgp.ernet.in/be/
2. https://be-iitkgp.vlabs.ac.in/
3. https://electricvlab.com/
4. https://www.circuitlab.com/editor/#?id=7pq5wm&from=homepage

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	-	-	-	-	-	-	-	3	3	3
2	3	3	2	3	2	-	-	-	-	-	-	-	3	3	3
3	3	3	2	3	2	-	-	-	-	-	-	-	3	3	3
4	3	3	2	3	2	-	-	-	-	-	-	-	3	3	3
5	3	3	2	3	2	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Dr. P. Jamuna

Evaluation Method

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VI**	Course Category Code: **PA**			*End Semester Exam Type: **-**			
Course Code	**U23EEW602**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MINI PROJECT**	**0**	**0**	**2**	**1**	**100**	**-**	**100**
EEE								
Prerequisite	Electrical Engineering, Electronics, C Programming							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Identify the problem statement for the mini project work through the literature survey	**K2**
	CO2	Choose the proper components as per the requirements of the design/ system.	**K2**
	CO3	Apply the acquainted skills to develop final model/system	**K3**

There shall be a Mini Project, which the student shall pursue as a team consists of maximum 4 students during the third year, fifth semester. The aim of the mini project is that the student has to understand the real time hardware / software applications. The student should gain a thorough knowledge in the problem he/she has selected and in the hardware / software he/she using in the Project. The Mini-project is an application that should be formally initiated and should be developed and also to be implemented by the respective team.

The Mini Project shall be submitted in a report form along with the hardware model / software developed, duly approved by the department internal evaluation committee. It shall be evaluated for 100 marks as Continuous Assessment. The department internal evaluation committee shall consist of faculty coordinator, supervisor of the project and a senior faculty member of the department. There shall be two reviews that will be considered for assessing a Mini Project work with weightage as indicated evaluation Methods.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

COs/POs/PSOs Mapping

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	3	2	2	2	-	-	-	-	3	3	-	1	1	1	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	2	2
3	3	2	2	1	-	2	-	-	3	3	3	1	2	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Method

Assessment	**Review 1**			**Review 2**				**Total Marks**
	Novelty	**Presentation**	**Viva**	**Presentation**	**Demonstration**	**Viva**	**Report**	
Marks	10	20	10	20	20	10	10	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VI**	Course Category: **AEC**			End Semester Exam Type: **-**			
Course Code	**U23EEC6XX**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CERTIFICATION COURSE - VI**	**0**	**0**	**4**	**-**	**100**	**-**	**100**
EEE								
Prerequisite	**-**							

Students shall choose an International / Reputed organization certification course of 40-50 hours duration specified in the curriculum (It is mandatory to do a minimum of six courses) which will be offered through the Centre of Excellence. These courses have no credit and will not be considered for CGPA calculation.

(i) Certification Courses are required to be completed to fulfil the degree requirements. All Certification courses are assessed internally for 100 marks.

(ii) The Course coordinator handling the course will assess the student through attendance and MCQ test, and declare the student as “pass” on satisfactory completion. A letter grade “P” is awarded to declare pass.

(iii) The marks scored in these courses will not be taken into consideration for the SGPA / CGPA calculations in the grade sheet.

Evaluation Method

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Attendance	**MCQ Test**	
Marks	**10**	**90**	**100**

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VI**	Course Category: **MC**			End Semester Exam Type :**TE**			
Course Code	**U23EEM606**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**GENDER EQUALITY**	**2**	**0**	**0**	**-**	**100**	**-**	**100**
Common to ALL Branches								
Prerequisite	**-**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the general identity, social construction of gender roles.	**K2**
	CO2 Illustrate the causes and issues of gender discrimination in Indian society.	**K2**
	CO3 Describe the workplace discrimination, media influences on gender and culture.	**K2**
	CO4 Familiarize with international and Indian frameworks on gender equality.	**K2**
	CO5 Illustrate the current challenges in gender equality, including the glass ceiling and the role of technology.	**K2**

UNIT – I	**Introduction to Gender Equality**	**Periods:06**
Gender equality – exploring gender identity and expression, Understanding the social construction of general roles and norms, historical perspectives on gender roles, Analyzing key milestones in the fight for gender equality.		**CO1**
UNIT – II	**Gender Inequality and Its Manifestations**	**Periods:06**
Gender discrimination in Indian society – causes of gender inequality – Illiteracy, patriarchal set up, lack of awareness, social beliefs, practice and custom - Issues of gender discrimination - Child marriage, child domestic work, poor education and health, violence and exploitation in workplace.		**CO2**
UNIT – III	**Gender and Culture**	**Periods:06**
Workplace discrimination, Media influences on gender and culture, Gender and power dynamics in society. Strategies for promoting gender equality and cultural understanding.		**CO3**
UNIT – IV	**Promoting Gender Equality**	**Periods:06**
Gender Equality and Human Rights - International frameworks and Conventions on Gender Equality - Equality under the Indian Constitution - Policies and initiatives for gender mainstreaming - Strategies for promoting Gender Equality in various contexts.		**CO4**
UNIT – V	**Contemporary Challenges and Future Directions**	**Periods:06**
Current challenges and emerging issues in gender equality - Glass ceiling - role of technology in continuing or challenging gender inequality - Exploring possibilities for transformative change and envisioning a gender-equal future.		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 30**

Text Books

1. "Gender and Society" by Raewyn Connell - This book provides a comprehensive overview of gender roles, power dynamics, and the social construction of gender.
2. "The Second Sex" by Simone de Beauvoir – A historical and philosophical examination of women's oppression and gender inequality.
3. "Women and Gender in the Indian Society" by Neera Desai and Usha Thakkar – Focuses on the context of gender roles, inequality, and feminist movements in India.

Reference Books

1. Woman in early Indian societies, New Delhi: Manohar Publications. Sita A. Raman (2009).
2. A social and Cultural history, Volume1. Connecticut: Oxford: Praeger. Sita Raman (2009).
3. A social and Cultural history, Volume2. Connecticut: Oxford: Praeger.
4. Iftikhar R. (2016). Indian Feminism: Class, Gender and Identity in Medieval Ages. Chennai: Notion Press. Iftikhar, R. (2012).

Web References

1. https://www.unwomen.org
2. https://ncw.nic.in
3. https://en.unesco.org/themes/gender-equality
4. https://www.weforum.org/reports
5. https://wcd.nic.in

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
2	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
3	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
4	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1
5	1	-	-	-	-	-	-	-	-	3	-	1	1	-	1

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)			Total Marks
	Attendance	MCQ Test	Presentation / Activity / Assignment	
Marks	10	30	60	100

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VII**	Course Category: **PC**			End Semester Exam Type: **TE***			
Course Code	**U23EET714**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INDUSTRIAL AUTOMATION AND CONTROL**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Prerequisite	Electrical Engineering, Electrical Machines	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the types of Automation system and its architecture in detail	**K2**
	CO2 Discuss the history of PLC, main parts and its functions	**K2**
	CO3 Illustrate the operation of Relays, contactors, Motor Starters, Switched, Sensors, Output Control Devices, etc.,	**K3**
	CO4 Acquire knowledge about the operation of SCADA and its sub-systems.	**K2**
	CO5 Demonstrate the fundamentals of Human-Machine Interface	**K2**

UNIT – I	**INTRODUCTION TO AUTOMATION**	**Periods:09**
Automation overview – requirement of automation systems – architecture of industrial automation system – Levels of Automation-basic elements of an automated system – industrial bus systems: modbus and profibus.		**CO1**
UNIT – II	**PROGRAMMABLE LOGIC CONTROLLERS**	**Periods:09**
Introduction to PLC, Principles of Operation - Size and Application. Hardware Components: I/O Section, Discrete /Analog I/O Modules, Special I/O Modules, CPU, Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data - Processor Memory Organization, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions.		**CO2**
UNIT – III	**LADDER LOGIC PROGRAMMING**	**Periods:09**
PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manual/Mechanical Operated Switches, Sensors, Output Control Devices, Seal-in Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Programming Timers: Mechanical Timing Relays, Timer Instructions, On-Delay /Off-Delay Timer Instruction, Retentive Timer, Cascading Timers.		**CO3**
UNIT – IV	**SCADA FUNDAMENTALS**	**Periods:09**
Introduction, Open system: Need and advantages, Building blocks of SCADA systems, RTU-Evolution, Components, Communication, Logic, Termination and Testing and HMI subsystem - Power supplies, Advanced RTU functionalities, IEDs : Evolution of IEDs, IED functional block diagram, Hardware and software architecture of the IED, IED advanced functionalities, Data concentrators and merging units. Master Station: Software /Hardware components, Server systems in the master station, Small, medium, and large master stations, GPS.		**CO4**
UNIT – V	**HUMAN-MACHINE AND M2M INTERFACE**	**Periods:09**
HMI components, software functionalities, Situational awareness, Intelligent alarm filtering - Techniques, Operator needs and requirements- Machine – Machine communication-Introduction-Architecture – Introduction to IoT, IoT application protocols - Message Queueing Telemetry Transport, HyperText Transfer Protocol.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Frank D. Petruzella, "Programmable Logic Controllers", McGraw Hill, 6th Edition, 2023.
2. Mini S. Thomas, "Power System SCADA and Smart Grids", CRC Press;1st edition 2015.
3. Carles Anton-Haro, MischaDohler, "Machine-to-machine (M2M) Communications Architecture, Performance and Applications", Woodhead Publishing, 1st Edition - December, 2014.

Reference Books

1. Gary Dunning, "Introduction to Programmable Logic Controllers", Cengage Learning, 3rd India Edition, 2007.
2. Frank lamb, "Industrial Automation: Hands On", McGraw-Hill Education, 1st Edition, 2013.
3. Thomas A. Hughes, "Programmable Logic Controllers", ISA press, 4th Edition, 2005.
4. William T. Shaw, "Cybersecurity for SCADA systems", Penn Well Books, 2nd Edition, 2021.
5. S. Mukhopadhyay, S. Sen and A. K. Deb, "Industrial Instrumentation, Control and Automation", Jaico Publishing House, 1st Edition, 2013.

Web References

1. https://electrical-engineering-portal.com/download-center/books-and-guides/automation-control/plc-laddersequential-programming
2. https://www.beckhoff.com/english.asp?start/?pk_campaign=AdWordsAdWordsSearchIndustrialAutomationEN&pk_kwd=industrial%20automation
3. https://www.advantech.com/solutions/ifactory
4. https://www.plantautomation-technology.com/articles/an-overview-of-distributed-control-systems-dcs
5. https://www.controleng.com/articles/scada-remains-relevant-for-industrial-automation/
6. https://sw.aveva.com/monitor-and-control/scada
7. https://www.emnify.com/blog/guide-iot-protocols

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
2	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
3	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
4	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
5	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	Electrical and Electronics Engineering	Programme: **B. Tech.**						
Semester	**VII**	Course Category: **PC**			End Semester Exam Type :**TE***			
Course Code	**U23EET715**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**RENEWABLE ENERGY SOURCES**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								
Prerequisite	**Electrical Engineering, Electrical Machines**							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Explore the current energy scenario at both national and international levels, with a focus on renewable energy sources.	**K2**
	CO2 Apply the principles of wind turbine aerodynamics to design turbines and estimate their energy production.	**K3**
	CO3 Identify the technical aspects and sustainability challenges in generating electrical power from bioenergy.	**K2**
	CO4 Explain the methods of electrical power generation from ocean and geothermal energy.	**K2**
	CO5 Describe the technical challenges and sustainability issues involved in integrating renewable and hybrid energy systems.	**K2**

UNIT – I	**SOLAR ENERGY**	**Periods:09**
Overview - Limitations of conventional energy resource - Importance of renewable sources - Types - Present Indian and International energy scenario. **Solar Energy:** solar thermal power and its energy conversion - solar collectors - types and applications. Photovoltaic (PV) technology - photovoltaic effect - efficiency of solar cells - Design Concept of solar PV system - standards and applications.		**CO1**
UNIT – II	**WIND AND HYDRO POWER ENERGY**	**Periods:09**
Wind Energy: wind data – properties - wind turbine aerodynamics - speed and power relations - -wind turbine types – Wind energy conversion systems - wind energy farms - off-shore plants- Selection factors. **Hydro Energy:** small, mini and micro hydro power plants and their resource assessment - plant layout with major components -selection factors-application.		**CO2**
UNIT – III	**` BIO-ENERGY**	**Periods:09**
Bio resources – Biomass direct combustion – thermochemical conversion - biochemical conversion-mechanical conversion - Biomass gasifier - Types of biomass gasifiers - Cogeneration –- Carbonisation – Pyrolysis - Biogas plants – Digesters –Biodiesel production – Ethanol production - Applications.		**CO3**
UNIT – IV	**OCEAN AND GEOTHERMAL ENERGY**	**Periods:09**
Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations – Origin and Distribution of Geothermal energy – Types- Analysis of Geothermal resources – Applications - Environmental impact.		**CO4**
UNIT – V		**Periods:09**
Renewable energy-based hybrid power system- PV-diesel-battery system- Integrating PV forecasting mechanism. Grid Interface Requirements- Synchronizing with the Grid - Operating Limit - Energy Storage and Load Scheduling -Wind Farm-Grid Integration - Grid Stability Issues -Distributed Power Generation		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. B. H. Khan, "Non-Conventional Energy Resources", Tata McGraw Hill, 3rd Edition, 2017.
2. Mukund R Patel, "Wind and Solar Power Systems", CRC Press, New York, 2nd Edition, 2011.
3. Ersan Kabalci, "Hybrid Renewable Energy Systems and Microgrids: Design, Control, and Operation", Academic Press, Elsevier, 2021.

Reference Books

1. Solanki Chetan Singh, "Solar Photovoltaic - Fundamentals, Technologies and Applications", PHI, New Delhi, 3rd Edition, 2015.
2. John Twidell and Tony Weir, "Renewable Energy Resources", Routledge publication, 3rd Edition, 2015.
3. G. N. Tiwari and M. K. Ghosal, "Renewable Energy Resources: Basic Principle and Application", Alpha Science International Ltd, New Edition, 2005.
4. D. P. Kothari, K. C Singal, Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt. Ltd, New Delhi, 2nd Edition, 2013.
5. Godfrey Boyle, "Renewable Energy: Power for a Sustainable Future", Oxford University Press, 3rd Edition, 2012

Web References

1. https://nptel.ac.in/courses/103/107/103107157/
2. www.renewableenergyworld.com/rea/tech/home
3. www.eschooltoday.com/energy/renewable-energy
4. https://www.chetansinghsolanki.in/course.php
5. https://nptel.ac.in/courses/108/108/108108078/

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	2	1	2	2	-	-	-	-	2	3	2	2
2	3	2	1	2	1	2	2	-	-	-	-	2	3	2	2
3	3	2	1	2	1	2	2	-	-	-	-	2	3	2	2
4	3	2	1	2	1	2	2	-	-	-	-	2	3	2	2
5	3	2	1	2	1	2	2	-	-	-	-	2	3	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech**						
Semester	**VII**	Course Category: **PC / OE**			End Semester Exam Type: **TE***			
Course Code	**U23EEDC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRIC AND HYBRID VEHICLES**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
EEE, ECE, ICE, MECH, CCE, BME, AI&DS, MECHATRONICS								
Prerequisite	Physical Science for Engineers, Power Electronics, Electrical Machines – II							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Explain the fundamentals of electric vehicles, including their history, social and environmental impact, forces acting on a vehicle, and performance characteristics	**K2**
	CO2	Describe different hybrid vehicle configurations, analyze the working principles of series and parallel hybrid electric drive trains, and compare their advantages and disadvantages.	**K2**
	CO3	Evaluate various electric propulsion systems, including DC motors, BLDC motors, and SRM motor controllers, along with control techniques and autonomous EV technologies.	**K3**
	CO4	Explore energy storage technologies, including battery types, characteristics, and applications in EVs.	**K2**
	CO5	Explain battery management systems (BMS) and EV charging technologies, including state-of-charge determination, charging methods, and the need for inductive charging.	**K2**

UNIT – I	**Introduction To Electric Vehicle**	**Periods: 09**
History of electric vehicles - social and environmental importance. Longitudinal vehicle model-Forces acting on a vehicle – Aerodynamic, rolling and gradient resistance. Maximum tractive effort and powertrain tractive effort. Vehicle performance- maximum speed of the vehicle- gradeability -acceleration. Braking performance. Vehicle power plant and transmission characteristics.		**CO1**
UNIT – II	**Hybrid Vehicle**	**Periods: 09**
EV configuration -Performance of EVs -Hybrid Electric Drive Trains-Concept -Classification -Series Hybrid Electric Drive Trains (Electrical Coupling)-Advantages and disadvantages.Parallel Hybrid Electric Drive Trains (Mechanical Coupling)- Torque Coupling-Speed Coupling- Advantages and disadvantages.		**CO2**
UNIT – III	**Electric Vehicle Drive Systems**	**Periods: 09**
Electric propulsion systems: BLDC motor-torque control and FOC method. SRM motor and PMSM controller - Block diagram.Dynamometer setup for traction motor testing. Electric Bicycle Propulsion System. Autonomous EV vehicle.		**CO3**
UNIT – IV	**Electric Vehicle Storage Technology**	**Periods: 09**
Energy Density and Specific Energy-Power Density and Specific Power -Cycle Life -Operating Temperature - Safety. Electrochemical Cells -Lead Acid -Nickel Metal Hydride -Lithium Ion -Sodium Nickel Chloride. Characteristic Terminology and Performance Parameters. Modeling-Electrochemical Cell-Equivalent Circuit Model- Packs and Management Systems-Design Considerations-Cell balancing		**CO4**
UNIT – V	**Battery Management Systems & EV Charging**	**Periods: 09**
Introduction to BMS, Objectives of the BMS: Discharging control, Charging control, State-of-Charge Determination, State-of-Health Determination, Cell Balancing. Building Blocks of EV charging station- Types of battery chargers – Slow, rapid and DC fast chargers - Charging technologies- Conductive charging - Need for inductive charging of EV - Inductive charging.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles", CRC Press, 3rd Edition, 2019.
2. Ali Emadi, „Advanced Electric Drive Vehicles", CRC Press-Taylor & Francis Group, 2015
3. Iqbal Hussain, "Electric and Hybrid Vehicles – Design Fundamentals", CRC Press, 2nd Edition, 2011.

Reference Books

1. K. T. Chau, "Electric vehicle machines and drives: Design, analysis and application", John Willey and Sons PTE Ltd., 1st Edition, 2015.
2. J. Larminie and J. Lowry, "Electric vehicle technology explained", John Willey & Son PTE Ltd., 2nd Edition, 2012.

Web References

1. https://nptel.ac.in/courses/108103009/
2. https://www.evgo.com/why-evs/types-of-electric-vehicles/
3. https://e-amrit.niti.gov.in/types-of-electric-vehicles
4. https://afdc.energy.gov/vehicles/how-do-all-electric-cars-work
5. https://www.bosch-mobility.com/en/solutions/powertrain/battery-electric/electric-drive/
6. https://e-vehicleinfo.com/different-types-of-energy-storage-systems-in-electric-vehicles/

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	-	-	3	3	-	-	-	-	3	3	2	3
2	3	3	3	2	-	3	3	-	-	-	-	3	3	2	3
3	3	3	3	2	-	3	3	-	-	-	-	3	3	2	3
4	3	3	3	1	-	3	3	-	-	-	-	3	3	2	3
5	2	3	3	2	-	3	3	-	-	-	-	3	3	2	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category Code: **PC**			End Semester Exam Type: **LE***			
Course Code	**U23EEP712**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INDUSTRIAL AUTOMATION AND CONTROL LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**

EEE

Prerequisite	Electronics - 1, Electrical Machines	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Apply Fundamental PLC Programming Concepts.	**K3**
	CO2 Design PLC-relay logic for the real time applications	**K3**
	CO3 Implement Industrial processing system	**K3**
	CO4 Integrate PLC with SCADA for Industrial Applications.	**K3**
	CO5 Implement IoT-Based Smart Automation Systems.	**K3**

List of Experiments:

Programmable Logic Controller

1. Implementation of Latching and Unlatching concepts in PLC
2. Interfacing of lamp and button with PLC for ON/OFF operation.
3. Perform Delayed Operation of Lamp using Push Button.
4. Combination of Counter and Timer for Lamp ON/OFF operation.
5. PLC program for Sequential Motor Control.
6. PLC based automated car parking system or elevator system.
7. DOL and Star Delta Starter operation for Three Phase Induction Motor using PLC.
8. PLC program for Forward and Reverse Control of Motors
9. PLC based Stair case lighting control system
10. PLC based Traffic Light Control system
11. Design and development of solar tracking control system using PLC
12. PLC program for speed control of DC motor

SCADA

1. PLC interface with SCADA and status read / Command Transfer operation
2. Alarm annunciation using SCADA

Internet of Things IoT

1. IoT – based Street light monitoring and control
2. IoT-based Industrial pollution monitoring system.
3. Sensors Interfacing (IR Sensor, Ultrasonic Sensor ,Soil Moisture Sensor) using ESP32

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods:30**	**Total Periods:30**

Reference Books

1. Frank D. Petruzella, “Programmable Logic Controllers”, McGraw Hill, 6th Edition , 2023.
2. Mini S. Thomas, “Power System SCADA and Smart Grids”, CRC Press;1st edition 2015.
3. Carles Anton-Haro, MischaDohler, “Machine-to-machine (M2M) Communications Architecture, Performance and Applications”, Woodhead Publishing, 1st Edition - December, 2014.
4. Gary Dunning, “Introduction to Programmable Logic Controllers”, Cengage Learning, 3rd India Edition, 2007.
5. Frank lamb, “Industrial Automation: Hands On”, McGraw-Hill Education, 1st Edition, 2013.
6. Thomas A. Hughes, “Programmable Logic Controllers”, ISA press, 4th Edition, 2005.
7. William T. Shaw, “Cybersecurity for SCADA systems”, Penn Well Books, 2nd Edition, 2021.
8. S. Mukhopadhyay, S. Sen and A. K. Deb, “Industrial Instrumentation, Control and Automation”, Jaico Publishing House, 1st Edition, 2013.

Web References

1. https://electrical-engineering-portal.com/download-center/books-and-guides/automation-control/plcladder-sequential-programming
2. https://www.beckhoff.com/english.asp?start/?pk_campaign=AdWords-AdWordsSearchIndustrialAutomationEN&pk_kwd=industrial%20automation
3. https://www.advantech.com/solutions/ifactory
4. https://www.controleng.com/articles/scada-remains-relevant-for-industrial-automation/
5. https://sw.aveva.com/monitor-and-control/scada

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	3	2	-	1	3	3	3
2	3	3	3	2	3	-	-	-	3	2	-	1	3	3	3
3	3	3	3	2	3	-	-	-	3	2	-	1	3	3	3
4	3	3	3	2	3	-	-	-	3	2	-	1	3	3	3
5	3	3	3	2	3	-	-	-	3	2	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VII**	Course Category: **PC**			End Semester Exam Type: **LE***			
Course Code	**U23EEP713**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**RENEWABLE ENERGY SOURCES LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
EEE								
Prerequisite	Electrical Engineering, Electrical Machines							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Determine the V-I characteristics and analyse the efficiency of Solar PV systems.	**K3**
CO2	Analyze the performance of the Perturb and Observe and Incremental Conductance MPPT Algorithm in PV systems.	**K3**
CO3	Apply and evaluate the performance of various renewable energy systems.	**K3**
CO4	Develop models and simulate various generators used in renewable energy conversion systems.	**K3**
CO5	Implement intelligent controllers for renewable energy conversion systems.	**K3**

List of Experiments:

1. Simulation and analysis of Solar PV Energy System.
2. Experiment on V-I characteristics and efficiency assessment of Solar PV system.
3. Experiment on Shadowing effect and diode-based solution in Solar PV System.
4. Performance Evaluation of PV System with Perturb and Observe (P&O) MPPT Algorithm.
5. Performance Analysis of Incremental Conductance (INC) MPPT Algorithm in a PV System.
6. Modeling and analysis of Permanent Magnet Synchronous Generator (PMSG).
7. Simulation and analysis of induction generation-based wind energy conversion system.
8. Performance Evaluation of Wind Energy Generator.
9. Simulation and analysis of Hybrid (Solar-Wind) Power System.
10. Experiment on Performance analysis of Hydro Power Generator.
11. Simulation and analysis of PEM Fuel Cell.
12. Simulation study on Intelligent Controllers for Hybrid Energy Systems.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Chuck Ammond, Albert F. Cutter, “The Complete Lab Manual for Renewable Energy”, Cengage Learning, 1st Edition, 2015.
2. William. J. Palm III, “Introduction to MATLAB for Engineers”, McGraw-Hill Education, 4th Edition, 2022
3. Franzis Verlag GmBH, “50 Experiments with Renewable Energy Kit & Manual”, Franziz, 1st Edition, 2014.
4. Ali Keyhani, “Design of Smart Power Grid Renewable Energy Systems: Solutions Manual”, WilleyBlackwell, 2nd Edition, 2016.
5. D. P. Kothari, D. K. Sharma, “Energy Engineering: Theory and Practice”, S. Chand Publisher, 3rd Edition, 2021.

Web References

1. http://www.ee.iitkgp.ac.in/faci_es.php
2. http://www.ee.iitkgp.ac.in/TeachingLabs/EnergySys/es1.pdf
3. http://www.ee.iitkgp.ac.in/TeachingLabs/EnergySys/es6.pdf
4. http://www.ee.iitkgp.ac.in/TeachingLabs/EnergySys/solar_sim.pdf
5. http://www.ee.iitkgp.ac.in/TeachingLabs/EnergySys/es8.pdf
6. http://www.ee.iitkgp.ac.in/TeachingLabs/EnergySys/solar_pv_plant.pdf
7. http://downloads.hindawi.com/journals/ijp/2014/895271.pdf

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	3	2	2	3	2	3	1	3	2	1	2	3	3	2
2	1	3	2	2	3	2	3	1	3	2	1	2	3	3	2
3	1	3	2	2	3	2	3	1	3	2	1	2	3	3	2
4	1	3	2	2	3	2	3	1	3	2	1	2	3	3	2
5	1	3	2	2	3	2	3	1	3	2	1	2	3	3	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VII**	Course Category Code: **PC**				End Semester Exam Type: **LE***		
Course Code	**U23EEP714**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRIC VEHICLES LABORATORY**	**0**	**0**	**2**	**1**	**50**	**50**	**100**
EEE								
Prerequisite	Physical Science for Engineers, Power Electronics, Electrical Machines – II							

Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Recognise key components and wiring layout of electric vehicles.	**K2**
	CO2	Implement mathematical models for EVs and hybrid EVs.	**K3**
	CO3	Execute motor control techniques for PMSM and BLDC motors.	**K3**
	CO4	Design and evaluate battery packs, BMS chargers, and SOC estimation methods.	**K3**
	CO5	Solve stability analysis of BLDC motors and simulate control techniques like SVPWM.	**K3**

List of Experiments:

1. Study of various components of electric vehicles.
2. Experiment on wiring layout of electric vehicle.
3. Mathematical modelling of Electric Vehicle.
4. Mathematical modelling of hybrid Electric Vehicle.
5. Speed Control of a Permanent Magnet Synchronous Motor (PMSM) for Electric Cars
6. Simulation and Implementation of speed control of SRM motor.
7. Stability Analysis of a BLDC Motor Using Bode Plot in Open-Loop and Closed-Loop Systems.
8. Design a Control Circuit and power module for BLDC.
9. Battery Pack Design and Capacity Calculation for EV Applications.
10. Development of a 5S BMS Charger by 18650 Li-ion Battery Pack.
11. Simulation and Analysis of Lithium-Ion Battery Characteristics in Simulink.
12. Battery Modeling and State-of-Charge (SOC) Estimation Using MATLAB.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 30**

Reference Books

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles”, CRC Press, 3rd Edition, 2019.
2. Ali Emadi, “Advanced Electric Drive Vehicles”, CRC Press-Taylor & Francis Group, 2015
3. Iqbal Hussain, “Electric and Hybrid Vehicles – Design Fundamentals”, CRC Press, 2nd Edition, 2011.
4. Wei Liu, “Hybrid Electric Vehicle system Modelling and control”, John Wiley and sons, 2nd Edition, 2017.

Web References

1. https://in.mathworks.com/help/simscape-battery/ug/battery-state-of-charge-estimation.html
2. https://nptel.ac.in/courses/108103009/
3. https://www.evgo.com/why-evs/types-of-electric-vehicles/
4. https://e-amrit.niti.gov.in/types-of-electric-vehicles
5. https://afdc.energy.gov/vehicles/how-do-all-electric-cars-work
6. https://www.bosch-mobility.com/en/solutions/powertrain/battery-electric/electric-drive/
7. https://e-vehicleinfo.com/different-types-of-energy-storage-systems-in-electric-vehicles/

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

Cos	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	3	2	2	3	2	3	1	3	2	1	2	3	3	2
2	1	3	2	2	3	2	3	1	3	2	1	2	3	3	2
3	1	3	2	2	3	2	3	1	3	2	1	2	3	3	2
4	1	3	2	2	3	2	3	1	3	2	1	2	3	3	2
5	1	3	2	2	3	2	3	1	3	2	1	2	3	3	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	Performance in practical classes			Model Practical Examination	Attendance		
	Conduction of practical	Record work	viva				
Marks	15	5	5	15	10	50	100

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VII**	Course Category: **PA**			End Semester Exam Type: **LE**			
Course Code	**U23EEW703**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROJECT PHASE – I**	**-**	**-**	**4**	**2**	**50**	**50**	**100**
EEE								
Prerequisite	**Electrical and Electronics Courses**							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Identify the problem statement for the proposed work through the literature survey	**K3**
	CO2	Choose the proper components as per the requirements of the design/system	**K2**
	CO3	Apply the acquainted skills to develop final model/system	**K2**
	CO4	Estimate, plan and execute the project as a team	**K4**
	CO5	Defend the finding and conclude with oral/written reports	**K2**

Course Description

Project work may be assigned to a group of students not exceeding 4 per group, under the supervision of project supervisor(s). Each student batch shall be required to undertake a suitable project in industry / research organization / department in consultation with the Head of the Department and the supervisor. A student shall register for the Project Phase I in 7th semester. The project team and the project title can be decided in the 6th semester itself.

The process and guidelines for industry/Research organization projects

(i) Students opting for the industry / research organization project should decide, identify and interact with relevant industry/ research organization in 6th semester itself. Training and Placement cell shall help to establish contact with industries. Students shall take necessary help from their department for exact plan of action and apply to the industry / research organization through proper channel. The project coordinator shall decide the schedule appropriately.

(ii) Students shall submit the application attached with relevant details viz. correspondence with industry, area and nature of project and its proposal to the department before the end of 6th semester.

(iii) Head of the Institution / Dean Academics / Dean R&D / Placement Officer shall issue permission letter to the students on the recommendation of HoD and supervisor. Students shall be allowed to do the final year project work in the industry.

(iv) An internal supervisor from the department and mentor from the industry/ research organization where the project is to be undertaken shall be allocated to the students. Both supervisors should discuss and finalize the scope of the project work and monitor the progress together.

(v) Internal supervisor should visit the industry a minimum of 3 times in a semester to see the progress of his/her students and a brief report should be submitted to the HoD about the progress.

(vi) Students should maintain a record on the progress and get the approval from both internal and external supervisors at least twice in a month either by physically or through email communication. If the progress is not found satisfactory due to any reason, the supervisor should take the corrective action, after consulting with project coordinator and HoD.

(vii) Progress report and certificate of completion of the project work from the industry / research organization shall be submitted by the students to the respective supervisor. The mode of evaluation shall be same as that of the in-house project.

The Process and guidelines for in-house project

(i) Students execute their in-house project in the Department with proper approval from the HoD through the respective supervisor.

(ii) Students should maintain a record on the progress and get the approval from supervisor at least once in a week. If the progress is not found satisfactory due to any reason, the supervisor should take the corrective action, after consulting with project coordinator and HoD.

Criteria for Assessment of Project Work

- Interim project report shall be submitted before the project review with the approval of the supervisor. The Project Report prepared according to the approved guidelines and duly signed by the supervisor and the Head of the Department shall be submitted as per the timeline announced by the department.
- The End Semester Examination for the project work shall consist of an evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted by a committee consisting of the external examiner and an internal examiner. The Controller of Examinations (CoE) shall appoint Internal and External Examiners for the End Semester Examination of the Project Work.

Lecture Periods: -	Tutorial Periods: -	Practical Periods: 60	Total Periods: 60

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	-	-	-	-	3	3	-	1	1	2	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	1	1
3	3	2	2	1	-	2	-	-	3	3	3	1	3	3	3
4	2	3	3	1	-	-	2	2	3	3	1	1	3	2	3
5	2	3	3	1	-	-	2	2	3	3	1	1	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

Evaluation Methods

CAM and ESM break-up for Project Phase - I

Sl. No	Description			Weightage
1	**Continuous Assessment Marks**			
a	Review 1	Review Committee#	10	15
		Supervisor	5	
b	Review 2	Review Committee#	10	15
		Supervisor	5	
c	Review 3	Review Committee#	15	20
		Supervisor	5	
			Total CAM	50
2	**End Semester Marks**			
a	Evaluation of Phase I report and Viva-voce	Report	15	50
		Presentation and Viva	20	
		Demonstration	15	
			Total ESM	50
			Total Marks	100

Review committee consists of internal faculty members nominated by the Head of the Department. The Supervisor of the student being examined shall not be part of the committee.

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VII**	Course Category: **PA**			End Semester Exam Type: **-**			
Course Code	**U23EEW704**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INTERNSHIP / INPLANT TRAINING**	**-**	**-**	**2**	**1**	**100**	**-**	**100**
EEE								

Course Description

The student is required to undergo 'internship' in industry / research laboratory / higher learning institution for a minimum period of 4 weeks during vacations and shall complete the internship before the completion of 7th semester.

(i) The internship carries 1 credit.

(ii) Each spell of internship shall be for a period not less than 2 weeks.

(iii) The main purpose of internship is to enhance the general professional outlook and capability of the student to advance his/her chances of improving the career opportunities. The student should get prior approval from the Head of the Department and Training and Placement cell in the college before undertaking the internship and need to submit a detailed report after completion for the purpose of assessment. The internship marks will be given in 7th semester mark sheet.

A committee comprising of two faculty members appointed by Head of the Department will assess the internship for 100 marks.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 60**	**Total Periods: 60**

Evaluation Methods

Assessment	**Continuous Assessment Marks (CAM)**		**Total Marks**
	Report	**Presentation**	
Marks	50	50	100

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VIII**	Course Category: **PA**			End Semester Exam Type: **LE**			
Course Code	**U23EEW805**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROJECT PHASE – II**	**-**	**-**	**16**	**8**	**50**	**100**	**150**
EEE								
Prerequisite	**Electrical and Electronics Courses**							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Identify the problem statement for the proposed work through the literature survey	**K3**
	CO2	Choose the proper components as per the requirements of the design/system	**K2**
	CO3	Apply the acquainted skills to develop final model/system	**K2**
	CO4	Estimate, plan and execute the project as a team	**K4**
	CO5	Defend the finding and conclude with oral/written reports	**K2**

Course Description

Project work may be assigned to a group of students not exceeding 4 per group, under the supervision of project supervisor(s). Each student batch shall be required to undertake a suitable project in industry / research organization / department in consultation with the Head of the Department and the supervisor. A student shall register for the Project Phase II in 8th semester. The continuation of the project work undertaken in the 7th semester should be carried out in the 8th semester.

The process and guidelines for industry/Research organization projects

(i) Students opting for the industry / research organization project should decide, identify and interact with relevant industry/ research organization in 6th semester itself. Training and Placement cell shall help to establish contact with industries. Students shall take necessary help from their department for exact plan of action and apply to the industry / research organization through proper channel. The project coordinator shall decide the schedule appropriately.

(ii) Students shall submit the application attached with relevant details viz. correspondence with industry, area and nature of project and its proposal to the department before the end of 6th semester.

(iii) Head of the Institution / Dean Academics / Dean R&D / Placement Officer shall issue permission letter to the students on the recommendation of HoD and supervisor. Students shall be allowed to do the final year project work in the industry.

(iv) An internal supervisor from the department and mentor from the industry/ research organization where the project is to be undertaken shall be allocated to the students. Both supervisors should discuss and finalize the scope of the project work and monitor the progress together.

(v) Internal supervisor should visit the industry a minimum of 3 times in a semester to see the progress of his/her students and a brief report should be submitted to the HoD about the progress.

(vi) Students should maintain a record on the progress and get the approval from both internal and external supervisors at least twice in a month either by physically or through email communication. If the progress is not found satisfactory due to any reason, the supervisor should take the corrective action, after consulting with project coordinator and HoD.

(vii) Progress report and certificate of completion of the project work from the industry / research organization shall be submitted by the students to the respective supervisor. The mode of evaluation shall be same as that of the in-house project.

The Process and guidelines for in-house project

(i) Students execute their in-house project in the Department with proper approval from the HoD through the respective supervisor.

(ii) Students should maintain a record on the progress and get the approval from supervisor at least once in a week. If the progress is not found satisfactory due to any reason, the supervisor should take the corrective action, after consulting with project coordinator and HoD.

Criteria for Assessment of Project Work

- Interim project report shall be submitted before the project review with the approval of the supervisor. The Project Report prepared according to the approved guidelines and duly signed by the supervisor and the Head of the Department shall be submitted as per the timeline announced by the department.
- The End Semester Examination for the project work shall consist of an evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted by a committee consisting of the external examiner and an internal examiner. The Controller of Examinations (CoE) shall appoint Internal and External Examiners for the End Semester Examination of the Project Work.

Lecture Periods: -	**Tutorial Periods: -**	**Practical Periods: 60**	**Total Periods: 60**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	3	2	2	2	-	-	-	-	3	3	-	1	1	2	1
2	3	3	3	2	2	2	2	2	3	3	3	1	2	1	1
3	3	2	2	1	-	2	-	-	3	3	3	1	3	3	3
4	2	3	3	1	-	-	2	2	3	3	1	1	3	2	3
5	2	3	3	1	-	-	2	2	3	3	1	1	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

Evaluation Methods

CAM and ESM break-up for Project Phase - II

Sl. No	Description			Weightage
1	**Continuous Assessment Marks**			
a	Review 1	Review Committee#	10	15
		Supervisor	5	
b	Review 2	Review Committee#	10	15
		Supervisor	5	
c	Review 3	Review Committee#	15	20
		Supervisor	5	
			Total CAM	50
2	**End Semester Marks**			
a	Evaluation of final report and Viva-voce	Report	20	80
		Presentation and Viva	40	
		Demonstration	20	
b	Expected O#u#tcome from	Publication / communication of papers /		20
			Total ESM	**100**
			Total Marks	**150****

 # Review committee consists of internal faculty members nominated by the Head of the Department. The Supervisor of the student being examined shall not be part of the committee.

Expected Outcome from the project, in terms of paper publication, patents, product development and industry projects shall be awarded based on the document proof submitted by the student concerned

*** To be weighted for 100 marks*

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23EEDC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL SAFETY ENGINEERING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Physical Science for Engineers, Electrical Engineering	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the Indian Electricity (IE) acts and various rules for electrical safety.	**K2**
	CO2 Interpret safety measures to prevent electrical shock in handling of domestic electrical appliances.	**K2**
	CO3 Demonstrate the safety aspects during installation of plant and equipment.	**K3**
	CO4 Explain the various hazardous area and application of electrical safety in various places.	**K2**
	CO5 Summarize the importance of electrical safety training to improve quality management in electrical systems.	**K2**

UNIT – I	**Concepts and Statutory Requirements**	**Periods:09**
Objective and scope of electrical safety - National electrical Safety code -Statutory requirements – Safety electrical one line diagram - General requirements for electrical safety as per IE rules -International standards on electrical safety -Safe limits of current and voltage - Grounding of electrical equipment of low voltage and high voltage systems - Safety policy - Electrical safety certificate requirement.		**CO1**
UNIT – II	**Electrical Shocks and their Prevention**	**Periods:09**
Primary and secondary electrical shocks - Possibilities of getting electrical shock and its severity - Effect of electrical shock of human being - Firing shock - Prevention of shocks - Safe guards for operators - Do's and Don'ts for safety in the use of domestic electrical appliances - Lightning Strokes on Overhead Transmission Lines and Outdoor Substations - Safety Precautions in Small LV Installations in Residential Buildings, Shops, Multi storied building - purpose of system grounding - grounding electrode system- grounding conductor connection to electrodes.		**CO2**
UNIT – III	**Safety During Installation, Testing and Commissioning, Operation and Maintenance**	**Periods:09**
Need for inspection and maintenance - Preliminary preparations - Field quality and safety - Personal protective equipment - Risks during installation of electrical plant and equipment - Effect of lightning current on installation and buildings - Safety aspects during installation -Safety during installation of electrical rotating machines - Importance of earthing in installation.		**CO3**
UNIT – IV	**Hazardous Zone**	**Periods:09**
Primary and secondary hazards - Hazardous area classification and of electrical equipments (IS, NFPA, API and OSHA standards) - Explosive gas area classifications: Class I (Division 1) - Zone 0, Zone 1, zone 2 classified locations, Design Philosophy for Equipment and installations - Classification of equipment enclosure for various hazardous gases and vapors - flash hazard calculation and approach distances- flash and thermal protection, head and eye protection - rubber insulating equipment.		**CO4**
UNIT – V	**Safety Management of Electrical Systems**	**Periods:09**
Principles of Safety Management - Occupational safety and health administration standards - Safety organization - Safety auditing - Employee electrical safety teams - Electrical safety training to improve Quality management - Total quality control and management – Importance of high load factor - Causes of low power factor - Disadvantages of low power factor - Power factor improvement - Importance of P.F. improvement - Case studies of electrical workplace safety practices.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. John Cadick, Mary Capelli Schellpfeffer, Dennis Neitzel, AlWinfield, "Electrical Safety Handbook", McGraw-Hill Education, 4th Edition, 2012.
2. Madden, M. John, "Electrical Safety and the Law: A Guide to Compliance", Wiley publications, 4th Edition, 2002.
3. Mohamed A. El-Sharkawi, "Electric Safety: Practice and Standards", CRC Press, 1st Edition, 2013.

Dr. P. Jamuna

Reference Books

1. Rob Zachariason, “Electrical Safety”, Delmar Cengage Learning, 1st Edition, 2011.
2. Peter E. Sutherland, “Principles of Electrical Safety”, Wiley- IEEE Press, 1st Edition, 2014.

Web References

1. https://www.apeasternpower.com/downloads/elecact2003.pdf
2. https://safetyculture.com/topics/electrical-hazards/
3. https://www.jove.com/science-education/10114/electrical-safety-precautions-and-basic-equipment
4. https://electrical-engineering-portal.com/21-safety-rules-for-working-with-electrical-equipment
5. https://www.electrical4u.com/safety-precautions-for-electrical-system/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
2	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
3	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
4	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
5	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23EEE402**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**NANO ELECTRONICS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Physical Science for Engineers, Electronics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the basics of nano electronics including quantum wires, dots and wells	**K2**
	CO2 Interpret the spintronic devices like spin transistors, spin diodes, and spin filters	**K2**
	CO3 Summarize the techniques for designing low-power nanoelectronic transistors	**K2**
	CO4 Examine the key performance aspects of tunneling and superconducting nano electronic devices	**K3**
	CO5 Apply the knowledge in the development of memory devices and sensors	**K3**

UNIT – I	**Introduction**	**Periods:09**
Scaling to nano - Electrons as waves and particles - origin of quantum mechanics - principles of quantum mechanics - Moore's law and continued miniaturization - Time independent Schrodinger wave equation - Electron confinement - Quantum dots - wires and well spin-Classification of Nanostructures		**CO1**
UNIT – II	**Spintronics**	**Periods:09**
Overview - History and Background -Generation of Spin Polarization - Theories of spin Injection - spin relaxation and spin dephasing - Spintronic devices and applications - spin filters - spin diodes - spin transistors		**CO2**
UNIT – III	**Nano Electronic Transistors**	**Periods:09**
Coulomb blockade: Coulomb blockade in Nano capacitors - Coulomb blockade in tunnel junctions - Single electron transistors (SETs) - Semiconductor nanowire FETs - Molecular SETs and molecular electronics - Memory cell		**CO3**
UNIT – IV	**Nano Electronic Tunneling and Super Conducting Devices**	**Periods:09**
Tunnel effect - Tunneling element - Tunneling diode - Resonant tunneling diode - Three terminal resonant tunneling devices- Superconducting switching devices - Cryotron - Josephson tunneling device - transport in nano MOSFET - transport in molecular structures		**CO4**
UNIT – V	**Memory Devices and Sensors**	**Periods:09**
Nano ferroelectrics - Ferroelectric random access memory - Fe-RAM circuit design - Fullerenes - Types of nanotubes - Carbon Nanotube - Formation of nanotubes - calorimetric sensors - electrochemical cells - surface and bulk acoustic devices - gas sensitive FETs - resistive semiconductor gas sensors - electronic noses - identification of hazardous solvents and gases - semiconductor sensor array		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Hanson, “Fundamentals of Nanoelectronics”, Pearson Education, 1st Edition, 2009.
2. Jan Dienstuhl, Karl Goser and Peter Glösekötter, “Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices”, Springer-Verlag Berlin and Heidelberg GmbH & Co. K, 1st Edition, 2004.
3. Robert Puers, LivioBaldi, Marcel Van de Voorde and Sebastiaan E. Van Nooten, “Nanoelectronics: Materials, Devices, Applications”, Wiley-VCH, 1st Edition, 2017.

Reference Books

1. Mircea Dragoman and Daniela Dragoman, “Nanoelectronics: Principles and Devices”, Artech House, 2nd Edition, 2009.
2. Brajesh Kumar Kaushik, “Nanoelectronics: Devices, Circuits and Systems”, Elsevier science, 1st Edition, 2018.

Web References

1. https://nptel.ac.in/courses/117108047
2. http://www.sze.hu/~bertam/Nanoelektronika/Nanoelectronics.pdf
3. https://www.sciencedirect.com/topics/materials-science/nanoelectronics
4. https://www.physics.mcgill.ca/~peter/nanoelectronics.htm
5. https://www.circuitstoday.com/nanoelectronics

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	2	-	-	-	-	-	2	3	2	2
2	3	3	2	2	2	2	-	-	-	-	-	2	3	2	2
3	3	3	2	2	2	2	-	-	-	-	-	2	3	2	2
4	3	3	2	2	2	2	-	-	-	-	-	2	3	2	2
5	3	3	2	2	2	2	-	-	-	-	-	2	3	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23EEE403**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**CONVENTIONAL POWER ENGINEERING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Electrical Engineering, Basics of Civil and Mechanical Engineering	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Differentiate the various conventional energy systems and factors affecting their site selection	**K2**
	CO2 Illustrate power generation using steam power plants with the detailed review on it	**K3**
	CO3 Explain about the nuclear energy production and its safety measures	**K2**
	CO4 Interpret and compare the construction, working principle of diesel, gas turbine and combined cycle power plants	**K3**
	CO5 Predict the economic feasibility and formulate tariff structure for power generating units	**K3**

UNIT – I	**Introduction to Power Plants**	**Periods:09**
Conventional and Non-Conventional Sources of Energy and their availability in India - Different Types of Power Plants - Choice of Power Generation - Basic schemes and constituents of Steam, Nuclear, Diesel and Gas Turbine power stations - Factors to be considered for selection of site - Power Plants in India.		**CO1**
UNIT – II	**Steam Power Plant**	**Periods:09**
Layout and types of Steam Power Plants - Fuel and Ash handling systems - Dust collectors – combustion equipment for steam boilers – Economizer and Air pre heater - Mechanical stokers – Pulverizes – Electrostatic precipitator – Draughts - Steam condensers - Cooling Ponds and Cooling Towers - Pollution Controls - Methods of Feed water treatment – Generating efficiency - Power generation capacities of various plants in India		**CO2**
UNIT – III	**Nuclear Power Plants**	**Periods:09**
Nuclear energy - Fission and Fusion reaction - Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors - Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium - Uranium reactor (CANDU), Breeder Reactor, Gas Cooled and Liquid Metal Cooled Reactors - Safety measures for Nuclear Power plants - Case study: Comparison of various nuclear power plants in India		**CO3**
UNIT – IV	**Diesel, Gas Turbine and Combined Cycle Power Plants**	**Periods:09**
Layout of Diesel power plants and components - Selection of engine – types and applications - Gas Turbine power plant - Classifications - Layout – Merits – fuels – Combined Cycle Power Plants -Integrated Gasified based Combined Cycle systems - Introduction to Energy storage – Case study: Decentralized Power technologies		**CO4**
UNIT – V	**Power Plant Economics**	**Periods:09**
Economics of Power generation - Cost of Electrical Energy, Expression for cost of electrical energy, interest, depreciation - Power tariff - types - Load distribution parameters - Load curve - load duration Curve – Effect of load on power plant design – Load forecasting – Peak load pricing - Comparison of site selection criteria - Relative merits and demerits - Capital and Operating Cost of different power plants.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. El-Wakil, “Power Plant Technology”, McGraw-Hill, 1st Edition, 2010.
2. Frederick T. Morse, “Power Plant Engineering”, Affiliated East-West Press Pvt. Ltd, 7th Edition, 2008.
3. R. K. Rajput, “Power Plant Engineering”, Laxmi Publications, 4th Edition, 2016.

Reference Books

1. Leonjard L. Grigsby, “Electric Power Generation, Transmission and Distribution”, CRC Press, 3rd Edition, 2012.
2. Bernhardt G.A. Skrotzki, “Power Station Engineering and Economy”, Tata McGraw Hill, Indian Edition, 2001.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, “Standard Handbook of Power Plant Engineering”, McGraw Hill, 2nd Edition, 2012.
4. P.K. Nag, “Power Plant Engineering”, Tata McGraw-Hill, 4th Edition, 2017.

Dr. P. Jamuna

Web References

1. https://swayam.gov.in/nd1_noc20_me10/preview
2. https://swayam.gov.in/nd1_noc20_me87/preview
3. https://swayam.gov.in/nd1_noc20_me40/preview
4. https://swayam.gov.in/nd1_noc20_me33/preview
5. https://swayam.gov.in/nd1_noc20_ee86/preview

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3
2	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3
3	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3
4	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3
5	3	1	2	2	-	1	-	-	-	-	-	-	3	2	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23EEE404**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ENERGY STORAGE TECHNOLOGY**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Physical Science for Engineers, Electrical Engineering	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Summarize the need and importance of energy storage	**K2**
	CO2 Analyze the various energy storage techniques in the form of electrical, magnetic and chemical systems	**K3**
	CO3 Examine the different batteries and its characteristics used for storing the energy in electric vehicles, nano-tubes etc.	**K3**
	CO4 Interpret the concepts of Superconducting Magnet Energy Storage Systems and super-capacitors in digital cameras, PC cards, electric vehicles, medical applications etc.	**K3**
	CO5 Classify the various energy storage techniques used in Electric vehicles and its hybridization concepts, power grid stabilization, rail-system power models etc.	**K4**

UNIT – I	**Introduction to Energy Storage**	**Periods:09**
Energy Storage: Need - Different modes of Energy Storage - Potential energy - Pumped hydro storage - Kinetic Energy and Compressed gas system - Flywheel storage, compressed air energy storage - Environmental and sustainability issues.		**CO1**
UNIT – II	**Energy Storage Types**	**Periods:09**
Electrical and Magnetic energy storage, Capacitors, electromagnets - Chemical Energy storage - Thermal energy storage (TES) - Thermo-chemical, fossil fuels and synthetic fuels - Hydrogen for energy storage, Solar Ponds for energy storage. Electrochemical Energy Storage Systems, Case study on perovskite solar cell.		**CO2**
UNIT – III	**Batteries**	**Periods:09**
Batteries: Primary, Secondary, Lithium, Solid-state and molten solvent batteries - Lead acid batteries - Nickel Cadmium Batteries - Li ion battery, Ni metal hydride battery - Advanced Batteries - Role of carbon nano-tubes in electrodes - Flow battery operation - Flexible fiber battery- air batteries		**CO3**
UNIT – IV	**Superconducting Magnet Energy Storage Systems**	**Periods:09**
Superconducting Magnet Energy Storage(SMES) systems - Capacitor and Batteries: Comparison and application - Super capacitor - Electrochemical Double Layer Capacitor (EDLC), principle of working, structure, performance and application, role of activated carbon and carbon nano-tube - Super Capacitors - power calculation – operation and design.		**CO4**
UNIT – V	**Vehicular Energy Storage Systems**	**Periods:09**
Energy storage technologies in hybrid vehicles - flywheel, hydraulic, fuel cell and hybrid fuel cell energy storage system - ultra capacitors - comparison - battery charging control		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Jiujun Zhang, Lei Zhang, Hansan Liu, Andy Sun, Ru-Shi Liu, "Electrochemical Technologies for Energy Storage and Conversion - 2 Volume set", John Wiley and Sons, 1st Edition, 2011.
2. Detlef Stolten, "Hydrogen and Fuel Cells: Fundamentals, Technologies and Applications", Wiley, 1st Edition, 2010.
3. Andrei G. Ter-Gazarian, "Energy Storage for Power Systems", Institution of Engineering and Technology, 3rd Edition, 2020.

Reference Books

1. Francois Beguin and Elzbieta Frackowiak, "Super capacitors: Materials, Systems and Applications", Wiley-VCH, 1st Edition, 2013.
2. Doughty Liaw, Narayan and Srinivasan, "Batteries for Renewable Energy Storage", The Electrochemical Society, 2010.
3. Ali Emadi, Mehrdad Ehsani, John M. Miller, "Vehicular Electric Power Systems: Land, Sea, Air and Space Vehicles", CRC Press, 1st Edition, 2003.
4. Chris Mi, M. AbulMasrur, David Wenzhong Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", Wiley, 1st Edition, 2011.
5. Robert Huggins, "Energy Storage: Fundamentals, Materials and Applications", Springer, 2nd Edition, 2016.

Dr. P. Jamuna

Web References

1. https://www.azocleantech.com/article.aspx?ArticleID=593
2. https://energystorage.org/why-energy-storage/technologies/
3. https://www.renewableenergyworld.com/2019/10/22/which-new-energy-storage-technologies-might-outcompete-lithiumion-in-the-2020s/
4. https://www.sciencedirect.com/topics/engineering/energy-storage-technology
5. https://en.wikipedia.org/wiki/Energy_storage

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
2	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
3	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
4	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3
5	3	3	3	2	1	-	-	-	-	-	-	-	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**IV**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23EEE405**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DIGITAL LOGIC DESIGN USING VHDL**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Physical Science for Engineers, Electronics	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Use modern development tools to design complex digital circuits.	**K2**
	CO2 Analyze syntax and behavior of the VHDL language in combinational circuits	**K4**
	CO3 Apply the VHDL for sequential logic circuits.	**K3**
	CO4 Examine the performance of circuits with Programmable logic devices.	**K3**
	CO5 Demonstrate the functions using Field Programmable Gate Array	**K3**

UNIT – I	**Introduction to VHDL**	**Periods:09**
Introduction to Packages - Subprograms - Introduction to Hardware Description Languages (HDL) - HDL based design, VHDL- Variables, Signals and constants, Arrays, VHDL operators - VHDL Modules-VHDL Libraries - Predefined Attributes - Configurations - VHDL Synthesis - constraints and attributes.		**CO1**
UNIT – II	**Combinational Circuit Design with VHDL**	**Periods:09**
VHDL description of combinational circuits - Design of a serial adder with accumulator, Design of a binary multiplier, Multiplication of signed binary numbers, Design of a binary divider-VHDL models for a multiplexer, demultiplexer		**CO2**
UNIT – III	**Sequential Circuit Design with VHDL**	**Periods:09**
VHDL description of sequential circuits-Modeling flip-flops, counters, Compilation and simulation of VHDL code, Modeling a sequential machine - Registers – Simple Processor.		**CO3**
UNIT – IV	**Implementation Technology with Programmable Logic Devices**	**Periods:09**
Memory structure: RAM - ROM - PROM - EPROM - EEPROM - Programmable logic arrays (PLAs), Programmable array logic (PALs), Other sequential programmable logic devices (PLDs), Design of a keypad scanner		**CO4**
UNIT – V	**Implementation Technology of FPGA**	**Periods:09**
Implementation of function using FPGA-Xilinx 3000 series FPGAs, Designing with FPGAs, Xilinx 4000 series FPGAs using a one hot state assignment, Altera complex programmable logic devices (CPLDs), Altera FELX 10K series COLDs.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. M. Morris Mano and Michael D.Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL and System Verilog", 6th Edition, 2018.
2. H. Charles, J. Roth, "Digital Systems Design using VHDL", Pearson Education, 11th Edition, 2020.
3. Comer, "Digital Logic & State Machine Design", Oxford, 5th Edition, 2018.

Reference Books

1. D. P. Kothari, J. S. Dhillon, "Digital circuits and Design", Pearson Education, 6th Edition, 2018.
2. Tocci R.J., Neal S. Widmer, "Digital Systems: Principles and Applications", Pearson Education Asia, 12th Edition, 2020.
3. Roger L. Tokheim, "Digital Electronics: Principles and Applications", McGraw Hill Education, 8th Edition, 2018.
4. Donald P Leach, Albert Paul Malvino, Goutam Sha, "Digital Principles and Applications", Tata McGraw Hill, 7th Edition, 2018.
5. Volnei A. Pedroni, "Circuit Design and Simulation with VHDL", Pearson Education, 11th Edition, 2018.

Web References

1. https://nptel.ac.in/courses/117103064/
2. https://nptel.ac.in/courses/117/105/117105080/
3. https://nptel.ac.in/courses/117/108/117108040/
4. http://www.nptelvideos.in/2012/12/digital-circuits-and-systems.html
5. http://nptel.unipune.ac.in/LocalG/listLectures.php?cid=70cfb15a91cff73d&bid=927d7542627865a3

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	3	2	-	-	-	-	-	-	-	2	2	2
2	2	2	2	3	2	-	-	-	-	-	-	-	2	2	2
3	2	2	2	3	2	-	-	-	-	-	-	-	2	2	2
4	2	2	2	3	2	-	-	-	-	-	-	-	2	2	2
5	2	2	2	3	2	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**V**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23EEE506**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**UTILIZATION OF ELECTRICAL ENERGY**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								
Prerequisite	Electrical Engineering, Electrical Machines							

Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Describe the various lighting schemes used in street, flood and factory.	**K2**
	CO2	Illustrate the principles of electrical heating methods and welding.	**K2**
	CO3	Apply the law of thermodynamics to troubleshoot, and optimize refrigeration and air conditioning systems	**K3**
	CO4	Examine the speed-time characteristics and performance parameters of electric traction systems	**K3**
	CO5	Summarize the principles and applications of electrolysis, electroplating, battery technology, and green building concepts	**K2**

UNIT – I	**Illumination**	**Periods:09**	
Production of light – Laws of illumination – Lighting calculation – Determination of MHCP and MSCP – Polar curves of different types of sources – Rousseau's construction –Interior and exterior illumination systems – Design on lighting schemes - Factory lighting - Flood lighting - Gaseous discharge lamps - High pressure and Low pressure neon sign - High frequency , low pressure discharge tubes-Bureau of energy efficiency star rating for lamps.			**CO1**
UNIT – II	**Electric Heating and Welding**	**Periods:09**	
Electrical heating - Methods, advantages and application, design of heating elements, efficiency and losses control. Induction heating: Core type furnaces, Core less furnaces and high frequency eddy current heating-Dielectric heating-Principle and special applications, Arc furnaces-Direct arc furnaces, Indirect arc furnaces, electrodes, power supply and control. Different methods of electrical welding. Arc furnaces transformer and welding transformer.			**CO2**
UNIT – III	**Refrigeration and Air Conditioning**	**Periods:09**	
Laws of Thermodynamics-First Law of Thermodynamics (Conservation of Energy), Second Law of Thermodynamics (Entropy), Third Law of Thermodynamics (Absolute Zero). Electrical Circuit of Refrigerator - Trouble shooting of Refrigerator – Air conditioning types and their applications – smart air conditioning systems – Trouble shooting of air conditioning.			**CO3**
UNIT – IV	**Electric Traction**	**Periods:09**	
Electric traction -Need, requirements and merits- Supply systems - Mechanics of train movement - Traction motors and control - Tractive effort calculations - Speed-time characteristics. Locomotives and train - Braking - recent trends in electric traction-Metro and Mono rail systems.			**CO4**
UNIT – V	**Electrolysis and Batteries**	**Periods:09**	
Electrolysis- Laws of Electrolysis, power supply, Efficiency – Electro Plating. Batteries-Types – Lead Acid, Ni Cd, Lithium Ion-battery components and design, electrode, battery modules and packs, rating of batteries – Methods of charging and maintenance. Introduction to Green Building Concept and energy auditing.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. J. B. Gupta, "Utilization of Electrical Power and Traction", Kataria Publications, 4th Edition, 2022
2. E. Openshaw Taylor, "Utilisation of Electric Energy", Oriented Longmans Limited, 16th Edition, 2013
3. R. K. Rajput, "Utilization of Electrical Power", Lakshmi publications, 4th Edition, 2023

Reference Books

1. S.S. Uppal, "Utilization of Electrical Energy", Khanna Publishers, 4th Edition, 2022.
2. H. Partap, "Art and Science of Utilization of Electrical Energy", Dhanpat Rai and Sons, Delhi, 3rd Edition, 2020.
3. C. L. Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", New Age International Publishers, 5th Edition, 2022.
4. Pradip Kumar Sadhu, Soumya Das, "Modern utilization of Electric Power", CBS Publisher, 2nd Edition, 2022.
5. Robert Spotnitz, "Modern Battery Technologies for Sustainable Energy Systems" Springer publications, 2nd Edition, 2020.

Dr. P. Jamuna

Web References

1. https://books.google.co.in/books?id=1LLVSAfXR8wC&lpg=PP1&pg=PR17#v=onepage&q&f=true
2. https://nptel.ac.in/courses/108/105/108105060/
3. https://nptel.ac.in/courses/112/107/112107090/
4. https://nptel.ac.in/courses/112/105/112105129/
5. https://nptel.ac.in/courses/103/108/103108162/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	1	-	-	-	-	-	-	-	1	3	2	2
2	3	2	2	1	-	-	-	-	-	-	-	1	3	2	2
3	3	2	2	1	-	-	-	-	-	-	-	1	3	2	2
4	3	2	2	1	-	-	-	-	-	-	-	1	3	2	2
5	3	2	2	1	-	-	-	-	-	-	-	1	3	2	2

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**V**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23EEE507**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SPECIAL ELECTRICAL MACHINES**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								

Prerequisite	**Electrical Machines**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the performance characteristics of stepper motors in various operating modes.	**K2**
	CO2 Examine the performance characteristics of synchronous reluctance motors and to select the appropriate controllers for industrial applications.	**K3**
	CO3 Illustrate the performance characteristics of different types of controllers used for switched reluctance motors.	**K3**
	CO4 Demonstrate the various sensors used for brushless DC motor control in EV applications.	**K3**
	CO5 Predict the performance characteristics of permanent magnet synchronous motors and to analyze the vector control schemes.	**K3**

UNIT – I	**Stepper Motors**	**Periods:09**
Constructional features and principle of operation: Variable reluctance, Permanent and Hybrid Stepper motor - Torque production in Variable Reluctance (VR) stepper motor- Static and Dynamic Characteristics – Microprocessor based control of stepper motors – Closed loop control – Applications.		**CO1**
UNIT – II	**Synchronous Reluctance Motors**	**Periods:09**
Constructional features of axial and radial air gap Motors - operating principle - Phasor diagram - Derivation of reluctance torque from phasor diagram- motor characteristics - Controller for Synchronous Reluctance motor - – Applications		**CO2**
UNIT – III	**Switched Reluctance Motors**	**Periods:09**
Constructional features - principle of operation - Torque equation - Torque Speed Characteristics - Converters for SRM - Current control schemes: Hysteresis and PWM - Microprocessor based controller and Sensorless Controller - Closed loop control of SRM - Applications.		**CO3**
UNIT – IV	**Brushless DC Motors**	**Periods:09**
Construction and Principle of operation - Torque and EMF equation - Torque-Speed characteristics - Permanent Magnet materials - electronic commutator - Difference between mechanical and electronic Commutator - Rotor Position sensors: Hall effect sensors - Optical sensor - Microprocessor based controller - Sensorless control – Applications.		**CO4**
UNIT – V	**Permanent Magnet Synchronous Motors**	**Periods:09**
Construction - Principle of operation - EMF and Torque equations - Phasor diagram - Torque-speed characteristics - Self-control - Vector control schemes - Microprocessor based control - Comparison of BLDC and PMSM - DFIG - Linear machines - Applications.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. E.G.Janardanan, “Special electrical machines”, PHI learning Pvt. Ltd, 2nd Edition, 2014
2. T. J. E. Miller, “Brushless permanent magnet and reluctance motor drives”, Clarendon Press, Oxford, 5th Edition, 2017.
3. K. Venkataratnam, “Special Electrical Machines”, Universities Press Private Limited, 1st Edition, 2009.

Reference Books

1. R. Krishnan, “Switched Reluctance Motor Drives Modeling, Simulation, Analysis, Design, and Applications”, CRC Press, 2017.
2. R. Srinivasan, “Special Electrical Machines”, Lakshmi Publications, 2013.
3. Bilgin, Berker Emadi, Ali Jiang, James Weisheng, “Switched reluctance motor drives: fundamentals to applications”, CRC, 2019.
4. J. Gnanavadivel, J. Karthikeyan and S. Albert Alexander, “Special Electrical Machines”, Anuradha publications, 3rd Edition, 2009.

Dr. P. Jamuna

Web References

1. https://ndl.iitkgp.ac.in.
2. http://ess.inflibnet.ac.in.
3. https://nptel.ac.in/courses/108/102/108102156.
4. http://www.electrical4u.com.
5. https://vidwan.inflibnet.ac.in.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	2	2	-	-	-	-	-	-	-	1	3	2	2
2	3	3	2	3	-	-	-	-	-	-	-	1	2	2	2
3	3	2	2	3	-	-	-	-	-	-	-	1	3	3	3
4	2	3	3	2	-	-	-	-	-	-	-	1	3	2	3
5	3	2	3	2	-	-	-	-	-	-	-	1	2	3	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech Degree**						
Semester	**V**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**U23EEE508**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**HIGH VOLTAGE ENGINEERING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								
Prerequisite	Power systems, Electrical Engineering							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the causes and types of over voltages.	**K2**
	CO2 Summarize various breakdown phenomena occurring in gaseous, liquid and solid dielectrics.	**K2**
	CO3 Discuss the different methods for generation of high voltages and currents for testing of high voltage apparatus.	**K2**
	CO4 Apply different methods used for measuring AC, DC and impulse voltages and impulse currents.	**K3**
	CO5 Examine appropriate testing method(s) for various high voltage apparatus.	**K3**

UNIT- I	**Over Voltages in Electrical Power Systems**	**Periods: 09**
Causes of over voltages and their effects on power system Lightning, switching and temporary over voltages - Protection against over voltages, surge diverters, surge modifiers- Bewley lattice diagram.		**CO1**
UNIT- II	**Insulation Material and Dielectric Breakdown**	**Periods: 09**
Introduction to Insulation materials: Classification, insulating materials used in various power equipment's. Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids- Breakdown mechanisms in solid and composite dielectrics.		**CO2**
UNIT- III	**Generation of High Voltages and High Currents**	**Periods: 09**
Generation of High DC, AC, impulse voltages and currents - Triggering and control of impulse generators.		**CO3**
UNIT- IV	**Measurement of High Voltages and Currents**	**Periods: 09**
HVDC measurement: Series resistance micro-ammeter, Resistance Potential divider, Generating Voltmeter. Power frequency A.C voltage measurement: Series Impedance Ammeter, Potential divider, Potential transformer, Electrostatic Voltmeters. Impulse voltage measurements: Sphere gaps, Digital techniques in high voltage measurement. Impulse current measurement: current transformer, Rogowski coil, pure resistive shunt method		**CO4**
UNIT- V	**High Voltage Testing and Insulation Coordination**	**Periods: 09**
High voltage testing of electrical power apparatus as per International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators, cables, surge arresters and transformers- design, planning and layout of high voltage laboratory - Insulation Co-ordination.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books:

1. M. S. Naidu and V. Kamaraju, "High Voltage Engineering", Tata McGraw-Hill Publishing Co. Ltd., 6th Edition, 2020.
2. E.Kuffel and W.S. Zaengl, J.Kuffel, "High voltage Engineering fundamentals", Newnes, Elsevier, 2nd Edition, 2005.
3. C. L. Wadhwa, "High Voltage Engineering", New age international, 4th Edition, 2020.

Reference Books:

1. L.L.Alston, "High Voltage Technology", Oxford University Press, 1st Indian Edition, 2011.
2. Subir Ray, "An Introduction to High Voltage Engineering", PHI Learning Private Limited, New Delhi, 2nd Edition, 2011.
3. Rakosh Das Begamudre, "High Voltage Engineering, Problems and Solutions", New Age International Publishers, New Delhi, 2010

Web Reference:

1. https://www.springer.com/gp/book/9783642119927
2. https://www.elsevier.com/books/high-voltage-engineering/Hammond/978-0-08-024212-5
3. https://nptel.ac.in/courses/108/104/108104048/#

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	1	1	1	-	-	-	-	-	1	3	1	2
2	3	3	2	1	1	1	-	-	-	-	-	1	2	1	2
3	3	3	3	1	1	1	-	-	-	-	-	1	2	1	2
4	3	3	3	1	1	1	-	-	-	-	-	1	3	2	2
5	3	3	3	1	1	1	-	-	-	-	-	1	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**V**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**U23EEE509**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**AUTOMOTIVE ELECTRONICS FOR ELECTRICAL ENGINEERING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
		EEE						
Prerequisite	**Electronics**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe various control elements, emission norms and standards in automobiles	**K2**
	CO2 Classify the electronic fuel injection/ignition components and their functions.	**K4**
	CO3 Demonstrate automotive sensors and actuators with microcontrollers.	**K3**
	CO4 Predict electronic engine control system problems with appropriate diagnostic tools	**K3**
	CO5 Analyze the chassis management system and safety system provided in the vehicles.	**K4**

UNIT- I	**Introduction**	**Periods:09**	
Evolution of electronics in automobiles - Emission laws - Emission norms and Standards, charging systems- Working - design - Types, D.C. and AC dynamo, flywheel magneto charging system and Alternators - controlling and regulator system: Relay/cut-out, voltage and current regulator, electronic regulator, characteristics. Drive for Charging system – Requirements of starting system - Starter motors and starter circuits.			**CO1**
UNIT- II	**Ignition and Injection Systems**	**Periods:09**	
Ignition systems: Ignition fundamentals - Requirements. Types- Ballast Resistance, Ignition coil characteristics, Cam angle and contact angle gap, spark advance mechanism, spark plug, ignition timing, multi-cylinder distributor, Distributor (contact breaker ignition system), limitations - spark plug: characteristics, material, types, plug fouling - Electronic fuel Control: Basics of combustion – Engine fuelling and exhaust emissions – carburettor – Petrol and diesel fuel injection.			**CO2**
UNIT- III	**Sensor and Actuators**	**Periods:09**	
Airflow rate, Engine crankshaft angular position, Throttle angle, exhaust gas oxygen sensors, Instrument Cluster panel, fuel gauges, oil temperature gauge, warning light sensors, coolant temperature gauge, speedometer, Odometer, tachometer, trip meter, oil level indicator, parking brake indicator, direction indicators – exhaust gas recirculation actuators, stepper motor actuator and vacuum operated actuator.			**CO3**
UNIT- IV	**Engine Control Systems**	**Periods:09**	
Control modes for fuel control-engine control subsystems - ignition control methodologies - Engine management system - Block diagram - different engine control units (ECU's). Vehicle networks: Controller Area Network (CAN) standard - Diagnostics systems in modern automobiles. Digital Engine control system.			**CO4**
UNIT-V	**Chassis and Safety Systems**	**Periods:09**	
Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system - Steering - power steering, collapsible and tiltable steering column - steer by wire - Airbag: working, role of Micro Electro-Mechanical Systems – centralized door locking system – climate control in Vehicle - Vision enhancement, road recognition system, Anti-theft technologies, smart key system.			**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Tom Denton, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, 5th Edition, 2018.
2. William B. Ribbens, "Understanding Automotive Electronics", Newnes Publishing, 8th Edition, 2017.
3. P. L. Kholi, "Automotive Electrical Equipment", Tata McGraw Hill Co., Ltd., New Delhi, 2001.

Reference Books

1. Barry Hollembeak, "Automotive Electricity, Electronics and Computer Controls", Delmar Publishers, 1st Edition, 2001.
2. Check-chart, Kalton C. Lahue and Alan Harold Ahlstrand, "Fuel System and Emission controls", Good Year Books, 3rd Edition, 2000.
3. Ronald. K. Jurgen, "Automotive Electronics Handbook", McGraw-Hill, 1st Edition, 1999.
4. Robert Bosch Gmbh, "Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive", John Wiley and Sons Inc., 5th Edition, 2007.

Dr. P. Jamuna

Web References

1. https://www.autotrainingcentre.com/blog/4-types-fuel-injection-systems-auto-parts-specialists/
2. https://www.bosch-mobility-solutions.com/en/products-and-services
3. https://www.oreilly.com/library/view/understanding-automotive-electronics/
4. https://clr.es/blog/en/sensors-and-actuators-for-safer-driving/
5. https://www.te.com/usa-en/industries/sensor-solutions/applications/automotive-sensors.html
6. https://www.renesas.com/us/en/solutions/automotive/chassis.html
7. https://www.st.com/en/applications/chassis-and-safety.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	2	-	-	-	-	-	1	2	3	3
2	3	3	3	2	2	2	-	-	-	-	-	1	2	3	3
3	3	3	3	2	2	2	-	-	-	-	-	1	2	3	3
4	3	3	3	2	2	2	-	-	-	-	-	1	2	3	3
5	3	3	3	2	2	2	-	-	-	-	-	1	2	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**V**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**U23EEE510**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MODERN CONTROL SYSTEMS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								

Prerequisite	**Electronics**	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Demonstrate pole placement and the state observer using state space and state feedback system in modern control systems	**K3**
	CO2 Analyze the nonlinear system behaviour by phase plane and describing function methods	**K4**
	CO3 Predict the stability by describing function method and Lyapounov's method for stability	**K3**
	CO4 Illustrate the Z transform analysis of sampled data control systems.	**K4**
	CO5 Examine discrete-time models using z domain to know the concept of sampling process that is used in digital control system.	**K3**

UNIT- I	**State Variable Design**	**Periods:09**
Introduction - concepts of state variables and state model - Effect of state feedback - Pole placement design - Necessary and sufficient condition for arbitrary pole placement-State regulator design - Design of state observers Separation principle - State feedback with integral control-State space controller for DC motor with feedback control.		**CO1**
UNIT- II	**Non-Linear Systems - I**	**Periods:09**
Introduction - nonlinearities - Phase plane method: concepts, singular points, stability of nonlinear systems - Construction of phase trajectories system analysis by phase plane method		**CO2**
UNIT- III	**Non-Linear Systems - II**	**Periods:09**
Stability analysis by describing function method - Jump resonance - Lyapounov's method for stability study, concept of Limit Cycle. Nonlinear modeling and identification of a DC motor		**CO3**
UNIT- IV	**Sampled Data Analysis - I**	**Periods:09**
Introduction - Spectrum analysis of sampling process signal reconstruction difference equations - Z transform function, Inverse Z transform function - Response of Linear discrete system		**CO4**
UNIT-V	**Sampled Data Analysis - II**	**Periods:09**
Response between sampling instants - Corelation between Z and S domain - Pulse transfer function-State equation - Stability analysis – Schur Cohn stability, Jury's Test and compensation techniques - Digital filter design techniques.		**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. M. Gopal, "Digital Control and State Variable Methods", Mc Graw Hill India, 4th Edition, 2012.
2. K. Ogata, "Modern Control Engineering", Pearson, 5th Edition, 2014.
3. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers, 2nd Edition, 2016.

Reference Books

1. M. Gopal, Modern Control System Theory, New Age International Publishers, 3rd Edition, 2014.
2. William S Levine, "Control System Fundamentals," The Control Handbook, CRC Press, Taylor and Franci Group, 2nd Edition, 2017.
3. Ashish Tewari, "Modern Control Design with MATLAB and SIMULINK", John Wiley,1st Edition 2002.
4. T. Glad and L. Ljung, "Control Theory-Multivariable and Non-Linear Methods", Taylor and Francis, 1st Edition, 2009.
5. D. S. Naidu, "Optimal Control Systems", CRC Press, 1st Edition, 2002.

Web References

1. https://nptel.ac.in/courses/Adavanced Control systems
2. https://www.mathworks.com/products/control.html/Control system tool box
3. https://www.tutorialspoint.com/control_systems_state_space_analysis.html
4. http://web.mit.edu/www/Handouts/StateSpace.pdf
5. https://www.tutorialspoint.com/ control systems steady state errors.html
6. https://www.mathworks.com/ optimal-and-robust-control-.html
7. https://arc.aiaa.org/doi/pdf/10.2514/6.2002-4635

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	-	-	-	-	-	-	1	2	3	3
2	3	3	3	2	2	-	-	-	-	-	-	1	2	3	3
3	3	3	3	2	2	-	-	-	-	-	-	1	2	3	3
4	3	3	3	2	2	-	-	-	-	-	-	1	2	3	3
5	3	3	3	2	2	-	-	-	-	-	-	1	2	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VI**	Course Category: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23EEE611**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**FINITE ELEMENT ANALYSIS FOR ELECTRICAL ENGINEERING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Electromagnetic Theory, Electrical Machines - I and Electrical Machines - II	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Determine Maxwell's equations to model and analyze electromagnetic fields.	**K3**
	CO2 Explain various solution methods for solving field equations	**K2**
	CO3 Interpret finite element formulations to solve one and two-dimensional problems.	**K2**
	CO4 Apply basic quantities such as flux and torque using FEM packages.	**K3**
	CO5 Analyze the performance of electrical apparatus using the Finite Element Method	**K4**

UNIT – I	**Introduction**	**Periods:09**
History of FEM and FEA, difference between FEM and FEA, review of basic field theory – Maxwell's equations – Constitutive relationships and Continuity equations - Poisson and Helmholtz equation - Outline of Electromagnetic Fields: Vector Analysis - Electromagnetic Fields - Fundamental. Equations - Principle of energy conversion -Force/Torque calculation		**CO1**
UNIT – II	**Basic Solution Methods for Field Equations**	**Periods:09**
Limitations of the conventional design procedure - Field Problems with Boundary Conditions - Classical Method for the Field Problem Solution - Classical Residual Method - Classical Variational Method - Solution by analytical methods: Direct integration method - Variable separable method - Method of images - Solution by numerical methods - Solution for matrix equations - Finite difference method.		**CO2**
UNIT – III	**Formulation of Finite Element Method**	**Periods:09**
Variational formulation - Energy minimization - Discretization - Shape functions - Stiffness matrix -1D and 2D planar and axial symmetry problems - Mesh generation in 2D - Axis-symmetric applications.		**CO3**
UNIT – IV	**Computation of Basic Quantities Using Fem Packages**	**Periods:09**
Basic quantities - Energy stored in electric field - Capacitance - Magnetic field - Linked flux - Inductance - Force - Torque - Skin effect - Resistance - Computation of electric field, Magnetic field intensity. Air-gap Elements for Electrical machines: Introduction - Description of the air gap element method - Finite Element Discretization - Analytical Solution - Coupling Scheme - Applications		**CO4**
UNIT – V	**Design Applications**	**Periods:09**
Introduction to software packages of finite element analysis - Applications to magnetic circuit design - Modeling and design of insulators - Magnetic actuators - Transformers - Rotating machines. Computation of Losses: Computation of Eddy Current Loss - Losses in Winding.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. J. N. Reddy, "An Introduction to the Finite Element Method", Tata McGraw-Hill, 4th Edition, 2019.
2. P. Seshu, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., 10th Edition, 2012.

Reference Books

1. Matthew. N.O. Sadiku, "Elements of Electromagnetics", Oxford University Press, 7th Edition, 2024.
2. Charles W. Steels, "Numerical Computation of Electric and Magnetic fields", Van Nostrand Reinhold Company, 7th Edition, 2018.
3. Silvester and Ferrari, "Finite Elements for Electrical Engineers", Cambridge University press, 3rd Edition, 1996.
4. S. J. Salon, "Finite Element Analysis of Electrical Machines", Kluwer Academic Publishers, 1st Edition, 1995.
5. Nicola Biyanchi, "Electrical Machine analysis using Finite Elements", Taylor and Francis Group, CRC Publishers, 1st Edition, 2005.

Web References

1. https://nptel.ac.in/courses/108/106/108106073/
2. https://nptel.ac.in/courses/108/106/108106152
3. https://nptel.ac.in/courses/108/101/108101090
4. https://www.youtube.com/watch?v=4c-sPXolD0w
5. https://nptel.ac.in/courses/112/104/112104116/

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
2	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
3	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
4	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
5	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23EEE612**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRIC TRACTION**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
		EEE						
Prerequisite	Electrical Machines, Transmission and Distribution							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Summarize the basics of Electric Traction System and its mechanics for train movements	**K2**
	CO2	Interpret the different Traction Drives and controlling techniques	**K2**
	CO3	Differentiate the best suited protection system for Electric Locomotive	**K2**
	CO4	Discuss about the equipment present in Electric Traction Sub-Systems	**K2**
	CO5	Apply the solid state interlocking principle in railway signalling system	**K3**

UNIT- I	**Introduction of Electric Traction**	**Periods:09**
Indian Scenario of Electric traction, Advantages of Electric Traction over other systems of traction, selection of traction system - Electric and Diesel-Electric. Mechanics of train movement- Speed - time curve for train movement - Requirement of tractive effort and T-N curve of a typical train load, Specific energy consumption and Coefficient of adhesion- Suspension and mechanism of torque transmission Concept of Weight Transfer & Effect of un-sprung mass and wheel diameter.		**CO1**
UNIT- II	**Traction Motor Drives**	**Periods:09**
Type of traction motor – characteristics - Optimization of design and construction features - Tractive Effort and Drive Ratings - Important Features of Traction Drives - conventional DC and AC Traction drives – Converter Controlled Drives - DC Traction using Chopper Controlled Drives - Poly phase AC /DC Traction Motors - Traction control of DC locomotives and EMU's - Traction control system of AC locomotives - Control gear.		**CO2**
UNIT- III	**Protection of Locomotive Equipment and Circuits**	**Periods:09**
Broad strategy for protection, Surge protection, Overload protection of main power circuits, Earth fault protection of power auxiliary circuits - Protection from over-voltage and under-voltage, Differential protection of traction circuits - Protection against high and low air pressure in the compressed air circuit – Temperature monitoring, Protection of transformer by buchholz relay - Protection against accidental contact with HT equipment Protection against fires.		**CO3**
UNIT- IV	**Electric Traction Sub-Systems (Overhead Equipment)**	**Periods:09**
Overhead Equipment (OHE), Sectionalizing, Bonding of Rails and Masts, Materials Employed in OHE Electric Traction Sub-Systems - Power Supply Installations - Layout design of Traction Substation/ Protection, Booster Transformers and Return Conductor- SCADA System.		**CO4**
UNIT-V	**Railway Signaling**	**Periods:09**
Block Section Concept - Track Circuits, Interlocking Principle - Train speed and signaling - Solid state Interlocking - Automatic Warning Systems.		**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Upadhayay J, Mahindra S.N, “Electric Traction”, Allied Publishers Ltd., 1st Edition, 2000.
2. Andreas Steimel, “Electric Traction-Motive Power and Energy Supply”, Deutscher Industrieverlag publishers, 2nd Edition, 2014.
3. A.T. Dover, “Electric Traction”, Pitman Publishing, 4th Edition, 1965.

Reference Books

1. P.S. Rao, “Principle of 25 KV Overhead Equipments”, Printpack Pvt. Ltd., 1st Edition, 2000.
2. Gopal K Dubey, “Fundamentals of Electric Drives”, Narosa Publishing, 2nd Edition, 2010.
3. H. Partab, “Modern Electric Traction”, Dhanpat Rai & Sons, 1st Edition, 2017.
4. C. L. Wadhwa, “Generation, Distribution and Utilization of Electrical Energy”, New Age International, 3rd Edition, 2015.
5. J.B. Gupta, “Utilization of Electrical Power and Electric Traction”, S. K. Kataria & Sons publications, 10th Edition, 2019.
6. R. B. Brooks, “Electric Traction Hand Book”, Sir Isaac Pitman and sons Ltd, London, 1st Edition, 1954.

Web References

1. https://epd.wisc.edu/courses/fundamentals-of-traction-power-systems-and-overhead-contact-systems/
2. http://www.railsystem.net/electric-traction-systems/
3. https://archive.nptel.ac.in/courses/108/104/108104140/
4. http://www.vssut.ac.in/lecture_notes/lecture1424084684.pdf
5. https://onlinecourses.nptel.ac.in/noc23_ag06/preview

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	3	1	-	-	-	-	-	-	1	3	2	3
2	3	2	3	3	1	-	-	-	-	-	-	1	3	2	3
3	3	2	3	3	1	-	-	-	-	-	-	1	3	2	3
4	3	2	3	3	1	-	-	-	-	-	-	1	3	2	3
5	3	2	3	3	1	-	-	-	-	-	-	1	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**U23EEE613**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL ENERGY AUDIT AND CONSERVATION**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								

Prerequisite	Electrical Engineering, Electrical Machines, Renewable Energy	
Course Outcome	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Outline about the energy audit process and instruments	**K2**
	CO2 Apply the energy efficient methods for improving efficiency of electric motors	**K3**
	CO3 Demonstrate good illumination systems and analyze the power factor	**K3**
	CO4 Examine various meters used for energy management	**K3**
	CO5 Analyze and evaluate cost effective model in electrical equipment	**K4**

UNIT- I	**Introduction**	**Periods:09**	
Basics of energy - need for energy management - energy accounting - energy monitoring - targeting and reporting - energy audit - definitions - types of energy audit - audit instruments - audit of process industry - Case studies.			**CO1**
UNIT- II	**Energy Management for Motors and Cogeneration**	**Periods:09**	
Energy management for electric motors: energy efficient controls and starting efficiency - motor efficiency and load analysis - selection of motors – energy efficient motors. Energy management by cogeneration: forms of cogeneration – electrical interconnection.			**CO2**
UNIT- III	**Lighting Systems**	**Periods:09**	
Energy management in lighting systems: task and the working space - light sources - ballasts - lighting controls - optimizing lighting energy - reactive power management - capacitor sizing - degree of compensation - capacitor losses -effect of harmonics - lighting and energy standards.			**CO3**
UNIT- IV	**Metering for Energy Management**	**Periods:09**	
Metering for energy management: units of measure - utility meters - demand meters - paralleling of current transformers - instrument transformer burdens - multi tasking solid state meters - metering location vs requirements - power analyzer - metering techniques and practical examples.			**CO4**
UNIT- V	**Economic Analysis and Models**	**Periods:09**	
Power system tariffs - Economic analysis: cash flow model - Time value of money - pay-back method - utility rate structures - cost of electricity - loss evaluation - load management - demand control techniques - utility monitoring and control system - economic analysis of HVAC systems.			**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, “Guide to Energy Management”, The Fairmont Press, Inc., 5th Edition, 2006.
2. Frank Kreith, D. Yogi Goswami, “Energy Management and Conservation Handbook”, CRC Press, 2nd Edition, 2016.
3. Wayne C. Turner, “Energy Management Handbook”, The Fairmont Press, 4th Edition, 2001.

Reference Books

1. P. Venkataseshaiah K.V. Sharma, “Energy Management and Conservation”, Dreamtech Press, 1st Edition, 2020.
2. Amit K. Tyagi, “Handbook on Energy Audits and Management”, TERI, 1st Edition, 2003.
3. ICAI, “Electricity in buildings good practice guide”, McGraw-Hill Education, 1st Edition, 2017.

Web References

1. https://nptel.ac.in/courses/108/106/108106022/
2. https://www.youtube.com/watch?v=onIhwmbL8CA
3. https://www.youtube.com/watch?v=CTt4y8bokWs
4. https://ieeexplore.ieee.org/document/7977655
5. https://ieeexplore.ieee.org/document/993185
6. https://ieeexplore.ieee.org/document/6450335

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	3	-	-	-	-	-	-	-	-	1	1	1	1
2	3	2	3	-	-	-	-	-	-	-	-	1	3	2	3
3	3	2	3	-	-	-	-	-	-	-	-	1	3	2	3
4	3	2	2	-	-	-	-	-	-	-	-	1	2	1	2
5	2	2	3	-	-	-	-	-	-	-	-	1	2	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **PE**			*End Semester Exam Type: **TE**			
Course Code	**U23EEE614**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INTELLIGENT CONTROL TECHNIQUES FOR ELECTRICAL APPLICATIONS**	**3**	**0**	**0**	**3**	25	75	100
EEE								

Prerequisite	Engineering Mathematics, Control Systems, Electric Drives	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the principles of fuzzy set theory and apply them to solve engineering problems with inherent uncertainty.	**K2**
	CO2 Examine fuzzy logic controllers for non-linear systems for practical real-world applications.	**K3**
	CO3 Illustrate the core concepts and various types of neural networks, including their structure and function.	**K3**
	CO4 Interpret the back propagation network and associative memory algorithms	**K2**
	CO5 Apply neural network techniques to model and control non-linear electrical systems effectively.	**K3**

UNIT - I	**Fuzzy Sets and Relations**	**Periods:9**
Crisp sets, Fuzzy sets, Fuzzy Vs Crisp, Membership functions, features. Operations on fuzzy sets, properties of fuzzy sets, Fuzzy cartesian products, Crisp Relations, Fuzzy relations- Operations on fuzzy relations - Properties of fuzzy -lambda – cut set- fuzzy tolerance, and equivalence relations in fuzzy logic.		**CO1**
UNIT - II	**Fuzzy Inference System**	**Periods:9**
Fuzzification, membership value assignment, and rule base development - Defuzzification techniques with a focus on Mamdani and Sugeno fuzzy models. Design of fuzzy logic controllers for DC motors – Design and control of fuzzy based power converter - Applications in power systems for voltage regulation, stability and fault detection.		**CO2**
UNIT - III	**Artificial Neural Network**	**Periods:9**
Review of fundamentals - Biological neuron, Artificial neuron, Activation function - McCulloch-Pitt Model of Artificial Neuron - Neural Network Architectures - Learning Methods - Supervised - Unsupervised - Perceptron learning algorithm - limitations		**CO3**
UNIT - IV	**Backpropagation and Associative Networks**	**Periods:9**
Backpropagation algorithm-derivation of up-dation rules, drawbacks. Variants of Backpropagation algorithm-momentum, variable learning rate-simple problems. Bidirectional associative memories - Algorithm - Applications.		**CO4**
UNIT- V	**Neural Networks for Modeling and Control**	**Periods:9**
Modelling of non-linear systems using ANN - Generation of training data - Optimal architecture - Direct and indirect neuro control schemes - Adaptive neuro controller - Neural Network Controller Design for DC Motor Control and Power System Stabilization.		**CO5**

Lecture Periods:45	**Tutorial Periods:**	**Practical Periods:-**	**Total Periods:45**

Text Books

1. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, Wiley, 2011
2. Laurene Fausett, “Fundamentals of Neural Networks”, Pearson Education, 2008
3. M. Norgaard, O. Ravn, N.K. Poulsen, L.K. Hansen, “Neural Networks for Modelling and Control of Dynamic Systems”, Springer 2003

Reference Books

1. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 2019
2. Rajasekaran. S, Pai. G.A.V., “Neural Networks, Fuzzy Logic and Genetic Algorithms”, Prentice-Hall of India, 2003
3. Jang J.S.R., Sun C.T. and Mizutani E, “Neuro-Fuzzy and soft computing”, Pearson Education, 2007
4. W.T.Miller, R.S.Sutton and P.J.Webrose, “Neural Networks for Control”, MIT Press, 2001.
5. S. N. Sivanandam, S. Sumathi, S. N. Deepa, “Introduction to Neural Networks using MATLAB 6.0”, Tata McGraw Hill Education, 1st Edition, 2017.

Web References

1. https://lecturenotes.in/subject/922.
2. https://www.ifi.uzh.ch/dam/jcr:00000000-2826-155d-0000-00005e4763e3/fuzzylogicscript.pdf.
3. https://nptel.ac.in/courses/106/105/106105173/.

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	2	-	-	-	-	-	2	3	3	3
2	3	3	3	3	3	2	-	-	-	-	-	2	3	3	3
3	3	3	3	3	3	2	-	-	-	-	-	2	3	3	3
4	3	3	3	3	3	2	-	-	-	-	-	2	3	3	3
5	3	3	3	3	3	2	-	-	-	-	-	2	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**VI**	Course Category Code: **PE**			End Semester Exam Type: **TE**			
Course Code	**U23EEE615**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INTERNET OF THINGS FOR SMART SYSTEM**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Programming in Python, Microprocessor and Microcontroller, Measurements and Instrumentation	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret Internet of Things and its architecture	**K2**
	CO2 Explain the concepts of hardware and software elements	**K2**
	CO3 Apply IoT solutions for smart home and appliances	**K3**
	CO4 Examine strategies for leveraging IoT data to optimize industrial processes	**K3**
	CO5 Demonstrate IoT-based solutions for connected cities and transportation	**K3**

UNIT- I	**Fundamentals of IoT**	**Periods:09**
Evolution of Internet of Things, IoT Vision, IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Enabling Technologies, Functional blocks of an IoT ecosystem		**CO1**
UNIT- II	**Elements of IoT**	**Periods:09**
Hardware Components: I/O interfaces, Computing (Arduino, Raspberry Pi, ESP8266, ESP32), Communication, Sensing, Actuation. **Software Components:** Programming APIs (using Python/Node.js/Arduino) for Communication Protocols, MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.		**CO2**
UNIT- III	**IoT for Smart Home and Appliances**	**Periods:09**
Components for smart home, Home automation and its stages, Smart Furniture, Smart Lighting, Smart Security Systems, Smart Monitors, Smart refrigerator, Smart Oven, Smart Washer and Dryer		**CO3**
UNIT- IV	**IoT for Industries**	**Periods:09**
IoT architecture for industry, IoT based Gas Leakage Monitoring System, Temperature and Liquid Level Monitoring in Boilers, Fire Detection System, Wireless Video Surveillance Robot, Automatic Solar Tracker		**CO4**
UNIT-V	**IoT for Smart Cities and Transportation**	**Periods:09**
Smart city IoT and security architecture, IoT based Connected Street Lights, Smart Water Management System, Women Security System, Air Pollution Meter, IoT architecture for transportation, Smart Parking, Smart Traffic Control, Connected Cars, Connected Fleet.		**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill ISBN: 9789352605224, 9789352605224, 2nd Edition, 2017
2. Michael Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", QUE, 1st Edition, 2015.
3. David Hanes, Gonzalo Salgueiro, "IoT fundamentals: Networking technologies, Protocols, and use cases for the Internet of Things", Pearson, 1st Edition, 2018.

Reference Books

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 1st Edition, 2017
2. Andrew Minteer: Analytics for the Internet of Things (IoT) Intelligent Analytics for Your Intelligent Devices, Packt Publishing, 1st Edition, 2017
3. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key Applications and Protocols", Wiley, 2nd Edition, 2012
4. Shriram K Vasudevan, Abhishek S Nagarajan and RMD Sundaram, "Internet of Things", Wiley, 1st Edition, 2019.
5. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer, 1st Edition, 2011.

Dr. P. Jamuna

Web References

1. https://nptel.ac.in/courses/106/105/106105166/
2. https://nptel.ac.in/courses/106105077
3. https://www.i-scoop.eu/internet-of-things-guide/
4. https://www.theinternetofthings.eu/
5. https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	2	1	-	-	1	-	1	2	3	3
2	3	3	3	2	2	2	1	-	-	1	-	1	2	3	3
3	3	3	3	2	2	2	1	-	-	1	-	1	2	3	3
4	3	3	3	2	2	2	1	-	-	1	-	1	2	3	3
5	3	3	3	2	2	2	1	-	-	1	-	1	2	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VII**	Course Category: **PE**			End Semester Exam Type: **TE***			
Course Code	**U23EEE716**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ADVANCED ELECTRIC DRIVES AND CONTROL**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								
Prerequisite	Electrical Machines, Power Electronics							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the components of electrical drives and classify their operating characteristics in various quadrants.	**K2**
	CO2 Demonstrate closed-loop control system for converter and chopper-fed drives, by validating its performance against specified criteria.	**K3**
	CO3 Interpret the behavior of various induction motor drive control techniques and closed-loop speed control methods for efficient motor operation.	**K3**
	CO4 Predict the control strategies for synchronous and Brushless DC motor drives, including V/F control, vector control, closed-loop speed regulation, and drive techniques for various applications.	**K3**
	CO5 Apply closed-loop control strategies to design and optimize speed and torque regulation for switched reluctance motor drives.	**K3**

UNIT – I	**DRIVE CHARACTERISTICS**	**Periods:09**
Electric Drives - Drive classifications - Advantage of Electric Drives – components of Electrical drives - Equations governing motor load dynamics – Speed-torque characteristics and multi-quadrant operation of electric drive, example of hoist operation in four quadrants - Components of Load Torques – Classes of duty, heating and cooling – Control of Electric Drives: Current limit, closed loop torque and speed control - Selection of Motor rating - constant HP and constant torque operations.		**CO1**
UNIT – II	**DC DRIVES**	**Periods:09**
Converter Fed Drives: Single and three phase fully controlled converter of separately excited DC motor drive – Multiquadrant operation of separately excited DC motor drive by Dual Converter- Closed loop control. **Chopper Fed Drives**: Single quadrant, Two quadrant and Four quadrant operation of chopper fed separately excited DC motor drive – Speed torque characteristics - Closed loop control.		**CO2**
UNIT – III	**INDUCTION MOTOR DRIVES**	**Periods:09**
Induction Motor Drive: Stator voltage control – V/F control – Static rotor resistance control – Slip power recovery schemes: Kramer and Scherbius drive – Voltage Source Inverter (VSI) control – Current Source Inverter (CSI) control – Closed-loop speed control of VSI and CSI drives - Vector Control		**CO3**
UNIT – IV	**SYNCHRONOUS MOTOR AND BRUSHLESS DC MOTOR DRIVES**	**Periods:09**
Synchronous Motor Drive: V/F control – True synchronous mode and self- controlled mode - Margin angle control and power factor control - Closed loop speed control of synchronous motor- Vector control. **Brushless DC Motor Drive:** Principle of operation and control of BLDC – Permanent Magnet Brushless DC motor (PMBDCM) drive scheme - Brushless DC motor drive for servo applications – Low cost Brushless DC motor drives		**CO4**
UNIT – V	**SWITCHED RELUCTANCE MOTOR DRIVES**	**Periods:09**
Switched reluctance motor drives: Evolution of switched reluctance motors – Operation and control requirements – Converter circuits – Modes of operation - Closed loop speed and torque control.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Gopal.K.Dubey, "Fundamentals of Electrical Drives", Narosa Publishing Hoise Private Limited, 2nd Edition, 2010.
2. R. Krishnan, "Electric Motor Drives: Modeling Analysis: Modeling, Analysis, and Control", Pearson Education India, 1st Edition, 2015.
3. Bimal K. Bose "Modern power electronics and AC drives", Pearson Education, Asia, 1st Edition, 2016.

Reference Books

1. Dr. P. S. Bimbra, "Power electronics", Khanna publishers, 6th Edition, 2018.
2. S. K. Pillai, "A first course on electric drives", New age publisher, 3rd Edition, 2012.
3. Vedam Subrahmanyam, "Electric Drives", Mc Graw Hill Education, New Delhi, 2nd Edition, 2017.
4. A. Veltman, D.W.J. Pulle, and R.W. DeDoncker, Advanced Electrical Drives: Analysis, Modeling, Control, Springer, 1st Edition, 2011.
5. Ned Mohan, Advanced Electric Drives: Analysis, Control, and Modeling Using MATLAB/Simulink, Wiley, 1st Edition, 2014.

Web References

1. https://nptel.ac.in/courses/108/105/108105066/
2. http://www.smpstech.com/websites.htm
3. http://www.electronics-tutorials.ws/
4. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-334-power-electronics-spring- 2007/
5. https://ndl.iitkgp.ac.in/

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	3	1	1	-	-	-	-	-	1	3	2	3
2	3	2	3	3	1	1	-	-	-	-	-	1	3	2	3
3	3	2	3	3	1	1	-	-	-	-	-	1	3	2	3
4	3	2	3	3	1	1	-	-	-	-	-	1	3	2	3
5	3	2	3	3	1	1	-	-	-	-	-	1	3	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 - High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	Electrical and Electronics Engineering	Programme: **B. Tech.**						
Semester	VII	Course Category: **PE**			End Semester Exam Type: **TE***			
Course Code	U23EEE717	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	MULTILEVEL POWER CONVERTERS	3	0	0	3	25	75	100

EEE

Prerequisite	Power Electronics		
Course Outcomes	On completion of the course, the students will be able to		BT Mapping (Highest Level)
	CO1	Explain multi-pulse rectifiers, their harmonic effects, and power quality improvements.	K2
	CO2	Interpret the working principles, modulation strategies, and voltage balancing techniques of Multilevel Inverters (MLIs).	K2
	CO3	Demonstrate the performance of multilevel inverters (MLIs) using various PWM techniques.	K3
	CO4	Apply the hybridization of Fundamental Frequency Switching (FFS) and PWM-based hybrid multilevel inverter topologies, including transformer-based and transformerless designs.	K3
	CO5	Describe the operation, control strategies, and energy management techniques of Modular Multilevel Converters (MMC) in AC-DC, AC-AC, and DC-DC conversion applications.	K2

UNIT-I	Multi-Pulse Converters	Periods:09
Introduction - Multi-pulse Diode & SCR Rectifiers, Definition of THD and PF, THD and PF of six-pulse diode rectifier, 12, 18, 24-pulse series-type and separate-type diode rectifiers, Six-pulse and 12-pulse SCR rectifier, Effect of line and leakage inductances, Phase-Shifting Transformers, Harmonic current cancellation.		CO1
UNIT-II	**Multilevel Topologies**	**Periods:09**
Introduction – Generalized Topology with a Common DC bus. **Diode Clamped Multilevel Converter:** Introduction – Converter structure and Functional Description – Modulation Techniques – Voltage balance Control. **Flying Capacitor Multilevel Converter:** Introduction – Flying Capacitor topology – Modulation scheme – Dynamic voltage balance. **Cascaded H-Bridge Multilevel Inverters:** Introduction – H-Bridge Inverter – CHB Inverter Topologies – Voltage balance control		CO2
UNIT-III	**Control Techniques for Multilevel Converters**	**Periods:09**
Introduction - Sinusoidal PWM – Bipolar Pulse Width Modulation – Unipolar Pulse Width Modulation – Space Vector PWM. Carrier-Based PWM Schemes: Phase-Shifted Multicarrier Modulation – Level-Shifted Multicarrier Modulation – Comparison between Phase and Level-Shifted PWM Schemes – Staircase Modulation		CO3
UNIT-IV	**Hybrid Multilevel Inverters**	**Periods:09**
Hybridization of Fundamental frequency switching (FFS) and PWM switching inverters: inverter topologies with an isolation transformer - PWM switching strategy; Transformerless hybrid inverter: Binary H-bridge multilevel converter - Control of dc bus voltages of different modules.		CO4
UNIT-V	**Modular Multilevel Converters (MMC)**	**Periods:09**
Introduction - Circuit configuration of conventional double star configured MMC for AC to DC conversion - Voltage and current in MMC arms, circulating current, Control of MMC - Modulation, Energy management from AC side / DC side, Triple star configured MMC for AC - AC conversion, Circuit configurations for MMC based DC - DC converters		CO5

Lecture Periods:45	Tutorial Periods:-	Practical Periods:-	Total Periods:45

Text Books

1. BinWu, Mehdi Narimani, “High Power Converters and AC drives”, IEEE press, 2nd Edition, 2017.
2. Sergio Alberto Gonzalez, Santiago Andres Verne, Maria Ines Valla, “Multilevel Converters for Industrial Applications”, CRC Press, 1st Edition, 2017.
3. Fujin Deng, Chengkai Liu, Zhe Chen, “Modular Multilevel Converters, Control, Fault Detection, and Protection”, IEEE Press and Wiley, 1st Edition, 2023.

Reference Books

1. Rashid M.H, "Power Electronics Circuits, Devices and Applications", Pearson Prentice Hall India, New Delhi, 4th edition, 2023.
2. D.Grahame Holmes, Thomas A. Lipo, "Pulse Width Modulation for Power Converters: Principles and Practice", John Wiley & Sons, 1st Edition, 2003.
3. Hani Vahedi, Mohamed Trabelsi, "Single-DC-Source Multilevel Inverters", Springer, 1st Edition, 2019.
4. Ersan Kabalcı, "Multilevel Inverters Introduction and Emergent Topologies", Academic Press Inc, 1st Edition, 2021.
5. Iftekhar Maswood, Dehghani Tafti, "Advanced Multilevel Converters and Applications in Grid Integration", Wiley, 1st Edition, 2018.

Web References

1. https://www.mdpi.com/1996-1073/14/18/5773
2. https://ieeexplore.ieee.org/document/10704631
3. https://archive.nptel.ac.in/courses/108/102/108102157/
4. https://ieeexplore.ieee.org/document/8301344
5. https://ieeexplore.ieee.org/document/9360490

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	3	2	1	-	-	-	-	-	1	3	3	3
2	3	2	3	3	2	1	-	-	-	-	-	1	3	3	3
3	3	2	3	3	2	1	-	-	-	-	-	1	3	3	3
4	3	2	3	3	2	1	-	-	-	-	-	1	3	3	3
5	3	2	3	3	2	1	-	-	-	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	Electrical and Electronics Engineering	Programme: **B. Tech.**						
Semester	**VII**	Course Category: **PE**			End Semester Exam Type:**TE***			
Course Code	**U23EET718**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**POWER SYSTEM OPERATION AND CONTROL**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Transmission and Distribution, Power system Analysis	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Analyze the electric power system performance under various load conditions and effectively forecast demand.	**K3**
	CO2 Examine the speed governing mechanism, LFC in single and two-area systems, and evaluate their static and dynamic performance under different control conditions	**K3**
	CO3 Evaluate reactive power management, voltage control methods, and excitation system modeling for stability.	**K3**
	CO4 Apply optimization techniques for unit commitment and economic dispatch to achieve cost-effective power generation.	**K3**
	CO5 Proficiency in computer control action, SCADA and EMS functions for real time operation of power systems.	**K3**

UNIT – I	**Power System Performance**	**Periods:09**
Structure of Electric power system - Load characteristics - Load curves - Load duration curve - Basic terms and factors. Reserve requirements: Installed reserves - Spinning reserves - Cold reserves - Hot reserves. Need for voltage regulation and frequency regulation - P-F and Q-V controls. Load forecasting: Importance of load forecasting - Least square fit-Quadratic and Exponential curve fitting techniques.		**CO1**
UNIT – II	**Real Power- Frequency Control**	**Periods:09**
Basics of speed governing mechanism and modeling - Speed - Load characteristics - Load sharing between two synchronous machines in parallel - LFC of a single area system - Static and dynamic analysis of uncontrolled and controlled cases. LFC of two area system- Static and dynamic analysis of uncontrolled case - Tie line with frequency bias control of two area system.		**CO2**
UNIT – III	**Reactive Power - Voltage Control**	**Periods:09**
Requirement of voltage and reactive power control - Generation and absorption of reactive power - Analysis of reactive power absorbed and generated by the transmission line - Typical excitation system - Modeling - Static and dynamic analysis - Stability compensation - Various voltage control methods - Case study: Reactive power control of single machine infinite bus system.		**CO3**
UNIT – IV	**Unit Commitment and Economic Dispatch**	**Periods:09**
Unit Commitment: Need for unit Commitment - Statement of Unit Commitment problem - Constraints: spinning reserve - thermal unit constraints - hydro constraints - must run constraints - fuel constraints. Solution methods: Priority list methods - forward dynamic programming approach. Economic dispatch: Generator operating Cost - Input output curve of a generating unit - Heat Rate curve - Incremental Cost Curve - Optimum economic Dispatch - coordination equations without loss and with loss- Solution by direct method and λ-iteration method.		**CO4**
UNIT – V	**Computer Control of Power Systems**	**Periods:09**
Need of computer control of power system - Energy Management System - Energy control center and its functions - SCADA and EMS functions - Power system security - Security Analysis and control - State estimation.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Olle I. Elgerad, "Electric Energy System Theory and Introduction", Tata McGraw Hill, 2nd Edition, 2004.
2. Allen J. Wood, Bruce F. Wollenberg, and Gerald B. Sheblé, Power Generation, Operation, and Control, 3rd Edition, Wiley, 2013.
3. Carson. W. Taylor, "Power System Voltage Stability", Taylor-McGraw Hill, 2000.

Reference Books

1. D. P. Kothar and I. J. Nagrath, "Modern Power System Analysis", Tata McGraw Hill, 4th Edition, 2011.
2. Prabha Kundur, "Power System Stability and Control", Tata McGraw Hill, 5th Edition, 2014.
3. A. K. Mahalanbias, D. P. Kothari and S. I. Ahson, "Computer Aided Power System Analysis and Control", Tata McGraw Hill, 1990.
4. P.S.R. Murty, "Operation and Control in Power Systems", BS Publications, 2nd Edition, 2011.

Web References

1. https://nptel.ac.in/courses/108/101/108101040/
2. http://www.nptelvideos.in/2012/12/power-system-operations-and-control.html
3. https://nptel.ac.in/courses/108/105/108105067/
4. https://nptel.ac.in/courses/108/107/108107028/
5. https://nptel.ac.in/courses/108/107/108107127/

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	2	-	-	-	-	-	-	2	3	3	3
2	3	3	3	2	3	-	-	-	-	-	-	3	3	3	3
3	3	3	3	3	2	2	2	-	-	-	-	2	3	3	3
4	3	3	3	3	3	2	2	-	-	-	-	3	3	3	3
5	3	3	3	2	3	-	-	-	-	-	-	3	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VII**	Course Category: **PE**			End Semester Exam Type :**TE***			
Course Code	**U23EEE719**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**FLEXIBLE AC TRANSMISSION SYSTEM**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Control Systems, Power Electronics, Power System Analysis	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Summarize the need for FACTS controllers based reactive power compensation	**K2**
	CO2 Apply modeling techniques for FACTS controller and analyze their impact on system performance.	**K2**
	CO3 Interpret the control schemes of shunt compensation devices.	**K3**
	CO4 Examine the various control schemes of series compensation devices.	**K3**
	CO5 Describe the advanced FACTS devices, FACTS controller interaction and control coordination.	**K2**

UNIT – I	**Introduction to FACTS and Power Flow Control**	**Periods:09**
Fundamentals of AC power transmission – Need for FACTS controllers - Classification of FACTS controllers – Control of power flow in AC transmission line – Uncompensated transmission line – Effect of series and shunt compensation – IEEE definitions and FACTS installations in India and worldwide		**CO1**
UNIT – II	**Modeling of Facts Controllers**	**Periods:09**
Thyristor-based shunt compensators: TCR, TSC, Thyristor-based series compensators: TCSC – TSSC, Static VAR Compensator (SVC) Static Synchronous Series Compensator (SSSC), Static Synchronous Compensator (STATCOM): Configuration, operation, characteristics and Modeling.		**CO2**
UNIT – III	**Shunt Compensation Techniques**	**Periods:09**
Voltage control by SVC – Applications: Transient stability enhancement and power oscillation damping – STATCOM: Harmonic Performance, SSR Mitigation, Dynamic Compensation: A Multilevel VSC Based STATCOM – Capacitor-Voltage Control – Advantages over SVC		**CO3**
UNIT – IV	**Series Compensation Techniques**	**Periods:09**
Static Synchronous Series Compensator (SSSC): control schemes – SSSC control scheme – Applications: Power Flow Control, SSR Mitigation – TCSC : Constant Current Control , Constant Angle Control, Constant Power Control – Enhancement of System Damping		**CO4**
UNIT – V	**Coordination of FACTS controllers and Advanced FACTS Devices**	**Periods:09**
Co-ordination of FACTS controllers in power systems - Controller interactions: SVC-SVC, TCSC-TCSC - Unified Power flow controller (UPFC) - Interline power flow controller (IPFC) - Unified Power quality conditioner (UPQC).		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. K. R. Padiyar, "FACTS Controllers In Power Transmission And Distribution", New Age International (P) Limited, Publishers, 2nd Edition, 2007.
2. R. Mohan Mathur,Rajiv K. Varma "Thyristor-Based Facts Controllers for Electrical Transmission Systems",A John Wiley & Sons, Inc. Publication, 2nd Edition, 2002.
3. N.G.Hingorani and L.Guygi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", John Wiley and Sons, Inc., 1st Edition, 2011

Reference Books

1. Xiao – Ping Zang, Christian Rehtanz and Bikash Pal, "Flexible AC Transmission System: Modelling and Control", Springer, 1st Edition, 2012
2. Bjarne R. Andersen, Stig L. Nilsson, "Flexible AC Transmission Systems" CIGREStudy Committee B4: DC Systems and Power Electronics- Springer Reference, 2020.

Web References

1. https://link.springer.com/book/10.1007%2F3-540-30607-2
2. http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=00634216
3. https://nptel.ac.in/courses/108107114/
4. https://www.elprocus.com/flexible-ac-transmission-system-need-definition-types/
5. https://link.springer.com/book/10.1007%2F3-540-30607-2

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
2	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
3	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
4	3	3	3	2	2	-	-	-	-	-	-	1	3	3	3
5	3	3	3	2	2	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**VII**	Course Category Code: **PE**			End Semester Exam Type: **TE***			
Course Code	**U23EEE720**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MODELLING AND SIMULATION OF GREEN ENERGY SYSTEMS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								
Prerequisite	Electrical Machine Design, Power Electronics, Renewable Energy Sources							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Apply the mathematical modelling methods for solving dynamic system equations	**K3**
	CO2 Design and simulate Maximum Power Point Tracking algorithms	**K3**
	CO3 Validate the wind energy system models using real-world datas,	**K3**
	CO4 Develop mathematical models for fuel cells, hydro turbines, and marine energy converters	**K3**
	CO5 Evaluate control strategies for stable operation of grid-connected systems	**K3**

UNIT- I	**Introduction to modelling and simulation**	**Periods:09**	
Role of Modelling and Simulation, Nature of a Model, Monte Carlo Simulation, Simulators, Stochastic Nature of DEDS Models, Modelling Exogenous Input and Output, DEDS Simulation Model Development, Modelling of Continuous Time Dynamic Systems, Simulation with CTDS Models: Initial Value Problem, The Runge-Kutta Family, The Linear Multistep Family			**CO1**
UNIT- II	**Photovoltaic systems**	**Periods:09**	
Photovoltaic Definitions, Characteristic Curves of Solar Cells, System Pre-Sizing, Irradiance Modelling: Sky and Ground Radiance Modelling, Atmospheric Model, Ideal PV array Model, Two Diode PV Array Models, Converter Modelling, Maximum Power Point Tracker Algorithms: Perturb and Observe Technique, Incremental Conductance Technique, Sliding Mode Control			**CO2**
UNIT- III	**Wind energy systems**	**Periods:09**	
Fundamentals, Block diagram, Modelling Wind Shear and Tower Shadow Effect, Active Damping Simulation, System Inertia Support, Synchronverter Simulation, Multiphase Generators systems, Offshore Wind Park with Series-Connected Generators, Simulation of Two-Terminal Offshore Wind Park, Direct Power Control of VSI-Gr			**CO3**
UNIT- IV	**Fuel cell, hydro, marine power systems**	**Periods:09**	
Fuel Cells and Electrolyzers: Block diagram, Model processes, simulation, Microturbine Simulation: Block diagram, Model processes, fuel cell and microturbine parallel operation, River Hydro Stations, Ocean Wave Energy Conversion: Point Absorber, Oscillating Water Columns, Tidal Power Plant Simulation, Pumped Storage Hydropower			**CO4**
UNIT-V	**Hybrid, Grid connected systems**	**Periods:09**	
Hybrid Wind/Photovoltaic System, Hybrid Photovoltaic-Electrolyser-Fuel Cell System, Microgrid Simplified Simulation, System Integration of Single-phase and three-phase Grid-connected System, Simulation Efficiency for Conventional Grid-connected PV Systems, Integration of wind plant models into grid databases, Time-sequential static analysis, Distribution system analysis			**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Louis G. Birta, Gilbert Arbez, "Modelling and Simulation: Exploring Dynamic System Behaviour", Springer, 3rd Edition, 2019
2. Djamila Rekioua, Ernest Matagne, "Optimization of Photovoltaic Power Systems: Modelization, Simulation and Control", Springer, 1st Edition, 2012.
3. Viktor M. Perelmuter, "Advanced Simulation of Alternative Energy Simulation with Simulink® and SimPowerSystems™", CRC Press, 1st Edition, 2020.

Reference Books

1. Weidong Xiao, "Photovoltaic Power System: Modeling, Design, and Control", John Wiley & Sons Ltd, 1st Edition, 2017
2. Paul Veers, "Wind Energy Modeling and Simulation Volume 2: Turbine and system", The Institution of Engineering and Technology, 1st Edition, 2019
3. LinashKunjumuhammed, Stefanie Kuenzel, Bbikash Pal, "Simulation of Power System with Renewables", Elsevier, 1st Edition, 2020
4. Aashish Kumar Bohre, Pradyumn Chaturvedi, Mohan Lal Kolhe, Sri Niwas Singh, "Planning of Hybrid Renewable Energy Systems, Electric Vehicles and Microgrid: Modeling, Control and Optimization", Springer, 1st Edition, 2022.
5. Djamila Rekioua, "Wind Power Electric Systems Modeling, Simulation, Control and Power Management Control", Springer, 2nd Edition, 2024.

Web References

1. https://onlinecourses.nptel.ac.in/noc25_ch40/preview
2. https://in.mathworks.com/videos/commissioning-and-validating-renewable-energy-systems-using-matlab-and-simulink-1651166405798.html
3. https://www.youtube.com/watch?v=MQgnLcQBPKk
4. https://www.udemy.com/course/renewable-energy-system-design-modeling-and-simulation/?srsltid=AfmBOoqQgIdZMthXLI2Gb347XetNw1EAMCslWDf7x_61bwqSy-MTkkM1&couponCode=ST17MT31325G3
5. https://in.mathworks.com/videos/simulate-renewable-energy-systems-from-months-to-microseconds-1693423552035.html

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	2	2	-	-	-	-	1	3	3	3
2	3	3	3	3	3	2	2	-	-	-	-	1	3	3	3
3	3	3	3	3	3	2	2	-	-	-	-	1	3	3	3
4	3	3	3	3	3	2	2	-	-	-	-	1	3	3	3
5	3	3	3	3	3	2	2	-	-	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**VIII**	Course Category: **PE**			End Semester Exam Type:**TE***			
Course Code	**U23EEE821**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SMPS AND UPS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
		EEE						
Prerequisite	Electronics-I, Electronics-II, Electronics-III							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the analysis and performance of DC-DC converters used for different applications.	**K2**
	CO2 Interpret the various types of advanced converters used for switched mode power supplies.	**K2**
	CO3 Demonstrate the importance of resonant Converters in reducing power loss and improving the life time of the power semiconductor device.	**K3**
	CO4 Describe the different types of inverters and harmonics reduction techniques used for Inverters	**K2**
	CO5 Illustrate the techniques used to improve the power quality and design of filters for UPS.	**K3**

UNIT-I	**DC - DC CONVERTERS**	**Periods:09**	
Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters-Gate driver circuit for MOSFET and IGBT --Cascaded Boost Converters -Choice of switching frequency -Device Selection - Applications - EMI issues			**CO1**
UNIT-II	**SWITCHED MODE POWER CONVERTERS**	**Periods:09**	
Basic concepts of SMPS-SMPS Types: Self-Oscillating Flyback, Forward, Push pull, Luo, SEPIC converter, Half bridge and Full bridge converters- control circuits- and Applications.			**CO2**
UNIT-III	**RESONANT CONVERTERS**	**Periods:09**	
Introduction- classification - Load Resonant converters - ZVS, ZCS, Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control. Multi energy storage element resonant converters - Applications.			**CO3**
UNIT-IV	**INVERTERS**	**Periods:09**	
Analysis and Performance parameters of Single phase and three phase inverters -Control techniques for inverter- Design of Multilevel inverters for UPS, electric vehicle, and renewable energy systems applications.			**CO4**
UNIT-V	**POWER CONDITIONERS AND FILTERS**	**Periods:09**	
Introduction- Power line disturbances- Power conditioners -UPS: offline UPS, Online UPS – Applications of UPS. Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, and filter for PWM VSI, current filter, DC filters- Design of high frequency inductor and transformer for PE applications – Selection of Batteries.			**CO5**

LecturePeriods:45	**Tutorial Periods:-**	**Practical Periods:-**	**TotalPeriods:45**

Text Books

1. M. H. Rashid, “Power Electronics handbook”, Elsevier Publication, 5th Edition, 2024.
2. Fang Lin Luo, “Advanced DC/DC converters: Applications in renewable Energy”, CRC press, 2nd Edition, 2017.
3. Ned Mohan, Tore M. Undeland, William P. Robbins, “Power Electronics: -Converters, Applications, and Design”, John Wiley and sons Publication, 3rd Edition, 2007

Reference Books

1. Philip T Krein,“Elements of Power Electronics”, Oxford University Press, 2nd Edition,2016.
2. Erickson, W.Robert, “Fundamentals of Power Electronics”,Springer,3rd Edition,2020.
3. Joseph Vithayathil,“Power Electronics, Principles and Applications”, McGraw Hill Series,3rd Edition,2013.
4. Simon Ang, Alejandro Oliva, “Power-Switching Converters”, CRC Press, 3rd Edition, 2010.
5. Kjeld Thorborg, “Power Electronics - In theory and Practice”, Overseas Press India Private Ltd, 5th Edition, 2005.

Web References

1. https://nptel.ac.in/courses/108/105/108105066/
2. http://www.ni.com/white-paper/14677/en/
3. http://www.smps.us/
4. https://ndl.iitkgp.ac.in/

5. http://www.cpes.vt.edu/areas/
6. https://www.coursera.org/specializations/power-electronics

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	-	-	-	-	-	-	1	3	3	3
2	3	3	3	2	2	-	-	-	-	-	-	1	3	3	3
3	3	3	3	2	2	-	-	-	-	-	-	1	3	3	3
4	3	3	3	2	2	-	-	-	-	-	-	1	3	3	3
5	3	3	3	2	2	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VIII**	Course Category: **PE**			End Semester Exam Type: **TE***			
Course Code	**U23EEE822**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ROBOTICS AND AUTOMATION**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Mathematics, Control Systems	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the Sensors and Actuators required for robotics	**K2**
	CO2 Demonstrate control mechanism required for Robotics	**K3**
	CO3 Explain path planning of Robotics	**K2**
	CO4 Demonstrate Manipulator kinematics of Robotics	**K3**
	CO5 Evaluate program based Robotic applications in Industry	**K3**

UNIT – I	**INTRODUCTION**	**Periods:09**
Robotics – Basic components – Robotics Classification – Performance characteristics – Mathematical representation of Robots - Position and orientation. **Robot Sensors**: Position and Velocity sensors. **Actuators:** Pneumatic and hydraulic Actuators - vision systems – Image processing – Segmentation -Smoothing – Object recognition.		**CO1**
UNIT – II	**ROBOT CONTROL**	**Periods:09**
Control of robot manipulators- State equations - A One Axis Robot - Constant solutions- Linear feedback systems- Single axis PID control- PD gravity control- Computed torque control- Variable structure control- Impedance control.		**CO2**
UNIT – III	**END EFFECTORS**	**Periods:09**
Types of End Effectors – Mechanical Grippers-Different types of Grippers - Tool as End effectors-Robot end effectors interface - Considerations in Gripper Selection and Design, Work space analysis - Work envelope-Workspace fixtures-pick and place operation- Continuous path motion-Interpolated motion- Straight line motion.		**CO3**
UNIT – IV	**ROBOT MOTION ANALYSIS**	**Periods:09**
Robot motion analysis and control: Introduction to Manipulator kinematics –Homogeneous transformations and robot kinematics - Manipulator torque control - Robot dynamics - Homogeneous coordinates - Link coordinates - Arm equation		**CO4**
UNIT – V	**ROBOT APPLICATIONS**	**Periods:09**
Industrial and Non industrial robots, Material Handling - processing Applications - Asssembly operations – Inspection Applications- Robot Safety – Micro Robotics- Bio Robotics- Mobile Robotics- Aerial Robotics- Robot Programming-Methods of Robot Programming		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Mikel P. Grover, „Industrial Robots – Technology Programming and Applications", McGraw Hill, 2nd edition, 2017.
2. Robert J.Schilling „Fundamentals of Robotics-Analysis and Control", PHI, 2015.
3. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2017.

Reference Books

1. K.S.Fu, R.C.Gonzalez, CSG. Lee, "Robotics, Control sensing vision and Intelligence", Tata Mcgraw-Hill, Indian edition, 2017.
2. JohnJ.Craig, "Introduction to Robotics Mechanics and Control", Pearson Education, 3rd edition, 2009.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, "Industrial Robotics", McGraw-Hill, Singapore, 2022.
4. Ashitava Ghoshal, "Robotics-Fundamental Concepts and Analysis", Oxford University Press, Sixth impression, 2010.
5. B.K.Ghosh, "Control in Robotics and Automation: Sensor Based Integration", Allied Publishers, Chennai.

Web References

1. https://robotics.nasa.gov/links/resources.php
2. https://hackernoon.com/16-best-resources-to-learn-robotics-and-iot-development-in-2019- 847bb93c9bd9
3. https://www.robotics.org/Online-Store
4. https://nptel.ac.in/courses/112/107/112107289/
5. https://www.mheducation.co.in/robotics-and-control-9780070482937-india

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	-	-	-	-	-	-	-	-	1	3	2	1
2	3	2	1	-	-	-	-	-	-	-	-	1	3	2	1
3	3	2	1	-	-	-	-	-	-	-	-	1	3	2	1
4	3	2	1	-	-	-	-	-	-	-	-	1	3	2	1
5	3	2	1	-	-	-	-	-	-	-	-	1	3	2	1

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VIII**	Course Category: **PE**			End Semester Exam Type: **TE***			
Course Code	**U23EEE823**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**PROTECTION AND SWITCHGEAR**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Mathematics, Control Systems	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Identify the equipment for protection scheme on power systems	**K2**
	CO2 Analyze the different applications of the relays in power system	**K3**
	CO3 Interpret the protection of transformer, Bus bar and transmission line	**K2**
	CO4 Comprehend the various circuit breakers (AC and DC) used in power system	**K2**
	CO5 Analyze the protection against over voltages and working of lightning arrester	**K2**

UNIT I	**PROTECTION SCHEMES**	**Periods:9**
Principles and need for protective schemes – Nature and causes of faults – Types of faults – Methods o Grounding - Zones of protection and essential qualities of protection – CTs and PTs and their applications-Solid state relays-RC Snubber networks-solid state decouplers		**CO1**
UNIT II	**RELAYS**	**Periods:9**
Operating Principles of the Relay - Classification of Relays - Universal relay – Torque equation – R-X diagram. Electromagnetic Relays – Over current, IDMT, Directional, Distance, Differential, Negative sequence and under frequency relays, Introduction to static relays, Phase, Amplitude, Comparators – Synthesis of various relays using Static comparators. Microprocessor relay - Applications		**CO2**
UNIT III	**APPARATUS AND LINE PROTECTION**	**Periods:9**
Generator Capability Curve – Short circuit Calculations – Ground fault and unbalanced current Protection – Ove excitation and Abnormal Frequency Protection - Field winding Protection – Loss of Synchronism – Moto Protection, Transformer Protection – Differential, Inrush and Over Current -over voltage protection- Bus zone Protection - Protection of Transmission Lines – Concept of Wide Area Monitoring and Protection.		**CO3**
UNIT IV	**CIRCUIT BREAKERS**	**Periods:9**
Functions of switchgear - Principles of arc extinction - Arc control devices - Fuses: types – selection discrimination – Resistance switching - Recovery voltage and restriking voltage - current chopping and capacitance current breaking – Oil circuit breakers, air break, air blast, and sulphur Hexafluoride and vacuum circuit breakers – HVDC breakers – Rating of Circuit Breaker.		**CO4**
UNIT V	**SURGE PROTECTION AND EARTHING**	**Periods:9**
Causes of overvoltage - Lightning phenomenon – Over voltage due to lightning - Protections against lightning Lightning arresters – Types - Lightning arrester selection - Surge absorbers – Current limiting reactor - Insulation coordination. Solid, resistance and reactance Earthing - Arc suppression coil - Earthing transformers - Earth wires - Introduction to Indian Electricity rules		**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Sunil S. Rao, "Switch Gear Protections", Khanna Publications, Delhi, 14th Edition, 2019.
2. Bhuvanesh A. Oza, N. C. Nair, R. P. Mehta, V.H. Makwana, "Power System Protection and Switchgear", Tata McGraw - Hill, New Delhi, 1st Edition, 2017.
3. A. Wright, C. Christopoulos, "Electrical Power System Protection", Springer, 2nd Edition, 2013.

Reference Books

1. T. S. Madhav Rao, "Power system protection static relays with microprocessor Applications", Tata McGraw hill Publication, 15th Edition, 2015.
2. Badri Ram, D. N. Vishwakarma, "Power System Protection and Switchgear", Tata Mc Graw Hill, 2nd Edition, 2013.
3. P. M. Anderson, "Power System Protection", Wiley-IEEE publication, 2015
4. E.T.A. Teta, "Power System Protection, 4 Volumes Set", SBA/IET, 2010.
5. V. K. Mehta, Rohit Mehta, "Principles of Power System" by S. Chand, 4th Revised Edition, 2008.

Web References

1. https://swayam.gov.in/nd1_noc20_ee80/preview.
2. https://nptel.ac.in/courses/108/107/108107167/
3. https://www.youtube.com/watch?v=_0T2Osgxdxs
4. https://ieeexplore.ieee.org/document/4111891.
5. https://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber
6. https://www.ieee-pes.org/ieee-transactions-on-power-delivery.
7. https://digital-library.theiet.org/content/journals/iet-epa
8. https://swayam.gov.in/nd1_noc20_ee80/preview.

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	-	-	-	-	1	3	1	2
2	3	3	3	3	-	-	-	-	-	-	-	1	2	2	2
3	3	3	3	3	-	-	-	-	-	-	-	1	2	2	3
4	3	3	3	3	-	-	-	-		-	-	1	3	1	2
5	3	3	3	3	-	-	-	-		-	-	1	3	3	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**VIII**	Course Category: **PE**			End Semester Exam Type:**TE***			
Course Code	**U23EEE824**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**DIGITAL SIGNAL PROCESSING FOR ELECTRICAL ENGINEERING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								

Prerequisite	Engineering Mathematics, Control Systems	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Interpret the characteristics and behavior of discrete-time systems.	**K2**
	CO2 Analyse the digital signals using various digital transforms DFT, FFT etc.	**K3**
	CO3 Design and develop the basic digital system.	**K2**
	CO4 Describe the behaviour of special and optoelectronic devices.	**K2**
	CO5 Evaluate the precision limitations affecting the behavior of digital filters.	**K3**

UNIT –I	**Discrete Time Signals And Systems**	**Periods:09**
Basic elements of signal Processing-Sampling of analog signals-aliasing-standard discrete time signals - classification of discrete time signals-manipulations on discrete time signals- representation of discrete time signals. Discrete time systems-properties-Linear Time Invariant systems-convolution sum properties of LTI systems-difference equation representation.		**CO1**
UNIT –II	**Discrete Time System Analysis**	**Periods:09**
Z-transform-region of convergence – properties of z-transforms- inverse z-transform-difference equation-solution by z-transform- application to discrete systems-interpretation of stability in z domain - stability analysis- convolution.		**CO2**
UNIT –III	**DFT and FFT**	**Periods:09**
Discrete Fourier Transform-properties - relationship between z- transform and DFT-Frequency analysis of signal using DFT. FFT algorithms-advantages over discrete computation of DFT -radix2 algorithms Decimation In Time-Decimation In Frequency-Computation of IDFT using FFT.		**CO3**
UNIT –IV	**Design of Digital Filters**	**Periods:09**
FIR filter design-linear phase FIR filters- Fourier series method-windowing techniques-frequency Sampling techniques. IIR filter design- analog filter design-Butterworth and Chebyshev approximations digital filter design using impulse invariant technique and bilinear transformation method -warping, pre warping-Frequency transformation.		**CO4**
UNIT –V	**Filter Implementation and Finite Word Length Effects**	**Periods:09**
Structures for FIR systems-direct form, cascade and linear phase structures-structures for IIR systems direct form, parallel, cascade and ladder structures- Representation of numbers-errors resulting in rounding and truncation quantization of filter coefficients-round off effects in digital filter-product quantization error, overflow limit cycle oscillations.		**CO5**

LecturePeriods:45	**Tutorial Periods:-**	**Practical Periods:-**	**TotalPeriods:45**

Text Books

1. John G. Proakis and Dimitris G. Manolakis, “Digital Signal Processing: Principles, Algorithms, and Applications”, PHI Learning, New Delhi, 4th Edition, 2008.
2. Alan V. Oppenheim and W. Schafer, “Discrete Time Signal Processing”, Prentice Hall of India Pvt. Ltd., 2001
3. Rabiner and Gold, “Theory and Applications of Digital Signal Processing”, Prentice Hall of India Pvt. Ltd., 2001.
4. SanjitK.Mitra, “Digital Signal Processing: A Computer Based Approach”, Tata McGraw-Hill, 3rd Edition, 2005.
5. Emmanuel C. Ifeachor and Barrie W. Jervis, “Digital Signal Processing”, Pearson Education, 2nd Edition, 2002
6. P. Ramesh Babu, “Digital Signal Processing”, Scitech Publications, 4th Edition, 2007.

Reference Books

1. Oppenheim A V, Willsky A S and Young I T, “Signal & Systems”, Prentice Hall, (1983).
2. Ifeachor and Jervis, “Digital Signal Processing”, Pearson Education India.
3. DeFatta D J, Lucas J G and Hodgkiss W S, “Digital Signal Processing”, J Wiley and Sons, Singapore, 1988.
4. Sanjit K Mitra “Digital Signal Processing” TMH.

Web References

1. https://users.dimi.uniud.it/~antonio.dangelo/MMS/materials/Guide_to_Digital_Signal_Process.pdf
2. https://www-elec.inaoep.mx/~jmram/Digital_Signal_Processing _LI_TAN.pdf
3. http://www.analog.com/en/content/beginners_guide_to_dsp/fca.html
4. https://nptel.ac.in/content/storage2/courses/108105057/Pdf/Lesson-7.pdf

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes(POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	1	1	1	1	1	1	2	3	2	2
2	3	3	3	2	3	1	1	1	1	1	1	2	3	3	2
3	3	3	3	3	3	1	1	1	1	2	2	3	3	3	3
4	3	2	2	2	2	1	2	1	1	1	1	2	3	2	2
5	3	3	3	3	3	1	2	1	1	2	2	3	3	3	3

Correlation Level: 1– Low, 2– Medium, 3–High

Evaluation Methods

Assessment	Continuous Assessment Marks(CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VIII**	Course Category:**PE**			End Semester Exam Type:**TE**			
Course Code	**U23EEE825**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**AI TECHNIQUES IN ELECTRICAL SYSTEM**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								

Prerequisite	Engineering Mathematics. Electrical Machines, Power Electronics, Power system	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Acquire the fundamental concepts of AI, its history, types, and real-world applications.	**K2**
	CO2 Apply supervised learning algorithms such as KNN, SVM, and regression models for classification and prediction tasks.	**K3**
	CO3 Differentiate between supervised and unsupervised learning, apply clustering algorithms, and utilize dimensionality reduction techniques.	**K2**
	CO4 Comprehend and implement neural networks and deep learning models like CNNs and RNNs for tasks such as image and sequence processing.	**K2**
	CO5 Apply AI techniques to optimize electrical systems, including load forecasting, load flow studies, and fault detection in electrical machines.	**K3**

UNIT – I	**Introduction to AI**	**Periods:09**
History- Evolution of AI - Application areas of artificial intelligence – Types of AI - **Intelligent agents**: Types - Agent environment – turing test in AI. **Search Algorithms** - Properties-Importance-Types - Informed search - uninformed search. Hill Climbing Algorithm.		**CO1**
UNIT – II	**Supervised Machine Learning**	**Periods:09**
Introduction –features- History -Classification **- Supervised learning:** Classification model-learning steps –Classification algorithms- K-nearest Neighbour (KNN) - decision free - support vector machines(SVM) - regression algorithms.		**CO2**
UNIT – III	**Unsupervised Machine Learning**	**Periods:09**
Introduction –comparison -Unsupervised vs Supervised Learning-application-clustering - hierarchical clustering- Dimensionality reduction (PCA). **Reinforcement learning methods**		**CO3**
UNIT – IV	**Deep Learning**	**Periods:09**
Convolution Neural Network (CNN): Neuron in human vision, Shortcoming of feature selection, Filters and feature maps, Full Description of Convolution neural network (CNN), Max pooling. - Principal component analysis - Auto encoder: Architecture, Sparsity. - Long short term memory units in RNN		**CO4**
UNIT – V	**Applications of AI Techniques**	**Periods:09**
Speed Control of DC and AC Motors - fault detection and diagnosis in electrical machines. - Load forecasting - Load flow studies - Economic load dispatch - Load frequency control –- Reactive power control		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books:

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, “Machine Learning: An Algorithmic Perspective, “Second Edition”, CRC Press, 2014.
3. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.

Reference Books:

1. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.
3. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
4. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Dos, “Machine Learning”, 1 st edition, Pearson, 2019.

Web References:

1. http://nptel.ac.in/
2. https://www.geeksforgeeks.org/types-of-artificial-intelligence/?ref=lbp
3. https://onlinecourses.nptel.ac.in/noc21_cs69
4. https://nptel.ac.in/courses/106106179
5. https://nptel.ac.in/courses/108/104/108104157/
6. https://nptel.ac.in/courses/108/108/108108148/
7. https://nptel.ac.in/courses/112/105/112105235

COs/POs/PSOs Mapping

COs	ProgramOutcomes(POs)												ProgramSpecific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO2	PSO3
1	3	2	2	3	3	-	-	-	-	-	-	3	3	2	2
2	3	2	2	3	3	-	-	-	-	-	-	3	3	2	2
3	3	2	2	3	3	-	-	-	-	-	-	3	3	2	2
4	3	2	2	3	3	-	-	-	-	-	-	3	3	2	2
5	3	2	2	3	3	-	-	-	-	-	-	3	3	2	2

Correlation Level: 1 - Low, 2-Medium, 3-High

Evaluation Methods

	Continuous Assessment Marks(CAM)					End Semester Examination (ESE)Marks	Total Marks
	CAT1	CAT2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***Application oriented/Problem solving/Design/Analytical in content beyond the syllabus**

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VIII**	Course Category: **PE**			End Semester Exam Type :**TE***			
Course Code	**U23EEE826**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INDUSTRIAL ELECTRICAL SYSTEM**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE

Prerequisite	Electrical Engg, Electrical Machines, Measurement and Instrumentation, Utilization of Electrical Energy.	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Acquire knowledge on electrical components used in industries.	**K2**
	CO2 Explore about residential and commercial wiring connection.	**K2**
	CO3 Choose the different illumination for industries.	**K3**
	CO4 Obtain knowledge on the protection of equipments and its calculations.	**K3**
	CO5 Apply PLC and SCADA system in the automation of industries.	**K3**

UNIT I	**ELECTRICAL CONTROL COMPONENTS**	**Periods:09**
LT system wiring components: selection of cables- wires. Switches- distribution box. Protection Components: Fuse- MCB- MCCB- ELCB- RCCB- MPCB. Single line diagram (SLD)ofa wiring system- Contactor, Isolator. Electric shock and Electrical safety practices.		**CO1**
UNIT II	**WIRING AND EARTHING SYSTEMS**	**Periods:09**
Types of residential and commercial wiring. General rules and guidelines for installation: load calculation and sizing of wire- rating of main switch. Requirements of commercial installation. Earthing systems: unearthed- solidly earthed- resistance earthed- neutral earthing resistors- reactance earthed. Grounding transformers. Components of earthing system. Earthing system for residential and commercial system.		**CO2**
UNIT III	**INDUSTRIAL ILLUMINATION**	**Periods:09**
Industrial lighting- factors of good industrial lighting- Design considerations for lighting industrial areas- factors for special consideration. Interior Illumination: Office- educational institution- hospitals- public buildings. Exterior Illumination: general features- Industrial area- security- decoration purpose- utility areas- sports. Installation aspects: Mechanical- Electrical. Day lighting for buildings. Emergency lighting. Maintenance for lighting.		**CO3**
UNIT IV	**SUBSTATION INSTALLATION**	**Periods:09**
HT connection- industrial substation, Transformer. Selection of industrial loads, motors. Lightning protection, earthing design, Power factor correction- KVAR calculations, types of compensation. Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.		**CO4**
UNIT V	**INDUSTRIAL AUTOMATION**	**Periods:09**
Study of basic PLC. Role of automation-advantages of process automation. PLC based control system design. Panel Metering. Introduction to Discrete Control System (DCS). Introduction to SCADA system for distribution automation.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. S.L.Uppal and G.C. Garg,"Electrical Wiring, Estimating & Costing", Khanna publishers,2008.H.Joshi, Residential Commercial and Industrial Electrical Systems, Vol.3, Tata Mcgrw-hill pub.ltd,2008.
2. BIS, "National lighting code", SP 72, 2010.

Reference Books

1. K.B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.
2. N.Alagappan,S.Ekambaram,"Electrical estimating and costing", TTI Madras, Tata Mcgraw Hill Pub. ltd, New Delhi

Web References:

1. https://aast.edu/pheed/staffadminview/pdf_retreive.php?url=45_16255_EE543_2015_1_1_1_week_8_9.pdf&staffttype=staffcourses
2. https://ibetww.com/what-is-power-control-center-pcc-panel/&
3. https://www.gothightech.com/resources/
4. Nptelcourses,Version 2 EE IIT, Kharagpur
5. www.centuryscipub.com/Design of PLC Electrical Control System/Journal of Theory and Practice

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	1	2	3	-	-	-	-	2	3	2	2
2	3	2	2	3	1	2	3	-	-	-	-	2	3	2	2
3	3	2	2	3	1	2	3	-	-	-	-	2	3	2	2
4	3	2	2	3	1	2	3	-	-	-	-	2	3	2	2
5	3	2	2	3	1	2	3	-	-	-	-	2	3	2	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	Electrical and Electronics Engineering	Programme: **B. Tech.**						
Semester	VIII	Course Category: **PE**			End Semester Exam Type :**TE***			
Course Code	U23EEE827	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
	EEE							
Prerequisite	Electronics-I, Electronics-II, Electronics-III, Renewable Energy Sources							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Describe the role of power electronics in renewable energy conversion and integration.	K2
CO2	Apply solar energy conversion techniques, including MPPT and battery integration.	K3
CO3	Evaluate wind energy conversion systems and their grid synchronization methods.	K2
CO4	Explore biomass and ocean conversion with power electronic interfaces.	K2
CO5	Analyze the advanced control techniques and emerging technologies in renewable energy systems.	K2

UNIT –I	**INTRODUCTION TO RENEWABLE ENERGY SYSTEMS**	**Periods:09**
Importance of power converters in renewable energy systems – Overview of renewable energy sources (Solar, Wind, Biomass, Ocean, Geothermal, Hydrogen, Fuel Cells) and their power conversion needs- Challenges in renewable energy conversion - Role of power electronics in efficient energy conversion.		**CO1**
UNIT –II	**CONVERTERS FOR SOLAR ENERGY SYSTEMS**	**Periods:09**
Solar PV characteristics – Power converters for solar PV (Buck, boost, buck-boost) – MPPT algorithms and implementation – Grid-connected and standalone inverter configurations – Battery charging techniques.		**CO2**
UNIT –III	**CONVERTERS FOR WIND ENERGY SYSTEMS**	**Periods:09**
Wind turbine systems – Power converters in wind energy (SEPIC, ZETA converters – Grid integration of wind energy – Doubly-fed induction generator (DFIG) and permanent magnet synchronous generator (PMSG) power conversion – Grid synchronization, PLLs, and islanding.		**CO3**
UNIT –IV	**CONVERTERS FOR BIOMASS AND OCEAN ENERGY SYSTEMS**	**Periods:09**
Biomass energy conversion - Power electronic converters in biomass gasification and biogas power - Energy storage and grid synchronization. Ocean energy (Tidal, Wave, Thermal) - Power converters for ocean energy extraction - Rectification and inversion techniques - Grid-connected and standalone modes.		**CO4**
UNIT –V	**ADVANCED CONTROL TECHNIQUES AND FUTURE TRENDS**	**Periods:09**
Digital control techniques for power converters (DSP/FPGA-based) - AI/ML in predictive maintenance and efficiency - Wide-bandgap semiconductors (SiC/GaN) in power conversion - Smart grid integration - Case studies on real-world renewable energy projects.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. S.N.Bhadra, D.Kastha, S.Banerjee,"Wind Electrical Systems", Oxford University Press,1st Edition,2005.
2. B.H.Khan,"Non-conventional Energy Resources",Tata McGraw-hill Publishing Company,3rd Edition,2017.
3. M.H. Rashid – Power Electronics: Circuits, Devices and Applications, Pearson India, 4th Edition.

Reference Books

1. M.H.Rashid, "Power Electronics Handbook", Academic press,4th Edition,2017.
2. R.K. Rajput – Non-Conventional Energy Sources, S. Chand Publishing.
3. Remus Teodorescu, Marco Liserre, Pedro Rodriguez, "Grid Converters for Photovoltaic and Wind Power Systems", John Wiley and Sons, Ltd., 1st Edition, 2011.
4. Gray,L. Johnson, "Wind energy system", Prentice hall linc, Electronic Edition,2006.
5. Andrzej M.Trzynnadlowski,"Introduction to Modern Power Electronics",Wiley, India Pvt.Ltd,2nd Edition, 2012.

Web References:

1. NPTEL Course by Prof. Ned Mohan / Prof. Ashish Pandharipande https://nptel.ac.in/courses/108105159
2. MNRE – Ministry of New and Renewable Energy, Government of Indiahttps://mnre.gov.in
3. ISRO"s Solar Power Satellite and Renewable Projectshttps://www.isro.gov.in
4. TERI – The Energy and Resources Institute, Indiahttps://www.teriin.org

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes(POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	1	1	1	1	2	1	2	3	2	2
2	3	3	3	3	3	1	1	1	1	2	1	2	3	3	3
3	3	3	3	3	3	1	1	1	2	2	2	2	3	3	3
4	3	2	2	2	2	1	2	1	1	2	2	2	3	2	2
5	3	3	3	3	3	1	2	1	1	2	2	2	3	3	3

Correlation Level: 1– Low, 2– Medium,3–High

Evaluation Methods

Assessment	Continuous Assessment Marks(CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**VIII**	Course Category: **PE**			End Semester Exam Type: **TE***			
Course Code	**U23EEE828**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**RESTRUCTURED POWER SYSTEM**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								
Prerequisite	Power System Analysis							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Describe the fundamentals of power industry deregulation, including unbundling, wheeling, and reform motivations.	**K2**
	CO2	Apply generation rescheduling techniques to mitigate transmission congestion.	**K3**
	CO3	Illustrate the role of transmission planning and expansion in a deregulated power system.	**K2**
	CO4	Interpret the role of spot pricing, uniform pricing, and locational marginal pricing in power markets.	**K2**
	CO5	Apply knowledge of power trading mechanisms to optimize generation and transmission costs.	**K3**

UNIT –I	**FUNDAMENTALS AND ARCHITECTURE OF POWER MARKETS**	**Periods:09**	
Deregulation of Electric utilities: Introduction-Unbundling-Wheeling- Reform Motivations Fundamentals of Deregulated Markets – Types (Future, Day-ahead and Spot) – Participating in Markets (Consumer and Producer Perspective) – bilateral markets – pool markets. Independent System Operator (ISO)-components-types of ISO - role of ISO - Lessons and Operating Experiences of Deregulated Electricity Markets in various Countries (UK, Australia, Europe, US, Asia).			**CO1**
UNIT –II	**TECHNICAL CHALLENGES**	**Periods:09**	
Total Transfer Capability - Limitations - Margins – Available transfer capability (ATC) – Procedure - Methods to compute ATC – Static and Dynamic ATC – Effect of contingency analysis – Case Study. Concept of Congestion Management – Bid, Zonal and Node Congestion Principles - Inter and Intra zonal congestion – Generation Rescheduling - Transmission congestion contracts – Case Study.			**CO2**
UNIT –III	**TRANSMISSION NETWORKS AND SYSTEM SECURITY SERVICES**	**Periods:09**	
Transmission expansion in the New Environment – Introduction – Role of transmission planning – Physical Transmission Rights – Limitations – Flow gate - Financial Transmission Rights – Losses – Managing Transmission Risks – Hedging – Investment. Ancillary Services – Introduction – Describing Needs – Compulsory and Demand-side provision – Buying and Selling Ancillary Services – Standards.			**CO3**
UNIT –IV	**MARKET PRICING**	**Periods:09**	
Transmission pricing in open access system – Introduction – Spot Pricing – Uniform Pricing – Zonal Pricing – Locational Marginal Pricing – Congestion Pricing – Ramping and Opportunity Costs. Embedded cost based transmission pricing methods (Postage stamp, Contract path and MW mile) – Incremental cost based transmission pricing methods (Short run marginal cost, Long run marginal cost) - Pricing of Losses on Lines and Nodes.			**CO4**
UNIT –V	**INDIAN POWER MARKET**	**Periods:09**	
Current Scenario – Regions – Restructuring Choices – State wise Operating Strategies - Salient features of Indian Electricity Act 2003 – Transmission System Operator – Regulatory and Policy development in Indian power Sector Opportunities for IPP and Capacity Power Producer. Availability based tariff – Necessity – Working Mechanism Beneficiaries – Day Scheduling Process - Deviation from Schedule – Unscheduled Interchange Rate - System Marginal Rate – Trading Surplus Generation – Applications.			**CO5**

LecturePeriods:45	**Tutorial Periods:-**	**Practical Periods:-**	**TotalPeriods:45**

Text Books

1.S. A. Khaparde and A. R. Abhyankar, “Restructured Power Systems”, Narosa Publishing House, New Delhi, India, 2008.
2.S. C. Srivastava and S. N. Singh, “Operation and Management of Power system in Electricity Market”, Narosa Publishing House, New Delhi, India, 2008.

Reference Books

1. Kankar Bhattacharya, Math H.J. Bollen and Jaap E. Daalder, "Operation of Restructured Power Systems", Kluwer Academic Publishers, 2001.
2. Loi Lei Lai, "Power system Restructuring and Regulation", John Wiley sons, 2001.
3. M. Shahidehpour and M. Alomoush, "Restructuring Electrical Power Systems", Marcel Decker Inc., Scholarly Transaction Papers and Utility web sites, 2001.

Web References

1. https://archive.nptel.ac.in/courses/108/101/108101005/#
2. https://www.scribd.com/document/447814310/1916204-Restructred-Power-System-pdf
3. https://www.sciencedirect.com/topics/engineering/restructured-electricity-market
4. https://www.grafiati.com/en/literature-selections/restructured-power-systems/book/

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes(POs)												Program Specific Outcomes(PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	2	1	2	2	3	1	1	2	2	3	3	3
2	3	3	3	3	3	2	2	2	2	2	3	3	3	2	2
3	3	2	3	2	2	3	3	2	2	2	3	3	3	3	3
4	3	3	3	2	2	3	3	3	2	2	3	3	3	3	3
5	3	3	3	2	2	3	2	3	2	2	3	3	3	3	3

Correlation Level: 1– Low, 2– Medium,3–High

Evaluation Methods

Assessment	Continuous Assessment Marks(CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electrical and Electronics Engineering**	Programme: **B.Tech.**						
Semester	**VIII**	Course Category Code: **PE**			End Semester Exam Type:**TE***			
Course Code	**U23EEE829**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**OPTIMIZATION TECHNIQUES**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
		EEE						
Prerequisite	**Mathematics**							

Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the optimization techniques analysis.	**K2**
	CO2 Analyze the various genetic algorithm operators for evaluation process.	**K2**
	CO3 Describe the efficient computational procedures to solve optimization problems.	**K2**
	CO4 Apply constrained optimization algorithm for evaluation process	**K3**
	CO5 Classify and analyze the various methods of optimization.	**K2**

UNIT-I	**INTRODUCTION**	**Periods:09**	
Introduction to optimization - historical development - Engineering Applications of Optimization -statement of an optimization problem - classification of optimization problem - techniques - single variable optimization- multivariable optimization with equality constraints, Inequality constraints			**CO1**
UNIT-II	**GENETIC ALGORITHM**	**Periods:09**	
Evolution in nature-Fundamentals of Evolutionary Algorithms-Working Principles of Genetic Algorithm – Crossover and Mutation-Issues in GA implementation- Tabu search algorithm for unit commitment problem -Representation of design variables- objective function and constraints- genetic operators-GA versus Traditional methods- steady state selection- selection schemes.			**CO2**
UNIT-III	**LINEAR AND NON-LINEAR PROGRAMMING**	**Periods:09**	
Linear programming problems: Definition- Standard form – duality in linear programming – decomposition principle - karmarkar"s method- application. Non-Linear programming: Unrestricted Search, Search with Fixed Step Size, Search with Accelerated Step Size, Exhaustive Search, Dichotomous Search, Interval Halving Method, Fibonacci Method, Golden Section Method, Comparison of Elimination Methods. Direct Root Methods-			**CO3**
UNIT-IV	**CONSTRAINED OPTIMIZATION ALGORITHM**	**Periods:09**	
Characteristics of a constrained problem- Direct methods: complex method- sequential linear programming method- Indirect method: Transformation Technique- Basic approach in the penalty function method-Interior penalty function method- convex method.			**CO4**
UNIT-V	**MODERN METHODS OF OPTIMIZATION**	**Periods:09**	
Metaheuristic algorithm-Simulated Annealing, Particle Swarm Optimization, Ant Colony Optimization, Multi-level optimization Evolutionary algorithms for optimization, Artificial Bee Colony (ABC) algorithm.			**CO5**

LecturePeriods:45	**Tutorial Periods:-**	**Practical Periods:-**	**TotalPeriods:45**

Text Books

1. S.S. Rao, Engineering optimization: Theory and Practice, New age international (P) Ltd., 3rd edition, 2013.
2. David E. Gold Berg, "Genetic Algorithms in Search, Optimization and Machine Learning", Pearson Education, 1st Edition, 2008.
3. Parsopoulos, K.E., Vrahatis, M.N., Particle Swarm Optimization and Intelligence: Advances and Applications, Information Science Reference, IGI Global, 1st Edition, 2010.

Reference Books

1. Kalyanmoy Deb, "Optimization for Engineering Design, algorithms and examples", PHI Publishers, 2nd Edition, 2012.
2. T. J. Ross, "Fuzzy Logic with Engineering Applications", Wiley, 3rd Edition, 2010.
3. Sivanandam, S.N., Deepa, S. N, "Introduction to Genetic Algorithms, Springer", 1st Edition, 2011.
4. EthemAlpydin, "Introduction to Machine learning (Adaptive Computation and Machine Learning series)",MIT Press, 2nd Edition, 2010.

Web References

1. https://www.researchgate.net/publication/261831018_Soft_Computing_Techniques_for_Protecting
2. https://shodhganga.inflibnet.ac.in/bitstream/10603/10161/11/11_chapter%203.pdf
3. https://www.semanticscholar.org/paper/Chapter-2-Soft-Computing-Techniques.
4. https://ieeexplore.ieee.org/document/7938905
5. https://www.igi-global.com/chapter/soft-computing-its-applications/46389

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	-	-	-	-	-	-	-	-	3	2	2
2	3	2	2	-	-	-	-	-	-	-	-	-	3	2	2
3	2	2	2	-	-	-	-	-	-	-	-	-	3	2	2
4	2	2	3	-	-	-	-	-	-	-	-	-	3	2	2
5	3	2	3	-	-	-	-	-	-	-	-	-	3	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**Electrical and Electronics Engineering**	Programme: **B. Tech.**						
Semester	**VIII**	Course Category: **PE**			End Semester Exam Type: **TE***			
Course Code	**U23EEE830**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**SMART GRID**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
EEE								
Prerequisite	Transmission and Distribution, Power System Analysis							

Course Outcomes		**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1	Determine conceptual ideas of Smart Grid with a thorough understanding of various communication technologies and power management issues with smart grid.	**K2**
	CO2	Outline about the protocols and networks used in Smart grid.	**K2**
	CO3	Explain the importance of WAMS used in smart grid.	**K2**
	CO4	Acquire knowledge on distributed generation and micro grids in smart grid.	**K3**
	CO5	Explain the power quality issues in smart grid.	**K3**

UNIT – I	**OVERVIEW OF SMART GRID**	**Periods:09**
Introduction to Smart Grids – Today"s Grid versus the Smart Grid - Key functions of smart grid - Opportunities & Barriers of Smart Grid - Smart grid elements and control layers - Policies and infrastructures - Concept of Resilient & Self-Healing Grid - Demand Side Management (DSM) and transactive energy models – Present development & International policies on Smart Grid. Case study of Smart Grid.		**CO1**
UNIT – II	**SMART METERING AND COMMUNICATION**	**Periods:09**
Smart meters - Communications infrastructure, protocols and hardware - Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers - benefits – Power line communication (PLC) - Machine to machine communication models - Home Area Networks (HAN), Wide Area Networks (WAN) and Neighbourhood Area Networks (NAN) - Wired and Wireless communication technologies – Cryptosystem - Internet of things (IOT).		**CO2**
UNIT – III	**WIDE AREA MEASUREMENT SYSTEMS**	**Periods:09**
Synchro-Phasor Measurement Units (PMUs) – Wide Area Measurement Systems (WAMS) - Geographic Information system (GIS) and Google Mapping Tools, Multiagent Systems (MAS) Technology - Sensor Networks, Fault Detection - Phasor Data Concentrator (PDC) – Road Map for synchro-phasor technology. Operational experience and Blackout analysis using PMU.		**CO3**
UNIT – IV	**INTEGRATION, CONTROL AND OPERATION OF DISTRIBUTED GENERATION**	**Periods:09**
Distributed Generation Technologies - benefits - Utilization Barriers - integration to power grid - Introduction t Renewable Energy Technologies – Micro grids – Advantages and disadvantages of DG – Vehicle to Grid technology and Grid to vehicle technology - Performance and stability analysis in smart grid.		**CO4**
UNIT – V	**POWER QUALITY MANAGEMENT IN SMART GRID**	**Periods:09**
Power Quality - issues - Conditioners - Web based monitoring – Energy Audit - Cyber Security- Power Quality Improvement methods – Introduction to EMC in smart grid.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. James Momoh, Smart Grid: Fundamentals of Design and Analysis, Wiley-IEEE Press, 2012.
2. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, and Nick Jenkins, Smart Grid: Technology And Applications, Wiley, New Delhi, Aug 2015.
3. Lars T. Berger and Krzysztof Iniewski, Smart Grid Applications, Communications, and Security, Wiley, New Delhi, Aug 2015.

Reference Books

1. Stuart Borlase, "Smart Grids: Infra structure, Technology and Solutions", CRC Press, 1st Edition, 2013.
2. Jean Claude Sabonnadiere, Nouredine Hadjsaid, "Smart Grids", Wiley Blackwell,1st Edition, 2012.
3. Fereidoon. P. sioshansi, "Smart grid – integrating renewable, distributed and efficient energy", Academic Press, 1st Edition, 2011.
4. Tony Flick, Justin Morehouse, "Securing the Smart Grid: Next Generation Power Grid Security", Academic Press, 1st Edition, 2011.

Web References

1. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee42/
2. https://onlinecourses.nptel.ac.in/noc19_ee64/preview
3. https://www.classcentral.com/course/swayam-introduction-to-smart-grid-14165
4. https://npti.gov.in/smart-grid-technologies
5. http://www.infocobuild.com/education/audio-video-courses/electronics/IntroductionToSmartGrid-IIT Roorkee/lecture-04.html

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												ProgramSpecific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	3	1	1	1	-	-	-	-	2	2	1	2
2	3	2	2	3	1	1	1	-	-	-	-	2	2	1	2
3	3	2	2	3	1	1	1	-	-	-	-	2	2	1	2
4	3	2	2	3	1	1	1	-	-	-	-	2	2	1	2
5	3	2	2	3	1	1	1	-	-	-	-	2	2	1	2

CorrelationLevel:1 - Low,2-Medium,3–High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT1	CAT2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

*Application oriented/Problem solving/Design/Analytical in content beyond the syllabus

Department	**Management Studies**	Programme: **B. Tech.**						
Semester	**V / VI**	Course Category: **OE**			End Semester Exam Type: **TE**			
Course Code	**U23HSOC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**INTELLECTUAL PROPERTY RIGHTS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Common to ALL Branches

Prerequisite	Nil	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the Concept and Importance of Intellectual Property Rights (IPR).	**K2**
	CO2 Describe the procedures for patent registration, including recognizing legal remedies for infringement.	**K3**
	CO3 Apply copyright laws to hypothetical scenarios involving academic integrity and plagiarism.	**K3**
	CO4 Infer the different types of trademarks and understand the registration process and infringement issues.	**K4**
	CO5 Explain the legalities surrounding industrial designs, geographical indications, and their protection mechanisms.	**K2**

UNIT – I	**Overview of Intellectual Property**	**Periods:09**
Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Trade Secret – International protection of IPR- Major International conventions and agreements: WTO/TRIPS Agreement, Paris Convention, The Berne Convention, Universal Copyright Convention, WIPO Convention, Madrid Agreement, Nice Agreement and TRIPS Agreement		**CO1**

UNIT – II	**Law of Patents**	**Periods:09**
Meaning and Nature of Patent - Subject matter of Patent - Registration Procedure, Patentable and Non-patentable Inventions - Process and product Patent, Legal Requirements for Patents – Patent document: Specification and Claims - Granting of Patents - Transfer of Patent rights - Infringement of Patents and Remedies - Evergreening of Patents		**CO2**

UNIT – III	**Law of Copyrights**	**Periods:09**
Meaning and Nature of Copyright - Subject matter of copyright - Law of Copyrights - Authorship and Ownership of copyright, Registration Procedure, Assignment and Licensing of copyright - Infringement of Copyrights and Remedies - Emerging new trends in Copyrights - Related Rights: Celebrity Rights, Academic Integrity or Plagiarism: An Intellectual Theft - Copyrights with special reference to software.		**CO3**

UNIT – IV	**Law of Trademarks**	**Periods:09**
Meaning and Nature of Trademarks - Different kinds of Trademarks - Registrable and Non-Registrable Trademarks - Registration of Trademarks - Grounds for refusal of Registration: Absolute Ground and Relative Ground - Assignment and Licensing of trademarks - Infringement, Remedies and Penalties - Offenses relating to Trademarks - Passing off action – Deceptive similarity - Defences - Emerging New trends in trademarks		**CO4**

UNIT – V	**Other Forms of IPR**	**Periods:09**
Meaning and nature of Industrial Design - Subject Matter - Procedure for registration - Infringement of Copyrights in designs - Remedies for Infringement - Trade secret Law-Determination of Trade Secret Status - Liability for misappropriations of Trade Secrets- Protection for submission-Trade Secret litigation - Meaning and Nature of Geographical Indication (GI) - Procedure for registration - Infringement of Geographical indication - Remedies for Infringement.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. K.V. Nithyananda, “Intellectual Property Rights: Protection and Management”, Cengage Learning India Pvt. Ltd., 2nd Edition 2019.
2. P. Neeraj and D. Khusdeep, “Intellectual Property Rights”, PHI Learning Private Limited, 2nd Edition, 2018.

Dr. P. Jamuna

Reference Books

1. V. K. Ahuja, "Law Relating to Intellectual Property Rights", Lexis Nexis, 2nd Edition, 2017.
2. Bouchoux, E. Deborah, "Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets", Cengage Learning, 4th Edition, 2013.
3. P. Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", Tata McGraw-Hill Publishing Company, 2022.
4. Jyoti Rattan, "Intellectual Property Rights", Bharat Law House, 2nd Edition, 2024.
5. Surendra Malik and Sudeep Malik, "Supreme Court on Intellectual Property", Eastern Book Company, 2022.

Web References

1. https://www.wipo.int/about-ip/en/
2. https://www.uspto.gov/patents/basics/general-information-patents
3. https://www.wto.org/english/tratop_e/trips_e/trips_e.htm
4. https://www.epo.org/about-us/annual-reports-statistics/annual-report.html
5. https://articles.manupatra.com/article-details/Patent-Types-Laws-related-to-them-in-India
6. https://www.inta.org/trademarks/trademark-basics/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	1	-	-	-	3	2	2	-	2	1	2	2	2	2
2	1	2	-	2	-	3	2	2	-	2	1	1	2	2	2
3	-	2	-	-	-	2	2	3	-	2	-	1	2	2	2
4	1	1	-	-	-	3	2	2	-	2	1	1	2	2	2
5	1	2	-	-	-	3	3	2	-	2	1	1	2	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT1	CAT2	ModelExam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Management Studies**	Programme: **B. Tech.**						
Semester	**V / VI**	Course Category: **OE**			End Semester Exam Type: **TE**			
Course Code	**U23HSOC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**NEW PRODUCT DEVELOPMENT**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Common to ALL Branches

Prerequisite	Nil	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Explain the stages and importance of new product development (NPD) in modern business contexts.	**K2**
	CO2 Apply market research to identify customer needs and translate them into product specifications.	**K3**
	CO3 Illustrate the product concepts using screening and scoring techniques to select the most viable option.	**K3**
	CO4 Examine product prototype that incorporates principles of product architecture and design for manufacturing.	**K3**
	CO5 Analyze a business plan and market strategy for the successful launch of a new product.	**K4**

UNIT – I	**Introduction to New Product Development**	**Periods:09**
Introduction to New Product Development (NPD) - Product Development vs New Product Development - Stages of NPD - Role of Innovation and Creativity in NPD - Reverse Engineering and its Application in NPD - Business Models for New Products - Risk Management in New Product Development - Sustainability and Ethical Considerations in NPD		**CO1**
UNIT – II	**Market Research and Customer Needs**	**Periods:09**
Identifying Market Opportunities for New Products - Conducting Market Research for NPD - Translating Customer Needs into Product Specifications - Establishing and Refining Product Specifications - Competitive Analysis and Benchmarking in NPD - Tools for Understanding Consumer Behaviour: Surveys, Focus Groups, and Ethnography		**CO2**
UNIT – III	**Concept Generation and Evaluation**	**Periods:09**
Concept Generation Process: Continuous and External Idea Sources - Clarifying the Problem and Brainstorming Solutions - Design Thinking for New Products - Techniques for Concept Generation - Systematic Exploration of Concepts - Screening and Scoring Product Concepts - Concept Evaluation and Selection Methods - Prototyping Techniques		**CO3**
UNIT – IV	**Product Design and Development**	**Periods:09**
Product Architecture and its role in NPD - Modular vs. Integral Product Architecture - Design for Sustainability - Environmental Considerations - Organizing Product Development Teams - Stages of team Development - Collaboration and Cross - Functional Teams in Product Development - Tools for Effective Product Design - Agile Product Development Methodologies		**CO4**
UNIT – V	**Launch, Strategy and Commercialization**	**Periods:09**
Developing a New Product Strategy - Building Market Demand and Entry Strategies for New Products - Developing a New Product Business Plan - Preparing for Market Launch - Post - Launch Evaluation - Product Life Cycle - Continuous Improvement and Future Product Enhancements		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. KT. Ulrich, SD. Eppinger, “Product Design and Development”, McGraw-Hill Education, 7th Edition, 2020.
2. CM. Crawford, A. Di Benedetto, “New Products Management”, 11th Edition, McGraw-Hill Education, 2014.
3. RG. Cooper, “Winning at new products: Creating value through innovation”, Basic Books, 5th Edition, 2017.

Reference Books

1. P. Trott, “Innovation management and new product development”, Pearson Education, 6th Edition, 2017.
2. S. Thomke, “Experimentation works: The surprising power of business experiments”, Harvard Business Review Press, 2020
3. S.G. Blank, B. Dorf, “The start-up owner's manual: The step-by-step guide for building a great company”, Wiley, 2020.
4. T. Brown, “Change by design: How design thinking transforms organizations and inspires innovation”, Harper Business, 2009.
5. T. Kelley, J. Littman, “The ten faces of innovation: IDEO's strategies for beating the devil's advocate and driving creativity throughout your organization”, Currency/Doubleday, 2006.

Dr. P. Jamuna

Web References

1. https://conjointly.com/kb/
2. https://www.entrepreneur.com/article/281999
3. https://www.mindtools.com/pages/article/newSTR_66.htm
4. https://www.interaction-design.org/literature/article/design-thinking-getting-started-with-empathy
5. https://www.productplan.com/glossary/product-architecture/
6. https://hbr.org/2019/09/why-design-thinking-works
7. https://www.smartsheet.com/new-product-development.
8. https://www.ptc.com/en/blogs/cad/best-practices-for-developing-new-products

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	3	-	3	1	1	-	-	1	-	2	2	2	2
2	1	-	2	1	3	-	-	1	-	1	-	3	2	2	2
3	1	1	3	-	2	-	1	-	2	-	1	2	2	2	2
4	3	-	1	1	3	1	-	1	2	-	1	1	2	2	2
5	1	-	3	-	3	-	-	-	2	-	1	2	2	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT1	CAT2	ModelExam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Management Studies**	Programme: **B. Tech.**						
Semester	**V / VI**	Course Category: **OE**			End Semester Exam Type: **TE**			
Course Code	**U23HSOC03**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**FINANCE FOR ENGINEERS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Common to ALL Branches								
Prerequisite	Nil							

Course Outcomes		On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1	Explain the objectives, scope, and role of financial management in engineering, and differentiate between profit maximization and wealth maximization.	**K2**
	CO2	Apply the concepts of the time value of money to engineering projects and use investment appraisal techniques such as NPV, IRR, and Payback Period for decision-making.	**K3**
	CO3	Demonstrate the steps in the capital budgeting process and apply techniques like cost-benefit and sensitivity analysis for evaluating engineering projects.	**K3**
	CO4	Analyze financial statements, including balance sheets and income statements, from an engineering perspective, and evaluate financial ratios to assess the financial performance of engineering projects.	**K4**
	CO5	Analyze different types of costs, such as fixed, variable, and marginal costs, and evaluate cost-benefit analysis and break-even analysis for engineering decision-making.	**K4**

UNIT – I	**Introduction to Financial Management**	**Periods:09**
Overview of Financial Management: Objectives, Scope, and Role in Engineering - Financial Planning and Strategy: Short-Term and Long-Term Planning - Basic Concepts: Profit Maximization vs Wealth Maximization - Role of Engineering Managers in Financial Decision - Making, Relationship between Finance and Other Engineering Disciplines.		**CO1**
UNIT – II	**Time Value of Money and Investment Decisions**	**Periods:09**
Time Value of Money: Concept, Importance and Applications in Engineering Project, Present Value and Future Value Calculations - Investment Appraisal Techniques: Payback Period, Net Present Value (NPV), Internal Rate of Return (IRR) (Theory only) and Profitability Index (PI) - Risk Analysis in Investment Decision Making.		**CO2**
UNIT – III	**Capital Budgeting for Engineering Projects**	**Periods:09**
Capital Budgeting Process: Steps and Key considerations, Techniques for Evaluating Engineering Project, Cash-Flow Estimation for Project, Cost - Benefit Analysis in Engineering Project, Sensitivity Analysis, and Decision Trees for Project Evaluation.		**CO3**
UNIT – IV	**Financial Statements and Ratio Analysis**	**Periods:09**
Introduction to Financial Statements: Balance Sheet, Income Statement, and an Engineering Perspective on Financial Statement Interpretation - Financial Ratios: Liquidity, Profitability - Engineering Case Studies on Financial Performance Evaluation - Limitations of Ratio Analysis in Engineering Projects.		**CO4**
UNIT – V	**Cost Estimation and Engineering Economic Analysis**	**Periods:09**
Introduction to Cost Estimation in Engineering - Types of Costs: Fixed, Variable, Marginal, and Sunk Costs, Cost-Benefit Analysis in Engineering Projects, Break-Even Analysis and Its Application in Engineering Decision Making - Engineering Economic Analysis: Replacement Analysis.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. WG. Sullivan, EM. Wicks, CP. Koelling, “Engineering Economy”, Pearson, 17th Edition, 2020.
2. RA. Brealey, SC. Myers, F. Allen, “Principles of Corporate Finance”, 19th Edition, McGraw-Hill Education, 2022.
3. EF. Brigham, JF. Houston, “Fundamentals of Financial Management”, 15th Edition, Cengage Learning, 2019.

Reference Books

1. BJ. Ranganath, KK. Sinha, “Financial Management for Engineers”, Vikas Publishing House, 4th Edition, 2018.
2. F. Crundwell, “Finance for Engineers: Evaluation and Funding of Capital Projects”, Springer, 2017.

Dr. P. Jamuna

Web References

1. https://www.netsuite.com/portal/resource/articles/financial-management/financial-management.shtml
2. https://www.investopedia.com/ask/answers/033015/why-time-value-money-tvm-important-concept-investors.asp
3. https://omnicard.in/blogs/capital-budgeting-24042024
4. https://www.linkedin.com/pulse/role-capital-budgeting-process-engineering-studies-ashraf
5. https://corporatefinanceinstitute.com/resources/accounting/financial-ratios/
6. https://www.dau.edu/acquipedia-article/engineering-cost-estimation-method

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	-	-	-	1	1	1	-	2	1	1	2	2	2
2	1	2	1	-	1	2	1	2	-	3	1	-	2	2	2
3	-	3	3	-	1	3	1	2	-	3	1	1	2	2	2
4	1	2	-	2	1	1	2	1	1	2	1	-	2	2	2
5	-	3	-	-	2	3	2	2	1	2	2	3	2	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT1	CAT2	ModelExam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Management Studies**	Programme: **B. Tech.**						
Semester	**V / VI**	Course Category: **OE**			End Semester Exam Type: **TE**			
Course Code	**U23HSOC04**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ECONOMICS FOR ENGINEERS**	**3**	**0**	**0**	**3**	**25**	**75**	**100**
Common to ALL Branches								
Prerequisite	Nil							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Interpret principles of managerial economics to real-world scenarios, utilizing demand analysis and forecasting techniques.	**K2**
CO2	Discuss production functions and cost structures to evaluate their impact on managerial decision-making and market strategies.	**K2**
CO3	Examine various market structures and pricing strategies, synthesizing their effects on market behavior and competitive dynamics.	**K3**
CO4	Apply macroeconomic policies and their implications on business cycles, investment decisions, and economic stability.	**K3**
CO5	Analyze recent economic trends, such as technological advancements and income inequality.	**K4**

UNIT – I	**Introduction to Managerial Economics**	**Periods:09**
Managerial Economics: Meaning, Scope, and Importance - Functions of a Managerial Economist - Demand Analysis: Law of Demand, Elasticity of Demand, Law of Supply, Elasticity of supply and Market Equilibrium - Comparative statistics: Shift of a curve and movement along with the curve - Demand Forecasting: Criteria for Effective Forecasting - Qualitative Methods - Quantitative Methods.		**CO1**

UNIT – II	**Production Function and Cost Concepts**	**Periods:09**
Production Function: Meaning, Types, Applications in Managerial Decision Making - Law of variable proportion and law of returns to scale - ISO Quants - Producer Surplus: Price ceiling and price floor - Cost concept: Types of Costs - Total, average and marginal cost - Revenue Concepts: Total Revenue (TR) - Marginal Revenue (MR) and Average Revenue (AR).		**CO2**

UNIT – III	**Market Structure**	**Periods:09**
Market structure: Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly and Duopoly - Pricing policies: Cost-Based Pricing, Demand - Based Pricing, Competition - Based Pricing, Psychological Pricing, Geographical Pricing, Dynamic Pricing, Bundle Pricing, Price Discrimination, Premium Pricing and practices.		**CO3**

UNIT – IV	**Macroeconomics**	**Periods:09**
Globalization and Economic Policies - National Income Concepts: Methods of measuring national income - circular flow of income - Monetary policy and Fiscal Policy - Business Cycles concepts - Inflation, deflation and its types - Foreign Direct Investment (FDI) - Foreign Institutional Investment (FII).		**CO4**

UNIT – V	**Recent Trends in Economics**	**Periods:09**
Digital Economy : E-commerce, Fintech, and Online Services - Role of Technology : Big Data, Artificial Intelligence and Automation in Economic Decision-Making - Gig Economy : Growth of Freelance and Contract Work - Impact on Global Economies - Income In - equality : Causes, Effects and Socio - political Impact		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Samuelson, F. William, Marks, G. Stephen, “Managerial Economics: Theory, Applications, and Cases”, Wiley, 10th Edition, 2020.
2. H. L. Ahuja, “Principles of Managerial Economics”, Tata McGraw-Hill, 7th Edition, 2017.
3. D. M. Mithani, “Managerial Economics”, Himalaya Publishing House, 3rd Edition, 2021.

Reference Books

1. Varian, Hal R., “Intermediate Microeconomics: A Modern Approach”, W.W. Norton & Company, 9th Edition, 2014.
2. Brickley, A. James, Jr. Smith, W. Clifford, Zimmerman, L. Jerold, “Managerial Economics and Organizational Architecture”, 7th Edition, McGraw-Hill Education, 2016.
3. Samuelson, Paul, Nordhaus, William, “Economics”, McGraw-Hill Education, 20th Edition, 2019.
4. Schiff, Peter, and Schotter, J. Andrew, “Introduction to Microeconomics”, Cengage Learning, 3rd Edition, 2012.
5. Moore, C. James, “Economic Theory and Operations Analysis”, Academic Press, 2nd Edition, 1970.

Dr. P. Jamuna

Web References

1. https://www.jaroeducation.com/blog/nature-and-types-of-managerial-economics/
2. https://psu.pb.unizin.org/introductiontomicroeconomics/chapter/chapter-6-costs-and-production/
3. https://corporatefinanceinstitute.com/resources/economics/market-structure.
4. https://www.britannica.com/money/macroeconomics
5. https://www2.deloitte.com/us/en/insights/economy/global-economic-outlook/weekly-update.html

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	1	1	-	1	1	-	-	-	2	2	-	2	2	2
2	1	1	1	2	2	2	2	-	-	3	3	3	2	2	2
3	1	1	1	2	-	2	2	-	-	3	-	3	2	2	2
4	1	1	-	2	2	2	2	2	-	3	3	3	2	2	2
5	1	1	1	2	2	-	2	2	-	3	3	3	2	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT1	CAT2	ModelExam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	**Management Studies**	Programme: **B. Tech.**						
Semester	**V / VI**	Course Category: **OE**			End Semester Exam Type: **TE**			
Course Code	**U23HSOC05**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MARKETING MANAGEMENT**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

Common to ALL Branches

Prerequisite: Nil

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Explain the importance of marketing and differentiate between marketing and selling.	**K2**
CO2	Apply the consumer decision-making process and differentiate between industrial and consumer buying behavior.	**K3**
CO3	Examine product life cycle management strategies and demonstrate the steps involved in new product development.	**K3**
CO4	Illustrate the role of distribution channels and design an effective channel distribution strategy for both consumer and industrial goods.	**K3**
CO5	Analyze emerging trends in marketing, including Customer Relationship Management and experiential marketing strategies.	**K4**

UNIT – I	**Introduction to Marketing**	**Periods:09**
Marketing - Importance of Marketing - Difference between Marketing and Selling - Marketing Environment: The Macro and Micro Environment factors, Importance of environment analysis – Strategic Marketing planning: Introduction, Need, Framework of Strategic planning process and Steps in strategic planning - Ethical and Social Responsibility of Marketing - 4 Ps of Marketing		**CO1**
UNIT – II	**Consumer Behaviour and Marketing Strategy**	**Periods:09**
Role of buyer - Types of Buying behavior - Factors influencing buying decisions - Consumer decision making process: Meaning and Steps in Consumer decision making Process – Organizational buying behaviour: Classification of organizational markets, Characteristics, Difference between Industrial and Consumer buying - Market Segmentation - Needs, Classification and Significance - Targeting, Positioning and Competitive Strategies.		**CO2**
UNIT – III	**Product and Pricing Mix**	**Periods:09**
Product classifications - Product Life cycle - Strategies for managing Product Life cycle – Categories of New product, Importance and Steps in New Product Development – Packaging: Need for packaging, Essential qualities of packaging, kinds of packaging and advantages of packaging – Labelling: Functions, Types of labelling, advantages and disadvantages of labelling – Pricing objectives – Pricing strategies		**CO3**
UNIT – IV	**Place and Promotion Mix**	**Periods:09**
Distribution Channel and Physical distribution: Meaning and Importance of distribution channel - Channel design decisions - Channels of distribution for consumer and industrial goods - Physical Distribution: Meaning, Objectives and components of physical distribution - Promotion: Objectives, Types of sales promotion: Consumer, Salesperson and Dealer sales promotion – Introduction to Integrated Marketing Communication		**CO4**
UNIT – V	**Trends in Marketing**	**Periods:09**
Emerging trends in Marketing - Customer Relationship Management: Definition, features, Types and importance - Experiential Marketing: Meaning, strategies and benefits - Mobile Marketing: Definition and types of mobile marketing - Digital Marketing: Meaning, types of digital marketing – Inbound marketing: Meaning, fundamentals and difference between inbound and outbound marketing - Marketing Analytics: Meaning, importance, metrices of marketing analytics – An overview of Sustainable Marketing		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Keller, Philip, Kevin Lane Kotler, "Marketing Management", Pearson Education Limited, 16th Edition, 2022.
2. Ramaswamy V. S., Namakumari.S, "Marketing Management", Sage Publications India Pvt Ltd, 6th Edition, 2018.

Reference Books

1. Prachi Gupta, Ashita Aggarwal, et al., "Marketing Management: Indian Cases", Pearson Education Limited, 2024.
2. Arunkumar, N. Meenakshi, "Marketing Management", Vikas Publishing House, 3rd Edition, 2016.
3. Rajan Saxena, "Marketing Management", McGraw Hill Publications, 5th Edition, 2017.

Dr. P. Jamuna

Web References

1. https://www.ama.org/
2. https://www.marketingprofs.com/
3. https://indianjournalofmarketing.com/
4. http://www.publishingindia.com/ijamm/
5. https://onlinecourses.swayam2.ac.in/imb20_mg36/preview

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	-	-	-	2	1	1	-	2	1	1	2	2	2
2	1	2	1	-	1	2	1	2	-	2	1	1	2	2	2
3	1	2	3	-	1	2	1	2	-	2	1	1	2	2	2
4	1	1	3	-	2	1	2	1	1	2	2	1	2	2	2
5	1	3	2	2	2	3	2	2	1	2	2	3	2	2	2

Correlation Level: 1 - Low, 2 - Medium, 3 - High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT1	CAT2	ModelExam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

* Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Dr. P. Jamuna

Department	EEE	Programme: B.Tech.						
Semester	VI	Course Category: **OE**			End Semester Exam Type: **TE***			
Course Code	U23EEOC01	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	SOLAR PHOTOVOLTAIC FUNDAMENTAL AND APPLICATIONS	3	0	0	3	25	75	100

ECE, ICE, MECH, CIVIL, MCTR, CCE, BME, IT, CSE, FT, AI&DS, CSBS

Prerequisite	Physical Science for Engineers, Electrical Engineering	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the basic concepts of solar cells and its properties.	**K2**
	CO2 Discuss about the selection of interfacing components in solar grid connected systems.	**K2**
	CO3 Review about the various DC/AC equipment's used for stand-alone PV applications through requirements and design calculations.	**K2**
	CO4 Analyze the applications of hybrid systems and define the structure of micro grid system.	**K3**
	CO5 Compute cost analysis of solar PV systems.	**K3**

UNIT – I	**Photovoltaic basics and Developing Technologies**	**Periods:09**
Solar Cells: Structure and working - Types, Electrical properties - Cell properties and design - PV cell interconnection and Module fabrication - PV Modules and arrays. Commercial technologies: Mono crystalline and Multi crystalline, Silicon – Wafer based Solar cell, Thin film solar cells: A–Si, Cd–Te and CIGS, Concentrated PV cells, Developing technologies: Organic cells, Dye sensitized cells – Photovoltaic in global and Indian scenario		**CO1**
UNIT – II	**Solar PV for On-Grid Applications**	**Periods:09**
Solar cells to solar array – On–Grid PV system – With and Without storage – Balance of system – DC–DC converters – Inverters – Net Metering – Design and analysis – Performance evaluation and monitoring.		**CO2**
UNIT – III	**Solar PV for Off-Grid Applications**	**Periods:09**
Off-Grid standalone PV system – System sizing – Module and Battery – Storage – Batteries for PV systems – Sun Tracking mechanism – Types of tracking – One–axis, Two–axis – Maximum power point tracking – Design and analysis – Performance evaluation and monitoring.		**CO3**
UNIT – IV	**Hybrid Systems**	**Periods:09**
Solar, Biomass, Wind and Diesel Hybrid systems - Comparison and selection criteria - simple hybrid systems – storage arrangements - Introduction to Micro grid – Comparison of micro grid with conventional power system – Architecture.		**CO4**
UNIT – V	**Cost Benefit Analysis for Solar PV Installations**	**Periods:09**
Cost and manufacturability – Manufacturing economics – Scaling – Pricing – Trends in retail pricing – Energy economics – Grid tied power plant – Solar street lighting system - Simple payback calculation.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. C.S. Solanki, "Solar Photovotaics – Fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd., 2nd Edition, 2011.
2. Martin A. Green, "Solar Cells Operating Principles, Technology, and System Applications", Prentice - Hall, 1st Edition, 2008.

Reference Books

1. J. Nelson, "The Physics of Solar Cells", Imperial College Press, 1st Edition, 2003.
2. Thomas Markvart, "Solar Electricity", John Wiley and Sons, 2nd Edition, 2000.
3. Stuart R. Wenham, Martin A. Green, Muriel E. Watt, Richard Corkish, "Applied Photovoltaics", Earth scan, 3rd Edition, 2011.
4. Michael Boxwell, "The Solar Electricity Handbook", Green stream Publishing, 10th Edition, 2016.
5. RikDe Gunther, "Solar Power-Your Home for Dummies", Wiley Publishing Inc, 2nd Edition, 2010.

Web References

1. https://swayam.gov.in/nd1_noc20_ph21/preview
2. https://swayam.gov.in/nd2_nou20_ag13/preview
3. https://www.studentenergy.org/topics/solar-pv
4. https://www.eia.gov/energyexplained/solar/photovoltaics-and-electricity.php
5. https://www.energysage.com/solar/
6. https://www.bca.gov.sg/publications/others/handbook_for_solar_pv_systems.pdf
7. http://www.oas.org/dsd/publications/unit/oea79e/ch05.htm

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2
2	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2
3	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2
4	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2
5	3	3	2	2	2	-	-	-	-	-	-	1	3	3	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**EEE**	Programme: B.Tech.						
Semester	**IV / VI**	Course Category: **PE / OE**			End Semester Exam Type: **TE***			
Course Code	**U23EEDC01**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL SAFETY ENGINEERING**	**3**	**0**	**0**	**3**	**25**	**75**	**100**

EEE, ECE, ICE, MECH, CIVIL, MCTR, CCE, BME, IT, CSE, FT, AI&DS, CSBS

Prerequisite	Physical Science for Engineers, Basics of Electrical and Electronics Engineering	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Describe the Indian Electricity (IE) acts and various rules for electrical safety.	**K2**
	CO2 Interpret safety measures to prevent electrical shock in handling of domestic electrical appliances.	**K2**
	CO3 Demonstrate the safety aspects during installation of plant and equipment.	**K3**
	CO4 Explain the various hazardous area and application of electrical safety in various places.	**K2**
	CO5 Summarize the importance of electrical safety training to improve quality management in electrical systems.	**K2**

UNIT – I	**Concepts and Statutory Requirements**	**Periods:09**
Objective and scope of electrical safety - National electrical Safety code -Statutory requirements – Safety electrical one line diagram - General requirements for electrical safety as per IE rules -International standards on electrical safety -Safe limits of current and voltage - Grounding of electrical equipment of low voltage and high voltage systems - Safety policy - Electrical safety certificate requirement.		**CO1**
UNIT – II	**Electrical Shocks and their Prevention**	**Periods:09**
Primary and secondary electrical shocks - Possibilities of getting electrical shock and its severity - Effect of electrical shock of human being - Firing shock - Prevention of shocks - Safe guards for operators - Do's and Don'ts for safety in the use of domestic electrical appliances - Lightning Strokes on Overhead Transmission Lines and Outdoor Substations - Safety Precautions in Small LV Installations in Residential Buildings, Shops, Multi storied building - purpose of system grounding - grounding electrode system- grounding conductor connection to electrodes.		**CO2**
UNIT – III	**Safety During Installation, Testing and Commissioning, Operation and Maintenance**	**Periods:09**
Need for inspection and maintenance - Preliminary preparations - Field quality and safety - Personal protective equipment - Risks during installation of electrical plant and equipment - Effect of lightning current on installation and buildings - Safety aspects during installation -Safety during installation of electrical rotating machines - Importance of earthing in installation.		**CO3**
UNIT – IV	**Hazardous Zone**	**Periods:09**
Primary and secondary hazards - Hazardous area classification and of electrical equipments (IS, NFPA, API and OSHA standards) - Explosive gas area classifications: Class I (Division 1) - Zone 0, Zone 1, zone 2 classified locations, Design Philosophy for Equipment and installations - Classification of equipment enclosure for various hazardous gases and vapors - flash hazard calculation and approach distances- flash and thermal protection, head and eye protection - rubber insulating equipment.		**CO4**
UNIT – V	**Safety Management of Electrical Systems**	**Periods:09**
Principles of Safety Management - Occupational safety and health administration standards - Safety organization - Safety auditing - Employee electrical safety teams - Electrical safety training to improve Quality management - Total quality control and management – Importance of high load factor - Causes of low power factor - Disadvantages of low power factor - Power factor improvement - Importance of P.F. improvement - Case studies of electrical workplace safety practices.		**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. John Cadick, Mary Capelli Schellpfeffer, Dennis Neitzel, AlWinfield, "Electrical Safety Handbook", McGraw-Hill Education, 4th Edition, 2012.
2. Madden, M. John, "Electrical Safety and the Law: A Guide to Compliance", Wiley publications, 4th Edition, 2002.
3. Mohamed A. El-Sharkawi, "Electric Safety: Practice and Standards", CRC Press, 1st Edition, 2013.

Reference Books

1. Rob Zachariason, “Electrical Safety”, Delmar Cengage Learning, 1st Edition, 2011.
2. Peter E. Sutherland, “Principles of Electrical Safety”, Wiley- IEEE Press, 1st Edition, 2014.

Web References

1. https://www.apeasternpower.com/downloads/elecact2003.pdf
2. https://safetyculture.com/topics/electrical-hazards/
3. https://www.jove.com/science-education/10114/electrical-safety-precautions-and-basic-equipment
4. https://electrical-engineering-portal.com/21-safety-rules-for-working-with-electrical-equipment
5. https://www.electrical4u.com/safety-precautions-for-electrical-system/

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
2	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
3	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
4	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3
5	3	3	3	3	2	-	-	-	-	-	-	1	3	3	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**EEE**		Programme: **B.Tech.**					
Semester	**VII**		Course Category Code: **OE**		*End Semester Exam Type: **TE***			
Course Code	**U23EEOC02**		Periods/Week			Credit	Maximum Marks	
			L	T	P	C	CAM	ESE	TM
Course Name	**ENERGY CONSERVATION AND MANAGEMENT**		**3**	**0**	**0**	**3**	**25**	**75**	**100**
ECE, ICE, MECH, CIVIL, CCE, BME, IT, CSE, AI&DS, MECHATRONICS									
Prerequisite	Basics of Electrical								
Course Outcome	**On completion of the course, the students will be able to**						BT Mapping (Highest Level)		
	CO1	Describe the energy conservation and policies					**K2**		
	CO2	Apply the energy efficient methods for improving efficiency of electric motors					**K3**		
	CO3	Demonstrate good illumination systems and analyze the power factor					**K3**		
	CO4	Illustrate various meters used for energy management					**K4**		
	CO5	Select the strategies for promoting sustainable energy development.					**K4**		

UNIT- I	**ENERGY FUNDAMENTALS AND MANAGEMENT PRINCIPLES**	**Periods:09**
Basics on energy- Energy conservation importance and energy strategy for future – General aspects of energy management and energy scenario, energy conservation act and related policies, energy management, material and energy balance, energy action planning, financial management, energy monitoring and targeting		**CO1**
UNIT- II	**ENERGY EFFICIENCY IN ELECTRICAL UTILITIES**	**Periods:09**
Energy management for electric motors – Transformer and reactors - Capacitors and synchronous machines, energy management by cogeneration – Forms of cogeneration – Feasibility of cogeneration – Electrical interconnection.		**CO2**
UNIT- III	**LIGHTING SYSTEMS**	**Periods:09**
. Energy management in lighting systems – Task and the working space - Light sources – Ballasts – Lighting controls – Optimizing lighting energy – Power factor and effect of harmonics, lighting and energy standards		**CO3**
UNIT- IV	**METERING FOR ENERGY MANAGEMENT**	**Periods:09**
Metering for energy management – Units of measure - Utility meters – Demand meters – Paralleling of current transformers – Instrument transformer burdens – Multi tasking solid state meters, metering location vs requirements, metering techniques and practical examples		**CO4**
UNIT- V	**SUSTAINABLE ENERGY DEVELOPMENT**	**Periods:09**
. Energy, Environment and Climate change Energy and environment, air pollution, climate change United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), CDM		**CO5**

Lecture Periods:45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods:45**

Text Books

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, “Guide to Energy Management”, The Fairmont Press, Inc., 5th Edition, 2006.
2. Frank Kreith, D. Yogi Goswami, “Energy Management and Conservation Handbook”, CRC Press, 2nd Edition, 2016.
3. Wayne C. Turner, “Energy Management Handbook”, The Fairmont Press, 4th Edition, 2001.

Reference Books

1. P. Venkataseshaiah K.V. Sharma, “Energy Management and Conservation”, Dreamtech Press, 1st Edition, 2020.
2. Amit K. Tyagi, “Handbook on Energy Audits and Management”, TERI, 1st Edition, 2003.
3. Yogi Goswami and Frank Kreith, “Sustainable Energy Development”, CRC Press, 1st Edition, 2017

Web References

1. https://nptel.ac.in/courses/108/106/108106022/
2. https://www.youtube.com/watch?v=onIhwmbL8CA
3. https://www.youtube.com/watch?v=CTt4y8bokWs
4. https://ieeexplore.ieee.org/document/7977655
5. https://ieeexplore.ieee.org/document/993185
6. https://ieeexplore.ieee.org/document/6450335

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	2	3	-	-	-	-	-	-	-	-	1	1	1	1
2	3	2	3	-	-	-	-	-	-	-	-	1	3	2	3
3	3	2	3	-	-	-	-	-	-	-	-	1	3	2	3
4	3	2	2	-	-	-	-	-	-	-	-	1	2	1	2
5	2	2	3	-	-	-	-	-	-	-	-	1	2	2	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

Department	**EEE**	Programme: **B.Tech**						
Semester	**VII**	Course Category: **PC / OE**			End Semester Exam Type:**TE***			
Course Code	**U23EEDC02**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRIC AND HYBRID VEHICLES**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
EEE, ECE, ICE, MECH, CCE, BME, AI&DS, MECHATRONICS								
Prerequisite	Physical Science for Engineers, Power Electronics, Electrical Machines – II							

Course Outcomes			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Explain the fundamentals of electric vehicles, including their history, social and environmental impact, forces acting on a vehicle, and performance characteristics	**K2**
	CO2	Describe different hybrid vehicle configurations, analyze the working principles of series and parallel hybrid electric drive trains, and compare their advantages and disadvantages.	**K2**
	CO3	Evaluate various electric propulsion systems, including DC motors, BLDC motors, and SRM motor controllers, along with control techniques and autonomous EV technologies.	**K3**
	CO4	Explore energy storage technologies, including battery types, characteristics, and applications in EVs.	**K2**
	CO5	Explain battery management systems (BMS) and EV charging technologies, including state-of-charge determination, charging methods, and the need for inductive charging.	**K2**

UNIT – I	**Introduction To Electric Vehicle**	**Periods: 09**	
History of electric vehicles - social and environmental importance. Longitudinal vehicle model-Forces acting on a vehicle – Aerodynamic, rolling and gradient resistance. Maximum tractive effort and powertrain tractive effort. Vehicle performance- maximum speed of the vehicle- gradeability -acceleration. Braking performance. Vehicle power plant and transmission characteristics.			**CO1**
UNIT – II	**Hybrid Vehicle**	**Periods: 09**	
EV configuration -Performance of EVs -Hybrid Electric Drive Trains-Concept -Classification –Series Hybrid Electric Drive Trains (Electrical Coupling)-Advantages and disadvantages. Parallel Hybrid Electric Drive Trains (Mechanical Coupling)- Torque Coupling-Speed Coupling- Advantages and disadvantages.			**CO2**
UNIT – III	**Electric Vehicle Drive Systems**	**Periods: 09**	
Electric propulsion systems: BLDC motor-torque control and FOC method. SRM motor and PMSM controller - Block diagram. Dynamometer setup for traction motor testing. Electric Bicycle Propulsion System. Autonomous EV vehicle.			**CO3**
UNIT – IV	**Electric Vehicle Storage Technology**	**Periods: 09**	
Energy Density and Specific Energy-Power Density and Specific Power -Cycle Life -Operating Temperature - Safety. Electrochemical Cells -Lead Acid -Nickel Metal Hydride -Lithium Ion -Sodium Nickel Chloride. Characteristic Terminology and Performance Parameters. Modeling-Electrochemical Cell-Equivalent Circuit Model- Packs and Management Systems-Design Considerations-Cell balancing			**CO4**
UNIT – V	**Battery Management Systems & EV Charging**	**Periods: 09**	
Introduction to BMS, Objectives of the BMS: Discharging control, Charging control, State-of-Charge Determination, State-of-Health Determination, Cell Balancing. Building Blocks of EV charging station- Types of battery chargers – Slow, rapid and DC fast chargers - Charging technologies- Conductive charging - Need for inductive charging of EV - Inductive charging.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles”, CRC Press, 3rd Edition, 2019.
2. Ali Emadi, ‘Advanced Electric Drive Vehicles’, CRC Press-Taylor & Francis Group, 2015
3. Iqbal Hussain, “Electric and Hybrid Vehicles – Design Fundamentals”, CRC Press, 2nd Edition, 2011.

Reference Books

1. K. T. Chau, “Electric vehicle machines and drives: Design, analysis and application”, John Willey and Sons PTE Ltd., 1st Edition, 2015.
2. J. Larminie and J. Lowry, “Electric vehicle technology explained”, John Willey & Son PTE Ltd., 2ndEdition, 2012.

Web References

1. https://nptel.ac.in/courses/108103009/
2. https://www.evgo.com/why-evs/types-of-electric-vehicles/
3. https://e-amrit.niti.gov.in/types-of-electric-vehicles
4. https://afdc.energy.gov/vehicles/how-do-all-electric-cars-work
5. https://www.bosch-mobility.com/en/solutions/powertrain/battery-electric/electric-drive/
6. https://e-vehicleinfo.com/different-types-of-energy-storage-systems-in-electric-vehicles/

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	-	-	3	3	-	-	-	-	3	3	2	3
2	3	3	3	2	-	3	3	-	-	-	-	3	3	2	3
3	3	3	3	2	-	3	3	-	-	-	-	3	3	2	3
4	3	3	3	1	-	3	3	-	-	-	-	3	3	2	3
5	2	3	3	2	-	3	3	-	-	-	-	3	3	2	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM)					End Semester Examination (ESE) Marks	Total Marks
	CAT 1	CAT 2	Model Exam	Assignment*	Attendance		
Marks	5	5	5	5	5	75	100

***** Application oriented / Problem solving / Design / Analytical in content beyond the syllabus

SRI MANAKULA VINAYAGAR
ENGINEERING COLLEGE
(An Autonomous Institution)

Puducherry

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.TECH. HONOURS / MINOR PROGRAMME

ELECTRIC VEHICLES

ACADEMIC REGULATIONS 2023
(R-2023)

CURRICULUM AND SYLLABI

B. Tech Honours / Minor Programme - ELECTRIC VEHICLES

CURRICULUM

COURSE DETAILS												
Sl. No.	Semester	Course Code	Course Title	Course Type**	Category	Periods			Credits	Max. Marks		
						L	T	P		CAM	ESM	Total
1	IV	U23VXT401	Electrical Vehicles: Design, Dynamics and Testing	T	PC / IC	3	-	-	3	25	75	100
2	V	U23VXT502	Energy Storage and Battery Management System	T	PC / IC	3	-	-	3	25	75	100
3	VI	U23VXB603	Electric Drives and Controls	B	PC / IC	3	-	2	4	50	50	100
4	VII	U23VXB704	Modelling and Simulation of EHV	B	PC / IC	3	-	2	4	50	50	100
5	VIII	U23VXT805	Autonomous and Connected Vehicles	T	PC / IC	3	-	-	3	25	75	100
6	VIII	U23VXW806	Project Work	PA	PC / IC	-	-	4	2	50	50	100
Total									**19**	**225**	**375**	**600**
Equivalent NPTEL courses##												
1	IV	U23VXT401	Electrical Vehicles: Design, Dynamics and Testing	Vehicle Dynamics and Electric Motor Drives					3	**12 WEEKS COURSE**		
2	IV			Vehicles and Renewable Energy					3			
3	V	U23VXT502	Energy Storage and Battery Management System	Electrochemical Energy Storage					3			

The student shall be given an option to earn 3 credits through one 12-week NPTEL course (Equivalent) instead of any one theory course listed for Honour / Minor degree programme and shall be completed before the commencement of eighth semester. The equivalent courses are subject to change based on its availability as per NPTEL course list.

** T – Theory, B – Theory cum Practical, PA – Project Work

Dr. P. Tamuna

Department	**EEE**	Programme: **B.Tech Honours / Minor – Electric Vehicles**						
Semester	**IV**	Course Category Code: **PC/ IC**			End Semester Exam Type: **TE***			
Course Code	**U23VXT401**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRICAL VEHICLES: DESIGN, DYNAMICS AND TESTING**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

Common to ALL Branches

Prerequisite	Engineering Mechanics		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Summarize the basic functions of both Electric and Hybrid vehicles and their performance.	**K2**
	CO2	Illustrate the automobile configurations, packaging, structural systems, aerodynamics and power demand, etc.,	**K3**
	CO3	Predict the vehicle resistance and proficiently optimize the powertrain performance for FWD, RWD, and multi-wheel drive systems.	**K3**
	CO4	Examine the vehicle testing, homologation, and standards compliance for safe automotive engineering.	**K3**
	CO5	Demonstrate the requirement of vehicular safety systems and road regulations	**K3**

UNIT- I	**Introduction**	**Periods: 9**	
History - Components of Electric Vehicle (EV)- General Layout of EV- EV classification- Comparison with Internal combustion Engine- Technology- Advantages and Disadvantages of EV. Hybrid vehicle – advantages- disadvantages- Architecture and energy flow– series, parallel, series-parallel- Drive train for hybrid and electric vehicles-Hybrid vehicle operating modes.			**CO1**
UNIT- II	**Vehicle Dynamics**	**Periods: 9**	
General Configuration of Automobile- Body and Chassis Fundamentals- General Packaging- Types of Structural System- Backbone Construction- Body and Chassis Materials. Automotive Aero-dynamics- Vehicle Power Demand Analysis- Types of suspension and drive- Tyre Mechanics-Tyres and wheels- Tyre characteristics- Vehicle handling and stability- Automotive instrumentation			**CO2**
UNIT- III	**Vehicle Design**	**Periods: 9**	
Vehicle resistance- **Types:** Rolling Resistance- grading resistance. Aerodynamic drag-vehicle performance- Calculation of Acceleration Force- maximum speed- Total Tractive Effort-Torque Required on drive Wheel- Transmission- Differential- clutch and gearbox- Braking performance. Front-Wheel Drive (FWD) Powertrains- Rear-Wheel Drive Powertrains (RWD)- Multi-Wheel Drive Powertrains (AWD and 4WD)			**CO3**
UNIT- IV	**Vehicle Testing and Homologation**	**Periods: 9**	
Need of vehicle testing and homologation- testing organizations- testing standards (AIS)- Hierarchy of testing- Individual component approval/testing- System level approval and Whole vehicle approval/testing- Conformity of production tests- Crash test- side impact test- rollover test- Impact test- Track testing			**CO4**
UNIT- V	**Vehicular Safety and Government norms**	**Periods: 9**	
Road and Automotive Safety Systems- Active and passive safety- Safety Regulations for vehicular application- occupant protection- Traffic signs- traffic rules- Government Norms- Regulations and Policies- penalties and procedures.			**CO5**

Lecture Periods:45	**Tutorial Periods:-**	**Practical Periods:-**	**Total Periods: 45**

Text Books:

1. Mehrdad Ehsani, Yimin Gao, Stefano Longo, Kambiz Ebrahimi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles”, CRC Press, 2018.
2. David C Barton, John D Fieldhouse, “Automotive Chassis Engineering”, Springer International Publishing, 2018.

Reference Books:

1. Thomas Gillespie, “Fundamentals of Vehicle Dynamics”, SAE International, April 2021.
2. Ulrich Seiffert, Lothar, Wech, “Automotive Safety Handbook, SAE International, 2007.

Web Reference:

1. https://www.nhtsa.gov/
2. https://www.ais.gov.in/
3. https://www.opal-rt.com/automotive-overview/

*** TE – Theory Exam, LE – Lab Exam**

Dr. P. Jamuna

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	2	1	2	1	-	-	-	-	1	3	3	2
2	3	2	3	2	1	2	1	-	-	-	-	1	3	3	2
3	3	2	3	2	1	2	1	-	-	-	-	1	3	3	2
4	3	2	3	2	1	2	1	-	-	-	-	1	3	3	2
5	3	2	3	2	1	2	1	-	-	-	-	1	3	3	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

	Continuous Assessment Marks (CAM)					End Semester Examination##	Total Marks (CAM+ESM)
	CAT 1	CAT 2	Model##	Assignment#	Attendance##		
Portion for Test	2 Units	2 Units	All 5 Units			All 5 Units	
Assessment Methodology	MCQ Test	MCQ Test	Written Exam	Individual Task #		Written Exam	
	50 Questions for Analytical Course 75 Questions for Theory Course						
Duration of the Test	1 hour 30 Minutes	1 hour 30 Minutes	3 hours			3 hours	
Test Marks	50	50	75	20	5	75	
Weightage for CAM	5	5	5	5	5		
CAM / ESE Marks	**CAM Marks = 25**					**ESE Marks = 75**	**100**

Open Book Analytical Exam/Analyse Real world problems and propose solutions/ Tool or Subject Proficiency Analysis – Test the Students skill by giving individual task/ Paper Presentation/Micro Project Presentation/Idea Presentation for the Societal Problem;(Questions standard shall be of level 3 or more in Blooms Taxonomy)

Distribution of Marks for Attendance, the Question Paper Pattern for Model and ESE are same as given in B. Tech. Regulations R2023 for Theory Courses.

Dr. P. Tamuna

Department	**EEE**	Programme: **B.Tech Honour / Minor – Electric Vehicles**						
Semester	**V**	Course Category: **PC /IC**			End Semester Exam Type: **TE***			
Course Code	**U23VXT502**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ENERGY STORAGE AND BATTERY MANAGEMENT SYSTEM**	**3**	**-**	**-**	**3**	**25**	**75**	**100**

Common to ALL Branches

Prerequisite	Physics, Electrical machines		
Course Outcomes	**On completion of the course, the students will be able to**		BT Mapping (Highest Level)
	CO1	Explain electrical parameters of energy storage systems, including energy capacity, voltage, power, efficiency, and lifecycle characteristics.	**K2**
	CO2	Compare and evaluate battery chemistries, fuel cells, ultra-capacitors, and flywheel storage, assessing their applications, advantages, and limitations in EVs.	**K2**
	CO3	Analyze the Battery Management System (BMS) for monitoring, protection, thermal management, and balancing, ensuring safe and efficient battery operation.	**K3**
	CO4	Explain the different levels of EV charging (Level 1, Level 2, Level 3) and the technology behind fast charging, comparing their advantages and charging speeds.	**K3**
	CO5	Explain charging technologies and systems such as conventional grid charging, smart grids (V to X, X to V), microgrids, and charging with PV systems, highlighting their roles in EV charging infrastructure.	**K3**

UNIT – I	**Battery Parameters**	**Periods: 9**	
Electrical parameter: Energy Capacity (E)- Nominal Voltage- Operating Voltage- Power Output (P)- C-Rate- Charge/Discharge Efficiency- Self-Discharge Rate- Internal Resistance. **Energy & Power Density**- Energy Density- Specific Energy- Specific Power. **Charging & Discharging Parameters-** Fast Charging Rate- Charge Cut-Off Voltage- Discharge Cut-Off Voltage- Charge Time**. Lifecycle & Aging Parameters-** Cycle Life- Depth of Discharge (DoD)- State of Charge (SoC)- State of Health (SoH).**Thermal & Safety Parameters-** Operating Temperature Range- Thermal Runaway Temperature.			**CO1**
UNIT – II	**Energy Storage Technologies to EV**	**Periods: 9**	
Lithium-Ion (Li-Ion) Battery Technology and Working Principles- Lithium Cobalt Oxide (LCO)- Lithium Iron Phosphate (LFP)- Lithium Nickel- Manganese Cobalt (NMC)- Lithium Nickel Cobalt Aluminum (NCA)- Lithium Titanate (LTO)- Advantages of Li-Ion Batteries**-** Challenges & Limitations**-**Comparison. Battery cell formats- Cylindrical Cells-Prismatic Cells-Pouch Cells **Fuel Cell Fundamentals** & its Types. Hydrogen Fuel Cell- Key Components- Advantage-**Challenges & Limitations-** Hydrogen fuel cell vs Battery Electric Vehicles. **Alternative Energy Storage Technologies**- Solid-State Batteries- Sodium-Ion Batteries**.** Introduction to Ultra-Capacitor Technologies and Flywheel Energy Storage.			**CO2**
UNIT – III	**Battery Management System**	**Periods: 9**	
Battery Management System (BMS) & Importance: Cell Monitoring- State of Charge (SoC) Calculation- State of Health (SoH) Calculation- Thermal Management- Overcharge/Discharge Protection- Balancing Cells **-** Fault Detection & Safety**. BMS Types -** Centralized BMS- Distributed BMS- Modular BMS-Advantages & Disadvantages.			**CO3**
UNIT – IV	**EV Charging Systems and Technologies**	**Periods: 9**	
EV Charging - EV Charging level 1-level 2-level 3- Fast Charging. **Battery Chargers and Charging Technologies**-Basic Charger Circuits-Microprocessor-Based Charger Circuits-Charge Equalization. **Conductive Charging Systems**-Principles of Conductive Charging-Standard Power Levels of Conductive Chargers-Arrangement of an Off-Board Conductive Charger. **Inductive Charging Systems**-Principle of Inductive Charging-Soft-Switching Power Converter for Inductive Charging. **Battery Indication and Monitoring Methods.**			**CO4**
UNIT – V	**EV Charging and Power Management Systems**	**Periods: 9**	
Charging Technologies and Systems: Conventional Grid Charging-Smart Grid (V to X, X to V)-Microgrid-Charging with PV Systems-Fast/Rapid Charging. **Challenges and Solutions in EV Charging:** Challenges in EV Charging Infrastructure-Solutions to Charging Challenges. **Advanced Charging Systems Management:** Hybridization-Battery Swapping-Advanced Charging Systems Management. **Case Studies in EV Charging-** Case Studies on Charging Solutions and Systems.			**CO5**

Lecture Periods: 45	**Tutorial Periods: -**	**Practical Periods: -**	**Total Periods: 45**

Dr. P. Jamuna

Text Books

1. Alfred Rufer, “Energy Storage Systems and Components” , CRC Press, 2018.
2. Ibrahim Dinçer, Halil S. Hamut and Nader Javani, “Thermal Management of Electric Vehicle Battery Systems”, John Wiley& Sons Ltd., 2016.

Reference Books

1. James Larminie, John Lowry, “Electric Vehicle Technology Explained”, John Wiley & Sons Ltd, 2012.
2. NITI Aayog, Handbook of Electric Vehicle Charging Infrastructure Implementation, Version 1, 2021.
3. T R Crompton, “Battery”, Newnes- Reed Educational and Professional Publishing Ltd. 3rd Edition, 2000.
4. F. Beguin and E. Frackowiak, “Super capacitors- materials, Systems and Applications”, Wiley-VCH & Company, 2013.
5. V.Hacker, S. Mitsushima, “Fuel Cells and Hydrogens: From Fundamentals to applied Research”, Elsevier, 2018.
6. Fraunhofer IEE, IIT Bombay, DTU, and IIT Comillas, A Critical Review: Smart Charging Strategies and Technologies for Electric Vehicles, NDC-TIA, Nov. 2021.
7. D. Kettles, Electric Vehicle Charging Technology Analysis and Standards, Florida Solar Energy Center, Feb. 2015

Web References

1. https://archive.nptel.ac.in/courses/108/103/108103009/
2. https://www.nhtsa.gov/
3. https://www.ais.gov.in/
4. https://www.opal-rt.com/automotive-overview/
5. https://apem-journal.org/Archives/2019/APEM14-1_065-079.pdf
6. https://ouci.dntb.gov.ua/works/4rrWg5X4/
7. https://www.beny.com/challenges-and-solutions-in-electric-vehicle-charging-infrastructure-development/

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	2	-	2	1	-	-	-	-	1	3	3	2
2	3	2	3	2	-	2	1	-	-	-	-	1	3	3	2
3	3	2	3	2	-	2	1	-	-	-	-	1	3	3	2
4	3	2	3	2	-	2	1	-	-	-	-	1	3	3	2
5	3	2	3	2	-	2	1	-	-	-	-	1	3	3	2

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

	Continuous Assessment Marks (CAM)					End Semester Examination##	Total Marks (CAM+ESM)
	CAT 1	CAT 2	Model##	Assignment#	Attendance##		
Portion for Test	2 Units	2 Units	All 5 Units			All 5 Units	
Assessment Methodology	MCQ Test 50 Questions for Analytical Course 75 Questions for Theory Course	MCQ Test	Written Exam	Individual Task #		Written Exam	
Duration of the Test	1 hour 30 Minutes	1 hour 30 Minutes	3 hours			3 hours	
Test Marks	50	50	75	20	5	75	
Weightage for CAM	5	5	5	5	5		
CAM / ESE Marks	CAM Marks = 25					ESE Marks = 75	100

Open Book Analytical Exam/Analyse Real world problems and propose solutions/ Tool or Subject Proficiency Analysis – Test the Students skill by giving individual task/ Paper Presentation/Micro Project Presentation/Idea Presentation for the Societal Problem;(Questions standard shall be of level 3 or more in Blooms Taxonomy)

Distribution of Marks for Attendance, the Question Paper Pattern for Model and ESE are same as given in B. Tech. Regulations R2023 for Theory Courses.

Dr. P. Jamuna

Department	EEE	Programme: **B.Tech Honours/ Minor – Electric Vehicles**						
Semester	VI	Course Category: **PC/IC**			End Semester Exam Type: **TE***			
Course Code	U23VXB603	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**ELECTRIC DRIVES AND CONTROLS**	**3**	**0**	**2**	**4**	**50**	**50**	**100**

Common to ALL Branches

Prerequisite	Electrical Machines	
Course Outcomes	**On completion of the course, the students will be able to**	BT Mapping (Highest Level)
	CO1 Comprehend the types, design, and sizing of electric vehicle motors, including their torque-speed characteristics and role in EV propulsion systems.	**K2**
	CO2 Analyze the operation and performance of DC and AC motor drives with speed control techniques.	**K2**
	CO3 Apply the various control techniques for PMSM and BLDC motor drives for the performance optimization.	**K3**
	CO4 Analyze and implement DC and AC motor control techniques for various Electric Vehicles.	**K4**
	CO5 Implement control techniques for PMSM, and BLDC motor drives, optimizing performance and minimizing torque ripple.	**K4**

UNIT – I	**Introduction to EV Drives**	**Periods:10**
Overview of EV Motors: Types of motors used in electric vehicles (EVs) and their classifications. **Traction Motors Design:** Design principles and sizing considerations for EV traction motors. **Torque-Speed Characteristics:** Analysis of constant-torque and constant-power modes in motor performance. Selection of Motor Power and converter Rating. **Motor Comparison for EVs:** Suitability analysis of motors for 2W, 3W, 4-wheelers, and large vehicles.		**CO1**
UNIT – II	**DC Drives and Induction Motor Drives**	**Periods:10**
DC Drives: Phase controlled DC-Drives: Operation with continuous and discontinuous modes; Chopper Controlled DC Drives, Multi-Quadrant Operation, harmonics control in chopper, speed control method, closed loop control scheme. **Induction Motor Drives:** Speed control techniques: Stator voltage control, Variable frequency control, V/f control, Static rotor resistance control and Slip power recovery control schemes, Slip compensation technique. Field-oriented control and direct torque control of induction motors for EVs.		**CO2**
UNIT – III	**BLDC and PMSM Drives**	**Periods:10**
BLDC Motor Drives: Principles of BLDC motor operation, inverter switching schemes for AC and DC, trapezoidal back EMF control, and design criteria for BLDC drives in EVs. **PMSM Drives:** Permanent Magnet Synchronous Motor (PMSM) construction, braking methods, field-oriented and flux-weakening control, and sensorless operation.		**CO3**
UNIT – IV	**Electric Drives Practice -I**	**Periods:15**
1. Demonstration of wiring layout of electric vehicle. 2. Speed control of DC drives using phase-controlled rectifier 3. Speed control of DC drives using chopper control. 4. Performance Analysis of Induction motor Drive. 5. V/f Control of PWM Inverter Based Three Phase Induction Motor 6. Simulation of Rotor Resistance Scheme in Wound-Rotor Induction Motor		**CO4**
UNIT – V	**Electric Drives Practice -II**	**Periods:15**
1. Speed control of FPGA based BLDC motor Drive 2. Simulation of PMSM speed control using the Field-Oriented Control method. 3. Sensorless Field Oriented Control for Permanent Magnet Synchronous Motor drive 4. Torques ripples reduction techniques in BLDC and PMSM motor drives. 5. Regenerative/ Dynamic breaking operation for AC motor using simulation software 6. Study of SRM motor drive fed by PWM inverter using simulation software.		**CO5**

Lecture Periods: 30	**Tutorial Periods: -**	**Practical Periods: 30**	**Total Periods: 60**

Text Books

3. KT. Chau, "Electric Vehicle Machines and Drives: Design, Analysis, and Application," Wiley-IEEE Press, 1st Edition, 2015.
4. John G. Hayes, G. Abas Goodarzi, "Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles," Wiley-Blackwell, 1st Edition, 2018.

Dr. P. Tamuna

Reference Books

1. C.G. Hochgraf, M.J. Ryan, and H.L. Wiegman, "Engine Control Strategy for a Series Hybrid Electric Vehicle," Warrendale, PA, 2nd Edition, 2002.
2. Seth Leitman, Bob Brant, "Build Your Own Electric Vehicle," McGraw-Hill, 3rd Edition, 2013.
3. C.C. Chan, K.T. Chau, "Modern Electric Vehicle Technology," Oxford University Press, 1st Edition, 2001.

Web References

8. https://archive.nptel.ac.in/courses/108/104/108104140/
9. https://onlinecourses.nptel.ac.in/noc24_ee30/preview
10. https://www.slideshare.net/slideshow/electric-drives-and-controls-unit-1-introduction/250009052
11. https://www.mygreatlearning.com/academy/learn-for-free/courses/introduction-to-inverters-and-electric-drive
12. https://onlinecourses.swayam2.ac.in/ntr24_ed16/preview

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	2	-	2	1	-	2	-	-	2	3	3	3
2	3	2	3	2	-	2	1	-	2	-	-	2	3	3	3
3	3	2	3	2	-	2	1	-	2	-	-	2	3	2	3
4	3	2	3	2	-	2	1	-	2	-	-	2	3	2	3
5	3	2	3	2	-	2	1	-	2	-	-	2	3	2	3

Correlation Level: 1 – Low, 2 – Medium, 3 – High

Evaluation Methods

Assessment	Continuous Assessment Marks (CAM) – Maximum 50 Marks										##End Semester Examination (ESE) (Theory)	Total Marks (CAM+ESE)
	Continuous Assessment (Theory)					Continuous Assessment (Practical)						
	CAT 1	CAT 2	Model##	Attendance##	Total	Conduction of Practical	Report	Viva	Total	End Semester Examination ESE) Marks (Practical)		
Portion for Test	1 ½ Units	1 ½ Units	All 3 Units								All 3 Units	
Assessment Methodology	MCQ Test	MCQ Test	Written Exam							Practical Exam	Written Exam	
	50 Questions for Analytical Course 75 Questions for Theory Course											
Duration of the Test	1 hour 30 Minutes	1 hour 30 Minutes	3 hours							3 hours	3 hours	
Marks	50	50	75	5		15	10	5	30*	30	75 *(To be weighted for* 50 Marks)	
Weightage of CAM	2.5	2.5	2.5	2.5	**10**	**To be weighted for 10 Marks*			**10**	**30**		
CAM / ESE Marks	***CAM Marks =10+10+30=50***										***ESE Marks = 50***	**100**

Distribution of Marks for Attendance, the Question Paper Pattern for Model and ESE are same as given in B.Tech. Regulations R2023 for Theory cum practical Courses

Dr. P. Jamuna

Department	**EEE**	Programme: **B.Tech Honour / Minor – Electric Vehicles**						
Semester	**VII**	Course Category Code: **PC/ IC**			End Semester Exam Type: **TE***			
Course Code	**U23VXB704**	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**MODELLING AND SIMULATION OF EHV**	**3**	**-**	**2**	**4**	**50**	**50**	**100**
Common to All Branches								
Prerequisite	Electrical Machines							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
CO1	Apply the concept of modeling for electric vehicle and predict the performance.	**K3**
CO2	Describe the drive train characteristics of electric vehicles	**K3**
CO3	Analysis the vehicle dynamic control and energy management techniques	**K3**
CO4	Design and simulate the Electric Vehicle Power train for the analysis	**K4**
CO5	Implement the battery management system for the battery pack	**K4**

UNIT - I	**Modeling of Electric Vehicles**	**Periods: 10**
Modeling Vehicle Acceleration - Acceleration performance parameters, modeling of acceleration of an electric scooter, modeling of acceleration of a small car. Electric Vehicle Modeling - Tractive Effort- Rolling resistance force- Aerodynamic drag- Hill climbing force- Acceleration force- Total tractive effort - Modeling Electric Vehicle Range - Driving cycles - Constant velocity range modeling - Range modeling of battery electric vehicles - fuel cell vehicles - hybrid electric vehicles		**CO1**
UNIT - II	**EV Drive Train Characteristics**	**Periods: 10**
Modeling and Characteristics of EV/HEV Power trains Components - ICE Performance Characteristics, Electric Motor Performance Characteristics - Battery Performance Characteristics - Transmission and Drive train Characteristics - Regenerative Braking Characteristics - Driving Cycles - Modeling and Analysis of Electric and Hybrid Electric Vehicles Propulsion and Braking - Longitudinal Dynamics Equation of Motion - Vehicle Propulsion Modeling and Analysis - Vehicle Braking Modeling and Analysis.		**CO2**
UNIT - III	**Vehicle Dynamic Control and Energy Management**	**Periods: 10**
Control of Electric and Hybrid Electric Vehicle Dynamics - Fundamentals of Vehicle Dynamic Control (VDC) Systems, VDC Implementation on Electric and Hybrid Vehicles – Case Studies, Rechargeable Battery Vehicles, Hybrid Vehicles, Fuel Cell Powered Vehicles. Handling Analysis of Electric and Hybrid Electric Vehicles - Simplified Handling Models Energy/Power Allocation and Management - Power/Energy Management Controllers – Rule Based Control Strategies – Optimization - Based Control Strategies.		**CO3**
UNIT - IV	**Modeling of EHV Practice -I**	**Periods: 15**
1. Determination of SoC, DoD, Cell Cycle for battery 2. Mathematical Modeling of lithium ion cell and design of battery pack / format. 3. Design and Development of Battery Pack for specified Rating 4. Electric Vehicle Power train Simulation using MATLAB/Simulink 5. Transmission and Drive train Simulation for EVs in MATLAB/Simulink 6. Rule-Based Power Management for Hybrid Electric Vehicles in Simulink		**CO4**
UNIT - V	**Modeling of EHV Practice -II**	**Periods: 15**
1. Implementation of Wiring Diagram for a 36V, 10S Battery Management System (BMS) 2. Implementation of Wiring Diagram and Testing of Smart BMS for a 48V, 15S battery pack 3. Battery Management System using battery pack equalizer through active balancer with Bluetooth monitoring 4. Microcontroller- Programmable Battery Management System 5. Design and Implementation of Conductive Charging Setup 6. Simulation of Vehicle Dynamic Control for Hybrid and Battery Electric Vehicles		**CO5**

Lecture Periods: 30	**Tutorial Periods:-**	**Practical Periods: 30**	**Total Periods: 60**

Text Books

1. James Larminie, John Lowry, "Electric Vehicle Technology Explained", John Wiley & Sons Ltd., 2nd Edition, 2012.
2. Amir Khajepour, Saber Fallah and AvestaGoodarzi, "Electric and Hybrid Vehicles -Technologies, Modelling and Control: A Mechatronic Approach", John Wiley & Sons Ltd, 1st Edition, 2014.

Reference Books

Dr. P. Jamuna

1. Antoni Szumanowski, “Hybrid Electric Power Train Engineering and Technology: Modelling, Control, and Simulation”, Idea Group, 1st Edition, 2013.
2. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles - Fundamentals, Theory, and Design, CRC Press, 2nd Edition”, 2017.

Web References

1. https://archive.nptel.ac.in/content/syllabus_pdf/108103009.pdf
2. https://www.researchgate.net/publication/309548969_MODELING_AND_SIMULATION_OF_HYBRID_ELECTRIC_VEHICLES
3. https://www.sciencedirect.com/science/article/pii/S2405896322014446
4. https://www.academia.edu/1003352/A_Matlab_Based_Modeling_and_Simulation_Package_for_Electric_and_Hybrid_Electric_Vehicle_Design
5. https://www.academia.edu/90442341/Modeling_and_Simulation_of_Hybrid_Electric_Vehicle_Power_Systems?uc-sb-sw=17290990

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	3	2	2	-	2	2	-	2	3	3	3
2	3	3	3	3	3	2	2	-	2	2	-	2	3	3	3
3	3	3	3	3	3	2	2	-	2	2	-	2	3	3	3
4	3	3	3	3	3	2	2	-	2	2	-	2	3	3	3
5	3	3	3	3	3	2	2	-	2	2	-	2	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

<table>
<tr><td rowspan="2">Assessment</td><td colspan="10">Continuous Assessment Marks (CAM) – Maximum 50 Marks</td><td>##End Semester Examination (ESE) (Theory)</td><td>Total Marks (CAM+ESE)</td></tr>
<tr><td colspan="5">Continuous Assessment (Theory)</td><td colspan="5">Continuous Assessment (Practical)</td><td></td><td></td></tr>
<tr><td></td><td>CAT 1</td><td>CAT 2</td><td>Model##</td><td>Attendance##</td><td>Total</td><td>Conduction of Practical</td><td>Report</td><td>Viva</td><td>Total</td><td>End Semester Examination ESE) Marks (Practical)</td><td></td><td></td></tr>
<tr><td>Portion for Test</td><td>1 ½ Units</td><td>1 ½ Units</td><td>All 3 Units</td><td rowspan="4"></td><td rowspan="4"></td><td colspan="4" rowspan="2"></td><td rowspan="2">Practical Exam</td><td>All 3 Units</td><td rowspan="5"></td></tr>
<tr><td rowspan="2">Assessment Methodology</td><td>MCQ Test</td><td>MCQ Test</td><td>Written Exam</td><td>Written Exam</td></tr>
<tr><td colspan="3">50 Questions for Analytical Course
75 Questions for Theory Course</td><td colspan="4"></td><td></td></tr>
<tr><td>Duration of the Test</td><td>1 hour 30 Minutes</td><td>1 hour 30 Minutes</td><td>3 hours</td><td colspan="4"></td><td>3 hours</td><td>3 hours</td></tr>
<tr><td>Marks</td><td>50</td><td>50</td><td>75</td><td>5</td><td>15</td><td>10</td><td>5</td><td>30*</td><td>30</td><td>75 (To be weighted for 50 Marks)</td></tr>
<tr><td>Weightage of CAM</td><td>2.5</td><td>2.5</td><td>2.5</td><td>2.5</td><td>10</td><td colspan="3">*To be weighted for 10 Marks</td><td>10</td><td>30</td><td></td></tr>
<tr><td>CAM / ESE Marks</td><td colspan="10">CAM Marks =10+10+30=50</td><td>ESE Marks = 50</td><td>100</td></tr>
</table>

Distribution of Marks for Attendance, the Question Paper Pattern for Model and ESE are same as given in B.Tech. Regulations R2023 for Theory cum practical Courses

Dr. P. Jamuna

Department	**EEE**	Programme: **B.Tech Honours / Minor – Electric Vehicles**						
Semester	**VIII**	Course Category: **PC/ IC**			End Semester Exam Type :**TE***			
Course Code	**U23VXT805**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**AUTONOMOUS AND CONNECTED VEHICLES**	**3**	**-**	**-**	**3**	**25**	**75**	**100**
Common to All Branches								
Prerequisite	Electrical Vehicles: Design, Dynamics and Testing							

Course Outcomes	On completion of the course, the students will be able to	BT Mapping (Highest Level)
	CO1 Summarize the advanced driver assistance systems for connected vehicle	**K2**
	CO2 Interpret the recent global navigation and Lidar technology for vehicle integration	**K2**
	CO3 Apply the Perception path, Deep Learning, planning for autonomous and connected vehicles	**K3**
	CO4 Demonstrate the hardware used in E-vehicle an computer architecture for Autonomous Driving	**K3**
	CO5 Illustrate the ECU evolution in architecture by software defined vehicles	**K3**

UNIT – I	**Autonomous System Architecture**	**Periods: 9**
Overview-Autonomous Driving Algorithms-Sensing- Perception- Object Recognition and Tracking- Action- Autonomous Driving Client System-Robot Operating System- Hardware Platform- Autonomous Driving Cloud Platform-HD Map Production, Deep Learning Model Training.		**CO1**
UNIT – II	**Autonomous Vehicle Integration**	**Periods: 9**
Localization with GNSS- GNSS Overview- GNSS Error Analysis- Satellite-based Augmentation Systems- Real-Time Kinematic and Differential GPS- Precise Point Positioning- GNSS INS Integration. Localization with LiDAR and High-Definition Maps- LiDAR Overview-High-Definition Maps Overview- Localization with LiDAR and HD Map- Visual Odometry- Stereo Visual Odometry- Monocular Visual Odometry- Visual Inertial Odometry- Dead Reckoning and Wheel Odometry- Wheel Encoders- Wheel Odometry Errors- Reduction of Wheel Odometry Errors		**CO2**
UNIT – III	**Perception and Deep Learning in Autonomous Driving Perception**	**Periods: 9**
Introduction- Datasets- Detection- Segmentation- Stereo- Optical Flow- Scene Flow- Tracking- Deep Learning in Autonomous Driving- Convolutional Neural Networks- Detection- Semantic Segmentation- Stereo and Optical Flow- Planning and Control Overview- Architecture-Traffic Prediction -Lane Level Routing		**CO3**
UNIT – IV	**Client Systems for Autonomous Driving**	**Periods: 9**
Hardware platform for autonomous driving- Operating system-ROS overview- system reliability- performance improvement- Resource Management And Security- Computing Platform- existing computing solution- computer architecture design exploration- Autonomous Driving on Mobile Processor- V2V-System Architecture-Safet application- V2I overview- BIM-V2P- System Architecture- Vehicle Warning Strategy		**CO4**
UNIT – V	**Cloud Platform for Autonomous Driving**	**Periods: 9**
Infrastructure-distributed computing framework-distributed storage-heterogeneous computing- Simulation-BINPIPERDD-connecting spark and ROS-performance- Model training-need of SPARK-Training platform architecture-HD map generation. Autonomous driving-Vehicle Onboard Architecture- ECU software architecture –AUTOSAR- COVESA		**CO5**

Lecture Periods: 45	**Tutorial Periods:-**	**Practical Periods: -**	**Total Periods: 45**

Text Books

1. Shaoshan Liu, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc Gaudiot, “Creating Autonomous Vehicle Systems”, Morgan & Claypool Publishers, 1st Edition, 2018
2. Radovan Miucic, “Connected Vehicles: Intelligent Transportation Systems”, Springer, 2018

Reference Books

1. Domokos Esztergár-Kiss, Pierluigi Coppola, “Autonomous Vehicles and Future Mobility”, Elsevier, 2019.
2. Mehrdad Ehsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles Fundamentals, Theory and Design”, CRC Press, 2nd Edition, 2017.

Dr. P. Jamuna

Web References

1. https://www.ibm.com/blogs/digitale-perspektive/2023/06/the-software-defined-vehicle/
2. https://www.sciencedirect.com/science/article/pii/S2405896322014446
3. https://www.ais.gov.in/
4. https://www.opal-rt.com/automotive-overview/

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3
2	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3
3	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3
4	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3
5	3	3	3	2	3	-	-	-	-	-	-	2	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

	Continuous Assessment Marks (CAM)					End Semester Examination##	Total Marks (CAM+ESM)
	CAT 1	CAT 2	Model##	Assignment#	Attendance##		
Portion for Test	2 Units	2 Units	All 5 Units			All 5 Units	
Assessment Methodology	MCQ Test	MCQ Test	Written Exam	Individual Task #		Written Exam	
	50 Questions for Analytical Course 75 Questions for Theory Course						
Duration of the Test	1 hour 30 Minutes	1 hour 30 Minutes	3 hours			3 hours	
Test Marks	50	50	75	20	5	75	
Weightage for CAM	5	5	5	5	5		
CAM / ESE Marks	**CAM Marks = 25**					**ESE Marks = 75**	**100**

Open Book Analytical Exam/Analyse Real world problems and propose solutions/ Tool or Subject Proficiency Analysis – Test the Students skill by giving individual task/ Paper Presentation/Micro Project Presentation/Idea Presentation for the Societal Problem;(Questions standard shall be of level 3 or more in Blooms Taxonomy)

Distribution of Marks for Attendance, the Question Paper Pattern for Model and ESE are same as given in B. Tech. Regulations R2023 for Theory Courses.

Dr. P. Jamuna

Department	**EEE**	Programme: **B.Tech Honours / Minor – Electric Vehicles**						
Semester	**VIII**	Course Category: **PC/ IC**			End Semester Exam Type :**LE***			
Course Code	**U23VXW806**	Periods/Week			Credit	Maximum Marks		
		L	T	P	C	CAM	ESE	TM
Course Name	**Project Work**	**-**	**-**	**4**	**2**	**50**	**50**	**100**
Common to All Branches								
Prerequisite	**-**							

Course Outcomes			BT Mapping (Highest Level)
	On completion of the course, the students will be able to		
	CO1	Apply literature survey techniques to identify and define the problem statement for the project	**K3**
	CO2	Comprehend, plan, and implement a project related to electric mobility	**K2**
	CO3	Develop a real-time application utilizing electric vehicle components, processes, or systems	**K3**
	CO4	Interpret and apply knowledge of publication and copyright processes in research	**K3**
	CO5	Justify and present project findings through structured oral and written reports	**K4**

Course Description

Student must select a project topic either from published lists or propose a suitable topic in consultation with his/her supervisor. The objective of the project is to enhance understanding of fundamental principles by applying them to a new challenge, which may involve designing and manufacturing a device, conducting research, developing a computer or management project, or solving a design problem.

The project progress will be assessed through a minimum of two reviews. The project evaluation shall be carried out by a Project evaluation committee comprising the Head of the Department or his/her nominee (Chairperson), Project coordinator (Professor / Associate Professor) and the project supervisor(s). The End Semester Examination for the project work will include an evaluation of the final project report by an external examiner, followed by a viva-voce examination conducted by a panel comprising the external examiner and an internal examiner.

Lecture Periods: -	**Tutorial Periods:-**	**Practical Periods: 60**	**Total Periods: 60**

*** TE – Theory Exam, LE – Lab Exam**

COs/POs/PSOs Mapping

COs	**Program Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	3	3	3	2	3	-	-	-	3	3	-	2	3	3	3
2	3	3	3	2	3	2	2	2	3	3	2	2	3	3	3
3	3	3	3	2	3	2	-	-	3	3	2	2	3	3	3
4	3	3	3	2	3	-	2	-	3	3	-	2	3	3	3
5	3	3	3	2	3	-	2	2	3	3	-	2	3	3	3

Correlation Level: 1 - Low, 2 - Medium, 3 – High

Evaluation Methods

Sl. No	**Description**			**Weightage**
1	**Continuous Assessment Marks**			
a	Review 1	Review Committee	15	25
		Supervisor	10	
b	Review 2	Review Committee	15	25
		Supervisor	10	
			Total CAM	50
2	**End Semester Marks**			
a	Evaluation of project work report and Viva-voce	Report	15	50
		Presentation and Viva	20	
		Demonstration	15	
			Total ESM	50
			Total Marks	100

Dr. P. Jamuna