SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

CURRICULAM & SYLLABI

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

(CHOICE BASED CREDIT SYSTEM)

REGULATIONS - 2023

(For the students admitted in the academic year 2023 – 2024 onwards)

Note: The regulations hereunder are subject to amendments as may be decided by the Academic Council of the Sengunthar Engineering College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates including those already undergoing the program under the same regulation as may be decided by the Academic Council.

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DEPARTMENT

OF

ELECTRICAL AND ELECTRONICS ENGINEERING

REGULATION 2023

CURRICULUM AND SYLLABI

FOR B. E. ELECTRICAL AND ELECTRONICS ENGINEERING

(For the students admitted in the academic year 2023 – 2024 onwards)

FIRST SEMESTER

TO

EIGHTH SEMESTER

INDEX

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SCHEME FOR CURRICULUM

B.E.-Electrical and Electronics Engineering

REGULATIONS 2023

CHOICE BASED CREDIT SYSTEM

B. E. ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

- To become a front-runner in bringing out globally competent innovators, researchers, and entrepreneurs in electrical and engineering.

MISSION

- To deliver exceptional quality undergraduate and doctoral programs in electrical and electronics engineering
- To provide state-of-the-art resources to achieve excellence in teaching-learning, research and economic development
- To bridge the gap between industry and academia for industrial and societal needs
- To enhance the creative talents of students to suite national and international standard
- To enable students and workforce to develop skills to solve complex technological problems of current times for promoting collaborative and multidisciplinary activities.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates can

- ✓ Apply their technical competence in Electrical science to solve real world problems, with technical and people leadership.
- ✓ Conduct cutting edge research and develop solutions on problems of social relevance.
- ✓ Work in a business environment, exhibiting team skills, work ethics, adaptability and lifelong learning.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1	**Engineering knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
PO2	**Problem analysis**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design / development of solutions**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4	**Conduct investigations of complex problems**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
PO6	**The engineer and society**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOME (PSOs)

PSO1	Ability to understand the principles and working of electrical components, circuits, systems and control that are forming a part of power generation, transmission, distribution, utilization, energy audit and conservation. Students can assess the power management, auditing, crisis and energy saving aspects.
PSO2	Competence to apply mathematical methodologies to solve problems related with electrical engineering using appropriate engineering tools and algorithms.
PSO3	Expertise to use knowledge in various domains to identify research gaps and hence to provide solutions.

MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME

Year	Sem	Course Name	PO												PSO		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
I	I	23HST101 - Professional English - I	-	-	-	-	-	1.4	2.2	1.25	1.8	3	-	3	-	-	-
		23MAT101 - Matrices and calculus	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-
		23HST102 - தமிழர்மரப/ Heritage of Tamils	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23PHE103 - Applied Physics for Electronics Engineering	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
		23CYE101 - Engineering Chemistry	1.6	1.6	2.4	1.25	1.8	1	2	-	-	-	-	1.5	-	-	-
		23GEE101 - Programming in C	2	2.3	2.3	1.2	2	1.7	1	0.8	2	0.2	2.8	2.3	1.8	2.2	-
		23EEC101 - Soft Skills	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC101 - Induction Program (2 Weeks)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	II	23HST201 - Professional English - II	-	-	-	-	2	1.2	1.2	1	2	3	-	3	-	-	-
		23MAT201 - Statistics and Numerical Methods with MATLAB	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-
		23PHT203 – Advanced Physics for Electronics Engineering	3	2	1	1	1	1	1	-	-	-	-	-	-	-	-
		23CYT201 - Environmental Science and Sustainability	1.5	1.8	2.2	1.8	1.5	1.4	2.2	2	1	2	-	1	-	-	-
		23HST202-தமிழரும் தொழில்நுட்பமும்/ Tamils and Technology	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		23GEE201 - Engineering Graphics	3	2	2	-	2	2	-	-	-	2	-	2	2	2	2
		23EEE201 - Circuit Theory	3	3	3	2.8	3	-	-	-	3	2	-	3	3	1	2
		23GEL201 - Engineering Practices Laboratory	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
		23EEC201 - Communication Skills	-	-	-	-	-	1.2	1.5	1.5	1.8	3	-	3	-	-	-
		23MDC201 - Life skills & Leadership Enhancement Programme	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME

Year	Sem	Course Name	PO												PSO		
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
II	III	23MAT301 - Transforms and Complex Functions	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-
		23EET301 - Electromagnetic Theory	3	3	3	2	2	-	2	1	-	1	-	2	3	-	3
		23EET302 - Measurements and Instrumentation	3	2	3	-	3	2	-	2	-	1	-	3	3	-	3
		23EEE301 - DC Machines and Transformers	3	3	2	2	2	-	-	-	3	1.3	-	3	3	1	2
		23EEE302 - Analog Electronics and Circuits	3	3	2	-	2	-	-	-	3	2.2	-	3	3	1	2
		23EEE303 - Digital Electronics and Linear Integrated Circuits	3	3	3	2.2	2	-	-	1	3	1.3	-	1	3	2	1
		23EEC301 - Professional Development	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	IV	23EET401 - Electrical Power Transmission and Distribution	3	3	2	2	1	1	-	1	-	1	-	2	3	-	2
		23EET402 - Power Electronics	3	3	3	3	-	-	1.6	1	-	1	-	2	3	-	2
		23EET403 - Microprocessors and Microcontrollers	2	1	2	3	3	-	-	1	-	1	-	3	3	-	3
		23EEE401 - Control Systems Engineering	3	3	3	3	3	-	-	1	3	2	-	-	3	3	3
		23EEE402 - Induction and Synchronous Machines	3	3	1.6	2.3	3	-	-	1	3	2	-	2	3	3	2
		23GEE301 - Problem Solving and Python Programming	2.3	2.5	1.5	1.8	1.8	-	-	-	-	-	1.5	0.7	2.7	0.5	-
		23EEC401 - Value Added Course - I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

B.E. - ELECTRICAL AND ELECTRONICS ENGINEERING - FIRST SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23HST101	Professional English - I	HS	3	0	0	3	40	60	100
23MAT101	Matrices and Calculus	BS	3	1	0	4	40	60	100
23HST102	தமிழர்மரபு/Heritage of Tamils	HS	1	0	0	1	40	60	100
EMBEDDED COURSE									
23PHE103	Applied Physics for Electronics Engineering	BS	3	0	2	4	50	50	100
23CYE101	Engineering Chemistry	BS	3	0	2	4	50	50	100
23GEE101	Programming in C	ES	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC101	Soft Skills	EEC	1	0	0	1	100	-	100
MANDATORY COURSE									
23MDC101	Induction Program (2 Weeks)	MC	-	-	-	-	-	-	-
TOTAL CREDITS IN SEMESTER - I			21						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
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PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B.E. - ELECTRICAL AND ELECTRONICS ENGINEERING - SECOND SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23HST201	Professional English – II	HS	3	0	0	3	40	60	100
23MAT201	Statistics and Numerical Methods with MATLAB	BS	3	1	0	4	40	60	100
23PHT203	Advanced Physics for Electronics Engineering	BS	3	0	0	3	40	60	100
23CYT201	Environmental Science and Sustainability	HS	3	0	0	3	40	60	100
23HST202	தமிழரும் தொழில்நுட்பமும்/ Tamils and Technology	HS	1	0	0	1	40	60	100
EMBEDDED COURSE									
23GEE201	Engineering Graphics	ES	3	0	2	4	50	50	100
23EEE201	Circuit Theory	PC	3	0	2	4	50	50	100
PRACTICALS									
23GEL201	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC201	Communication Skills	EEC	0	0	4	2	100	-	100
MANDATORY COURSE									
23MDC201	Life skills & Leadership Enhancement Programme	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - II			26						

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GE : General Elective
EEC : Employability Enhancement Courses
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CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B.E. - ELECTRICAL AND ELECTRONICS ENGINEERING - THIRD SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23MAT301	Transforms and Complex Functions	BS	3	1	0	4	40	60	100
23EET301	Electromagnetic Theory	PC	3	1	0	4	40	60	100
23EET302	Measurements and Instrumentation	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23EEE301	DC Machines and Transformers	PC	3	0	2	4	50	50	100
23EEE302	Analog Electronics and Circuits	PC	3	0	2	4	50	50	100
23EEE303	Digital Electronics and Linear Integrated Circuits	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC301	Professional Development	EEC	0	0	2	1	100	-	100
TOTAL CREDITS IN SEMESTER - III			24						

HS : Humanities and Social Sciences
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GE : General Elective
EEC : Employability Enhancement Courses
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L : Lecture
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ESE : End Semester Examination
TOT : Total

B.E. - ELECTRICAL AND ELECTRONICS ENGINEERING - FOURTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23EET401	Electrical Power Transmission and Distribution	PC	3	0	0	3	40	60	100
23EET402	Power Electronics	PC	3	0	0	3	40	60	100
23EET403	Microprocessor and Microcontrollers	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23EEE401	Control Systems Engineering	PC	3	0	2	4	50	50	100
23EEE402	Induction and Synchronous Machines	PC	3	0	2	4	50	50	100
23GEE301	Problem Solving and Python Programming	ES	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC401	Value Added Course-I	EEC	0	0	4	2	100	-	100
TOTAL CREDITS IN SEMESTER - IV			23						

HS : Humanities and Social Sciences
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PE : Professional Elective
OE : Open Elective
GE : General Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
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CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B.E. - ELECTRICAL AND ELECTRONICS ENGINEERING - FIFTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23EET501	Power System Analysis	PC	3	1	0	4	40	60	100
	Professional Elective I	PE	3	0	0	3	40	60	100
	Professional Elective II	PE	3	0	0	3	40	60	100
	Professional Elective III	PE	3	0	0	3	40	60	100
EMBEDDED COURSE									
23EEE501	Advanced Power Electronics and Drives	PC	3	0	2	4	50	50	100
23EEE502	Embedded Controllers and Real Time Operating Systems	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC501	Value Added Course-II	EEC	0	0	4	2	100	-	100
MANDATORY COURSE									
23MDC501	Mandatory Course-I	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - V			23						

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BS : Basic Sciences
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PC : Professional Core
PE : Professional Elective
OE : Open Elective
GE : General Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
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P : Practical
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CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B.E. - ELECTRICAL AND ELECTRONICS ENGINEERING - SIXTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
	Professional Elective IV	PE	3	0	0	3	40	60	100
	Professional Elective V	PE	3	0	0	3	40	60	100
	Professional Elective VI	PE	3	0	0	3	40	60	100
	Open Elective-I/NCC L1/ L3	OE	3	0	0	3	40	60	100
EMBEDDED COURSE									
23EEE601	Renewable Energy Systems	PC	3	0	2	4	50	50	100
23EEE602	Power System Operation and Control	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEJ601	Project Work	EEC	0	0	10	5	40	60	100
MANDATORY COURSE									
23MDC601	Mandatory Course-II	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - VI			25						

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BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
OE : Open Elective
GE : General Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B.E. - ELECTRICAL AND ELECTRONICS ENGINEERING - SEVENTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23HST701	Human Values Ethics	HS	3	0	0	3	40	60	100
	Elective-Management	GE	3	0	0	3	40	60	100
	Open Elective-II/NCC-II L2/ L4	OE	3	0	0	3	40	60	100
	Open Elective-III	OE	3	0	0	3	40	60	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC701	Research Paper Writing and Publication	EEC	0	0	4	2	100	-	100
TOTAL CREDITS IN SEMESTER - VII			14						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
OE : Open Elective
GE : General Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B.E. - ELECTRICAL AND ELECTRONICS ENGINEERING - EIGHTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
EMPLOYABILITY ENHANCEMENT COURSE									
23EEJ801	Innovative Product Development	EEC	0	0	14	7	40	60	100
23EEC801	Internship	EEC	0	0	4	2	100	-	100
TOTAL CREDITS IN SEMESTER - VIII			9						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
OE : Open Elective
GE : General Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

LIST OF HUMANITIES AND SOCIAL SCIENCES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23HST101	Professional English - I	HS	3	0	0	3	40	60	100
23HST102	தமிழர்மரபு/Heritage of Tamils	HS	1	0	0	1	40	60	100
23HST201	Professional English - II	HS	3	0	0	3	40	60	100
23CYT201	Environmental Sciences and Sustainability	HS	3	0	0	3	40	60	100
23HST202	தமிழரும் தொழில்நுட்பமும் /Tamil and Technology	HS	1	0	0	1	40	60	100
23HST701	Human Values Ethics	HS	3	0	0	3	40	60	100

LIST OF BASIC SCIENCES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MAT101	Matrices and calculus	BS	3	1	0	4	40	60	100
23PHE103	Applied Physics for Electronics Engineering	BS	3	0	2	4	50	50	100
23CYE101	Engineering Chemistry	BS	3	0	2	4	50	50	100
23MAT201	Statistics and Numerical Methods with MATLAB	BS	3	1	0	4	40	60	100
23PHT203	Advanced Physics for Electronics Engineering	BS	3	0	0	3	40	60	100
23MAT301	Transforms and Complex Functions	BS	3	1	0	4	40	60	100

LIST OF ENGINEERING SCIENCES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23GEE101	Programming in C	ES	3	0	2	4	50	50	100
23GEE201	Engineering Graphics	ES	3	0	2	4	50	50	100
23GEL201	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
23GEE301	Problem Solving and Python Programming	ES	3	0	2	4	50	50	100

LIST OF PROFESSIONAL CORE

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEE201	Circuit Theory	PC	3	0	2	4	50	50	100
23EET301	Electromagnetic Theory	PC	3	1	0	4	40	60	100
23EET302	Measurements and Instrumentation	PC	3	0	0	3	40	60	100
23EEE301	DC Machines and Transformers	PC	3	0	2	4	50	50	100
23EEE302	Analog Electronics and Circuits	PC	3	0	2	4	50	50	100
23EEE303	Digital Electronics and Linear Integrated Circuits	PC	3	0	2	4	50	50	100
23EET401	Electrical PowerTransmission and Distribution	PC	3	0	0	3	40	60	100
23EET402	Power Electronics	PC	3	0	0	3	40	60	100
23EET403	Microprocessor and Microcontrollers	PC	3	0	0	3	40	60	100
23EEE401	Control Systems Engineering	PC	3	0	2	4	50	50	100
23EEE402	Induction and Synchronous Machines	PC	3	0	2	4	50	50	100
23EET501	Power System Analysis	PC	3	1	0	4	40	60	100
23EEE501	Advanced Power Electronics and Drives	PC	3	0	2	4	50	50	100
23EEE502	Embedded Controllers and Real Time Operating Systems	PC	3	0	2	4	50	50	100
23EEE601	Renewable Energy Systems	PC	3	0	2	4	50	50	100
23EEE602	Power System Operation and Control	PC	3	0	2	4	50	50	100

LIST OF PROFESSIONAL ELECTIVE COURSES

PROFESSIONAL ELECTIVE - I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEP501	Under Ground Cable	PE	3	0	0	3	40	60	100
23EEP502	Power Quality	PE	3	0	0	3	40	60	100
23EEP503	Flexible AC Transmission Systems	PE	3	0	0	3	40	60	100

23EEP504	High Voltage Engineering	PE	3	0	0	3	40	60	100
23EEP505	Utilization of Electrical Energy	PE	3	0	0	3	40	60	100
23EEP506	Smart Grid	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEP507	SMPS and UPS	PE	3	0	0	3	40	60	100
23EEP508	Special Electrical Machines	PE	3	0	0	3	40	60	100
23EEP509	Multi Level Power Converter	PE	3	0	0	3	40	60	100
23EEP510	Protection and Switchgear	PE	3	0	0	3	40	60	100
23EEP511	Modern Power Converters	PE	3	0	0	3	40	60	100
23EEP512	Power Electronics for Renewable Energy System	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEP513	Discrete Time System and Signal processing	PE	3	0	0	3	40	60	100
23EEP514	Embedded System Design	PE	3	0	0	3	40	60	100
23EEP515	Embedded C Programming	PE	3	0	0	3	40	60	100
23EEP516	Embedded Control for Electrical Drives	PE	3	0	0	3	40	60	100
23EEP517	Microcontroller Based System Design	PE	3	0	0	3	40	60	100
23EEP518	Embedded System for Automotive Applications	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - IV

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEP601	Electric Vehicle Architecture	PE	3	0	0	3	40	60	100
23EEP602	Electric Vehicle Design, Mechanics and Control	PE	3	0	0	3	40	60	100
23EEP603	Design of Electric Vehicle Charging System	PE	3	0	0	3	40	60	100
23EEP604	Design of Motor and Power Converters for Electric Vehicles	PE	3	0	0	3	40	60	100
23EEP605	Electrical Vehicles	PE	3	0	0	3	40	60	100
23EEP606	Testing of Electric Vehicles	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE -V

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEP607	Process Modeling and Simulation	PE	3	0	0	3	40	60	100
23EEP608	Soft Computing	PE	3	0	0	3	40	60	100
23EEP609	Optimal Control	PE	3	0	0	3	40	60	100
23EEP610	Adaptive Control	PE	3	0	0	3	40	60	100
23EEP611	Computer Control of Process	PE	3	0	0	3	40	60	100
23EEP612	Machine Monitoring System	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - VI

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEP613	Design of Electrical Apparatus	PE	3	0	0	3	40	60	100
23EEP614	Energy Storage Systems	PE	3	0	0	3	40	60	100
23EEP615	Grid integrating Techniques and Challenges	PE	3	0	0	3	40	60	100

23EEP616	Hybrid Energy Technology	PE	3	0	0	3	40	60	100
23EEP617	Power Systems Transients	PE	3	0	0	3	40	60	100
23EEP618	PLC Programming	PE	3	0	0	3	40	60	100

LIST OF OPEN ELECTIVE COURSES

OPEN ELECTIVE - I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MEO601	Introduction to Industrial Engineering	OE	3	0	0	3	40	60	100
23ECO602	Fundamentals of Electronic Devices and Circuits	OE	3	0	0	3	40	60	100
23EEO603	Electric Vehicle Technology	OE	3	0	0	3	40	60	100
23EEO604	Renewable Energy System	OE	3	0	0	3	40	60	100
23MEO605	Resource Management Technique	OE	3	0	0	3	40	60	100
23MAO606	Graph Theory	OE	3	0	0	3	40	60	100
23CEO607	Environmental and Social Impact Assessment	OE	3	0	0	3	40	60	100
23PMO608	Pharmaceutical Nanotechnology	OE	3	0	0	3	40	60	100
23RAO609	Foundation of Robotics	OE	3	0	0	3	40	60	100
23CSO610	Introduction to Drone Technologies	OE	3	0	0	3	40	60	100
23MDO611	Bio Molecules	OE	3	0	0	3	40	60	100
23CSO612	Cyber Forensics and Ethical Hacking	OE	3	0	0	3	40	60	100

OPEN ELECTIVE- II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23HSO701	English for Competitive Examinations	OE	3	0	0	3	40	60	100
23MGO702	Democracy and Good Governance	OE	3	0	0	3	40	60	100
23MEO703	Fundamentals of Mechatronics	OE	3	0	0	3	40	60	100
23CEO704	Remote Sensing Concepts	OE	3	0	0	3	40	60	100

23MEO704	Nano Technology	OE	3	0	0	3	40	60	100
23MDO705	Ultrasound Principles and its Medical Applications	OE	3	0	0	3	40	60	100
23PMO706	IPR for Pharma Industry	OE	3	0	0	3	40	60	100
23RAO707	Concepts in Mobile Robots	OE	3	0	0	3	40	60	100
23ECO708	Energy Technology	OE	3	0	0	3	40	60	100
23EEO709	Sensors and Actuators	OE	3	0	0	3	40	60	100
23MAO710	Operations Research	OE	3	0	0	3	40	60	100
23CSO711	Introduction to Cyber Security	OE	3	0	0	3	40	60	100
23MEO712	3D Printing and Design	OE	3	0	0	3	40	60	100

OPEN ELECTIVE - III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23HSO713	Project Report Writing	OE	3	0	0	3	40	60	100
23MAO714	Advanced Numerical Methods	OE	3	0	0	3	40	60	100
23CSO715	Fundamentals of Block Chain Technology	OE	3	0	0	3	40	60	100
23EEO716	Electrical, Electronic and Magnetic Materials	OE	3	0	0	3	40	60	100
23CEO717	Geographical Information System	OE	3	0	0	3	40	60	100
23ECO718	VLSI Design	OE	3	0	0	3	40	60	100
23MDO719	Wearable Technology	OE	3	0	0	3	40	60	100
23MEO720	Additive manufacturing	OE	3	0	0	3	40	60	100
23RAO721	Nano Materials and Application	OE	3	0	0	3	40	60	100
23MGO722	Cost Management of Engineering Projects	OE	3	0	0	3	40	60	100
23HSO723	Food Safety and Quality Regulations	OE	3	0	0	3	40	60	100
23MDO724	Lifestyle Diseases	OE	3	0	0	3	40	60	100

GENERAL ELECTIVES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23NCCL01	NCC AIRFORCE LEVEL-1	GE	3	0	0	3	40	60	100
23NCCL02	NCC AIRFORCE LEVEL - 2	GE	3	0	0	3	40	60	100
23NCCL03	NCC ARMY LEVEL - 3	GE	3	0	0	3	40	60	100
23NCCL04	NCC ARMY LEVEL - 4	GE	3	0	0	3	40	60	100

ELECTIVE - MANAGEMENT

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MGT701	Principles of Management	GE	3	0	0	3	40	60	100
23MGT702	Total Quality Management	GE	3	0	0	3	40	60	100
23MGT703	Engineering Economics and Financial Accounting	GE	3	0	0	3	40	60	100
23MGT704	Human Resource Management	GE	3	0	0	3	40	60	100
23MGT705	Knowledge Management	GE	3	0	0	3	40	60	100
23MGT706	Industrial Management	GE	3	0	0	3	40	60	100
23MGT707	Hospital Management	GE	3	0	0	3	40	60	100
23MGT708	e-Waste Management	GE	3	0	0	3	40	60	100

LIST OF EMPLOYABILITY ENHANCEMENT COURSES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEC101	Soft Skills	EEC	1	0	0	1	100	-	100
23EEC201	Communication Skills	EEC	0	0	4	2	100	-	100
23EEC301	Professional Development	EEC	0	0	2	1	100	-	100
23EEC401	Value Added Course-I	EEC	0	0	4	2	100	-	100

23EEC501	Value Added Course-II	EEC	0	0	4	2	100	-	100
23EEJ601	Project Work	EEC	0	0	10	5	40	60	100
23EEC701	Research Paper Writing and Publication	EEC	0	0	4	2	100	-	100
23EEJ801	Innovative Product Development	EEC	0	0	14	7	40	60	100
23EEC801	Internship	EEC	0	0	4	2	100	-	100

LIST OF MANDATORY COURSES

MANDATORY COURSES - I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MDC501	Introduction to Women and Gender Studies	MC	3	0	0	0	-	-	-
23MDC502	Elements of Literature	MC	3	0	0	0	-	-	-
23MDC503	Film Appreciation	MC	3	0	0	0	-	-	-
23MDC504	Disaster Risk Reduction and Management	MC	3	0	0	0	-	-	-
23MDC505	Constitution of India	MC	3	0	0	0	-	-	-

MANDATORY COURSES - II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MDC601	Well Being with Traditional Practices- Yoga, Ayurveda and Siddha	MC	3	0	0	0	-	-	-
23MDC602	History of Science and Technology in India	MC	3	0	0	0	-	-	-
23MDC603	Political and Economical Thought for a Human Society	MC	3	0	0	0	-	-	-
23MDC604	State, Nation Building and Politics in India	MC	3	0	0	0	-	-	-
23MDC605	Industrial Safety	MC	3	0	0	0	-	-	-

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024onwards)

CREDIT SUMMARY

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Category	Credits Per Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
HS	4	7	-	-	-	-	3	-	11
BS	12	7	4	-	-	-	-	-	23
ES	4	6	-	-	-	-	-	-	10
PC	-	4	19	21	12	8	-	-	64
PE	-	-	-	-	9	9	-	-	18
OE	-	-	-	-	-	3	6	-	9
GE	-	-	-	-	-	-	3	-	3
EEC	1	2	1	2	2	5	2	9	24
MC	0	0	0	0	0	0	0	0	0
Total	21	26	24	23	23	25	14	9	165

SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

SCHEME FOR SYLLABI

B.E - Electrical and Electronics Engineering

SEMESTER I

23HST101	**PROFESSIONAL ENGLISH - I**	**L T P C**
	(Common to all B.E. & B.Tech. Branches)	**3 0 0 3**

OBJECTIVES

- To develop learning English language through grammar.
- To use grammar efficiently for demonstrating all the four language skills (LSRW).
- To write business letters, dialogue writing, paragraph and essay writing.
- To speak effectively about self introduction and real time situation.
- To build the reading skills through reading comprehension and note taking.

UNIT I VOCABULARY **8**

Synonyms and Antonyms - Word Formation - Sentence Types (declarative, imperative, interrogative & exclamatory) - Single Word Substitutes - Use of Abbreviations and Acronyms- Homonyms and Homophones - Collocation - British and American Vocabulary.

UNIT II GRAMMAR **10**

Parts of speech - Be, Have and Do verbs - Punctuation - Tenses - Numerical Adjectives - modal verbs - Single line Definition - Direct and Indirect Speech - Gerunds and Infinitives - Same Word Used as Different Parts of Speech.

UNIT III WRITING **9**

Letter Writing - Business communications - quotations, placing orders, complaints, replies to queries from business customers - Dialogue Writing – Paragraph Writing (descriptive, narrative, expository & persuasive) - Essay Writing - Writing Instructions.

UNIT IV SPEAKING **9**

Self-introduction - Giving personal and factual information - Talking about present circumstances, past experiences and future plans - Expressing opinions and justifying opinions - Agreement / disagreement - Likes and dislikes - Tongue twisters.

UNIT V READING SKILLS **9**

Reading Comprehension – Reading techniques, pre-reading, post-reading, comprehension questions (multiple choice questions or short questions) - Short Comprehension Passages, practice skimming - Scanning and Predicting - Reading the passage and taking (Note making) Notes - Scan and understand main contents of the passage.

TOTAL: 45 PERIODS

Mandatory activity: Self Introduction

OUTCOMES

Upon completion of the course, the students will be able to:

- Use a wide range of vocabulary in oral and written communication
- Frame grammatically correct sentences.
- Write letters, frame paragraphs and Essays, develop conversation.
- Develop speaking skills for self-Introduction, delivering speeches and Technical Presentation
- Read and comprehend the passage, technical content and take notes

TEXT BOOKS

1. Board of Editors. Using English A Course book for Under graduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad: 2015.
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

REFERENCES

1. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", 1st Edition, Orient Black Swan, Chennai, 2012.
2. MacMillan, Krishna Mohan, Meera Banerji, Developing Communication Skills, Paperback, 2019.

E-RESOURCES

1. http://www.usingenglish.com
2. https://www.khanacademy.org/humanities/grammar

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	1	3	1	2	3	-	3	-	-	-
2	-	-	-	-	-	1	2	-	1	3	-	3	-	-	-
3	-	-	-	-	-	3	3	2	3	3	-	3	-	-	-
4	-	-	-	-	-	1	2	1	2	3	-	3	-	-	-
5	-	-	-	-	-	1	1	1	1	3	-	3	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	-	-	-	-	-	1.40	2.20	1.25	1.80	3.00	-	3.00	-	-	-

1- Low 2-Medium 3-High '-' – No Correlation

23MAT101 **MATRICES AND CALCULUS** **LT P C**

(Common to all B.E. & B.Tech. Branches) **3 1 0 4**

OBJECTIVES

- To develop the use of matrix algebra techniques those are needed by engineers for practical applications.
- To familiarize the students with differential and integral calculus.
- To describe the student with functions of several variables.
- To acquire the student with mathematical tools needed in evaluating multiple integrals and their applications.
- To acquaint the student with the concepts of vector calculus that is needed for problems in engineering disciplines.

UNIT I MATRICES **9+3**

Eigen values and Eigen vectors – Properties of Eigen values – Cayley-Hamilton theorem – Reduction of quadratic form to canonical form by orthogonal transformation – Nature of quadratic form.

UNIT II DIFFERENTIAL AND INTEGRAL CALCULUS **9+3**

Differentiation rules: Derivatives of polynomials and exponential functions – The product and quotient Rules – Derivatives of trigonometric functions – The Chain rule – Implicit differentiation – Applications of differentiation: Maximum and Minimum Values – Techniques of integration: Integration by parts – Trigonometric integrals – Integration of rational functions by partial fractions.

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9+3**

Partial derivatives – Homogeneous functions – Euler's theorem – Total derivative – Jacobians –Taylor's theorem for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV MULTIPLE INTEGRALS **9+3**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double integrals.

UNIT V VECTOR CALCULUS **9+3**

Scalar and vector point functions – Gradient – Divergence and curl – Line integral – Surface integral – Green's theorem in a plane – Volume integral – Divergence theorem – Irrotational and Solenoidal fields.

LIST OF TUTORIALS

1. Computation of Eigen values and Eigenvectors.
2. Calculate differentiation and integration of simple functions.
3. Determining Maxima and minima of functions for two variables.
4. Evaluating double and triple integrals.
5. Computing Gradient, divergence and curl of point functions.

TOTAL: 45+15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Classify the matrix algebra methods for solving practical problems.
- Discover differential calculus tools in solving various application problems and compare different methods of integration in solving practical problems.
- Develop differential calculus ideas on several variable functions.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.
- Solve engineering problems using the concept of vector calculus.

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 43rd Edition, New Delhi, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

REFERENCES

1. Bali N.P, Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Kanti B. Dutta., "Mathematical Methods of Science and Engineering – Aided with MATLAB", Cengage Learning, New Delhi, 2013.

E-RESOURCES

1. https://nptel.ac.in/courses/111105121 (Differential Calculus and Integral Calculus)
2. https://nptel.ac.in/courses/111107112 (matrix analysis)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-
2	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-
3	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-
4	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-
5	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	3	2	-	-	-	-	-	-	-	1	2	-	-	-

1-Low 2-Medium 3-High '-' – No Correlation.

23HST102 **HERITAGE OF TAMILS** **L T P C**
1 0 0 1

UNIT I LANGUAGE AND LITERATURE **3**

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE **3**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils..

UNIT III FOLK AND MARTIAL ARTS **3**

Therukoothu, Karagattam, VilluPattu, KaniyanKoothu,Oyillattam,Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils

UNIT IV THINAI CONCEPT OF TAMILS **3**

Flora and Fauna of Tamils &Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE **3**

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL: 15 PERIODS

TEXT BOOKS

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

REFERENCE BOOKS

1. Heritage of Tamils,Publishedby:Yes Dee Publishing Pvt Ltd,Chennai
2. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

23HST102 **தமிழர் மரபு** **LT P C**
1 0 0 1

UNIT I மொழி மற்றும் இலக்கியம் **3**

இந்திய மொழி குடும்பங்கள் - திராவிட மொழிகள் -தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தில் சமய சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம்- திருக்குறளில் மேலாண்மை கருத்துக்கள் -தமிழ் காப்பியங்கள் - தமிழகத்தில் பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம் ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலயக்யத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு

UNIT II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை- சிற்பக்கலை **3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினை பொருட்கள் ,பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புற தெய்வங்கள் - குமரி முனையில் திருவள்ளுவர் சிலை - இசை கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம், தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

UNIT III நாட்டுப்புற கலைகள் மற்றும் வீர விளையாட்டுகள் **3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவை கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

UNIT IV தமிழர்களின் திணைகோட்பாடுகள் **3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறகோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவு, கல்வியும் - சங்க கால நகரங்களும் துறை முகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

UNIT V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்கு தமிழர்களின் பங்களிப்பு **3**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறபகுதிகளில் தமிழ்பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்தமருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ் புத்தகங்களின் வரலாறு

TOTAL: 15 PERIODS

TEXT BOOKS

1. தமிழக வரலாறு -மக்களும் பண்பாடும் -கே கே பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினி தமிழ் -முனைவர் இல சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி -வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)

REFERENCE BOOKS

1. தமிழர் மரபு -முனைவர் ஆ பூபாலன் (வி ஆர்பி பி பப்ளிஷர்ஸ்)

23PHE103 APPLIED PHYSICS FOR ELECTRONICS ENGINEERING LT P C

(Common to ECE, EEE & Medical Electronics) **3 0 2 4**

OBJECTIVES

- To Recognize different lattices and crystal structures
- To explore the principles of lasers and the uses for them in general.
- To build knowledge about optical fibre and its applications.
- To understand the applications of acoustics and ultrasonics in industry.
- To utilize Schrödinger's wave equation and the fundamentals of quantum mechanics to investigate the complicated phy sical phenomena.
- To analyze the engineering physics that may be used to calculate thermal properties, substance characteristics, optics, acoustics, and ultrasonics.

UNIT I CRYSTAL PHYSICS 9

Lattice and Unit cell - Crystal Systems and Bravais Lattice – Lattice Planes – Miller Indices – d -Spacing in Cubic Lattice – Calculation of Number of Atoms per Unit Cell – Atomic Radius, Coordination number, Packing factor for SC, BCC, FCC and HCP Structures – Crystal Growth Techniques – Melt Growth Techniques (Bridgman and Czochralski).- Silicon chip Production Process.

UNIT II PHOTONICS 9

Spontaneous and Stimulated Emission- Population Inversion - Derivation of Einstein's A and B co-efficient - Principle and Working of Laser - He Ne Laser - Direct Band gap and Indirect Bandgap Semiconductors - Semiconductor Diode Laser (Homo junction & hetero junction) - Applications of Lasers in Science, Engineering and Medicine - Working principle of Laser Printer - Digital Laser Material Processing Technology.

UNIT III FIBRE OPTICS 9

Principle and Propagation light in Optical Fibres- Derivation of Numerical Aperture and Acceptance angle - Fibre Optic Communication System - Classification of Optical Fibre -Ray Optics - losses in Optical Fibre- Types of fibre optic sensors. (Pressure, Temperature fibre)- Local area Network (qualitative) -Advantages of Optical Fibre and Application of Optical Fibre.

UNIT IV ACOUSTICS & ULTRASONICS 9

ACOUSTICS: Classification of Sound - Decibel - Weber Fechner law- Reverberation- Sabine's formula (Qualitative) - Factors affecting Acoustics of Buildings and their remedies.

ULTRASONICS: Properties -Production of ultrasonic's - Magnetostriction and Piezoelectric methods - Non Destructive Testing – Pulse Echo System, through Transmission and Reflection modes - Medical Endoscope - Sonogram.

UNIT V QUANTUM PHYSICS 9

Black Body Radiation - Planck's Theory (Derivation) - Electron Diffraction - Wave function and its Physical Significance - Schrödinger's Wave Equation: Time Independent and Time Dependent Equations - Particle in a One-Dimensional Box - Scanning Electron Microscope - Transmission Electron Microscope - Quantum Tunneling - Scanning Tunneling Electron Microscope.

LIST OF EXPERIMENTS

(Common to ECE EEE & Medical Electronics)

(Eight experiments are to be conducted in Lab)

1. Determination of wavelength of laser.
2. Determination of particle Size lycopodium powder using laser.
3. Fibre Optics: Determination of Numerical Aperture and Acceptance angle.
4. Determination of wavelength of mercury spectrum- Spectrometer.
5. Determination of velocity of ultrasonic in liquid.
6. Verification of truth tables of logic gates using IC's: (OR, AND, NOT, XOR, NOR and NAND)
7. Determination of thickness of wire - Air wedge method.
8. Determination of bandgap of a given semiconductor diode.
9. Determination of reverse bias characteristics of the photodiode. (Virtual)
10. Compact disc- Determination of width of the groove using laser. (virtual)

TOTAL: 45+15 PERIODS

OUTCOMES

Upon completion of this course, students will be able to;

- Apply crystallographic knowledge to get familiar with the structure of crystalline solids.
- Learn the basics of lasers and their use in some applications
- Acquire knowledge about fibre optics and apply it to various fields
- Understand the basics of Acoustic, Ultrasonic's and estimate the applications in diverse fields.
- Apply the basic principles of quantum mechanics and Schrödinger's wave equation to study the complex physical phenomenon.
- Relate elasticity, optics, and semiconductor physics in engineering applications.

TEXT BOOKS

1. P.Mani, "Engineering Physics Practicals", Dhanam Publications, 2019.
2. Rajendiran V, "Engineering Physics" Tata McGraw Hill, 2012
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGrawHill (Indian Edition), 2017

REFERENCES

1. Avadhanulu M.N & Kshirsagar P.G "Text Book of Engineering Physics". S.Chand, 2006.
2. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials" Narosa Publishing House, 2009
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019

E-RESOURSES

1. https://archive.nptel.ac.in/courses/122/107/122107035/
2. https://archive.nptel.ac.in/courses/115/101/115101107/

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
2	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
3	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
4	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
5	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
6	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-
AVG	3	**3**	1	1	-	-	-	-	-	-	-	-	-	-	-

1. Low 2-Medium 3-High '-' – No Correlation

23CYE101 **ENGINEERING CHEMISTRY** **LT P C**

(Common to CSE, EEE, ECE, CSE (CS), MDE, AI&DS, IT &PT) **3 0 2 4**

OBJECTIVES

- To classify the impurities of water and know the treatment and the conditioning methods for domestic and industrial uses.
- To develop an understanding the fundamentals of polymers.
- To gain knowledge the phase rule and its applications in engineering field.
- To explain the basics of Nanochemistry, synthesis, properties and applications of nano materials.
- To be familiar with the types of corrosion and control measures and working of batteries.
- To inculcate practical skills in the determination of water quality parameters and instrumental analysis.

UNIT I WATER TECHNOLOGY **9**

Introduction - Characteristics - Hardness - Estimation of hardness by EDTA method - Alkalinity and its estimation - Boiler feed water - Requirements –Boiler troubles (Scale and Sludge) - Internal conditioning (colloidal, phosphate, calgon and carbonate conditioning methods) - External conditioning - Zeolite process, Demineralization process – Desalination of brackish water by reverse osmosis- Nano filtration - Municipality water treatment - Break point chlorination.

UNIT II POLYMER CHEMISTRY **9**

Introduction - Classification of polymers - Natural and Synthetic; Thermoplastic and Thermosetting plastic. Functionality - Degree of polymerization. Types of polymerization: Addition Condensation and Copolymerization, Properties of polymers: Glass transition temperature, Tacticity- Molecular weight - Weight average, Number average and Polydispersity index- Preparation, properties and uses of PVC, Nylon 6,6, Polyethylene - Rubbers - Types - Vulcanization of rubber - Plastics - Moulding constituents of plastics - Moulding of plastics - Compression, injection and blow moulding - Biodegradable polymers - Conducting polymers.

UNIT III PHASE RULE AND ALLOYS **9**

Phase rule - Explanation of terms involved - One component system - Water system - Condensed phase rule - Construction of phase diagram by thermal analysis - Simple eutectic systems (Lead - Silver system only). Alloys: Introduction - Definition - Properties of alloys - Significance of alloying, functions and effect of alloying elements - Ferrous alloys - Nichrome and stainless steel - Heat treatment of steel, non-ferrous alloys - Brass and bronze.

UNIT IV CHEMISTRY OF NANO MATERIALS **9**

Nano chemistry - Basics (Surface area to volume ratio - Quantum confinement - 0D, 1D, 2D& 3D) - Distinction between molecules, nanoparticles and bulk materials - Characterization of nanomaterials using EDX and HR-TEM. Synthesis of nano materials: Top down approach - Ball milling - Bottom up approach - Sol-gel method, Chemical vapour deposition - Properties of nanomaterials and Applications of nanomaterials (Nano products of today).

UNIT V ELECTROCHEMISTRY, CORROSION AND ITS CONTROL 9

Introduction - Electrochemical cells, applications of electrochemical series - Reference Electrode - standard calomel electrode, ion selective electrode, glass electrode, Potentiometric titration - Redox titration, Conductometric titration- Strong acid vs Strong base. Corrosion - Types - Chemical Corrosion - Electrochemical Corrosion (galvanic and differential aeration) - Factors influencing corrosion - Material selection and design aspects- Control methods of corrosion - Sacrificial anodic and impressed current cathodic protection.

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by Argentometric method.
5. Determination of strength of given hydrochloric acid using pH meter.
6. Estimation of sodium and potassium present in water using flame photometer.
7. Conductometric Precipitation Titration using $BaCl_2$ and Na_2SO_4.
8. Conductometric titration of strong acid vs strong base.
9. Estimation of Ferrous ions by Potentiometric Titration.
10. Estimation of copper content in the brass by Iodometry.

TOTAL: 45+15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Infer the quality of water and Identify the method of removal of impurities from water for domestic and industrial purpose.
- Identify the different types of polymers, polymerization processes and some special properties and applications of polymers.
- Apply theknowledge of phase rule to alloy making for various engineering applications.
- Discuss the fundamentals of the nano materials and apply the basic concepts of nanochemistry in engineering applications.
- Analyze the causes of corrosion, suggest the control measures and discuss the functions of batteries.
- Determine the water quality parameters and perform quantitative chemical analysis bypH metery, flame photometry, conductometry and potentiometry.

TEXT BOOKS

1. Jain P.C and Monika Jain, "Engineering Chemistry", 17th Edition, Dhanpet Rai Publishing Company (P) Ltd. New Delhi, 2015.
2. Viswanathan B, "Nanomaterials" Alpha Science International Ltd, 2009.
3. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.

REFERENCES

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company Ltd, New Delhi, 2015.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.

E-RESOURCES

1. https://nptel.ac.in/courses/104105084
2. http://library.iitbbs.ac.in/open-access-e-resources.php

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	3	-	1	-	3	-	-	-	-	2	-	-	-
2	1	-	2	-	1	-	-	-	-	-	-		-	-	-
3	2	2	3	1	1	1	-	-	-	-	-	1	-	-	-
4	1	1	2	1	-	-	-	-	-	-	-	-	-	-	-
5	2	1	2	1	3	-	1	-	-	-	-	-	-	-	-
6	2	3	-	2	3	-	-	-	-	-	-	-	-	-	-
AVG	1.6	1.6	2.4	1.25	1.8	1	2	-	-	-	-	1.5	-	-	-

1-Low 2-Medium 3-High '-' – No Correlation

23GEE101 **PROGRAMMING IN C** **L T P C**

(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To develop C Programs using basic programming constructs.
- To demonstrate C programs using arrays and strings.
- To know the applications in C using functions and pointers.
- To understand the structures and Unions.
- To construct input/output and file handling programs in C and perform read and write operations on file.
- To apply the practical knowledge through the various concepts in C.

UNIT I BASICS OF C PROGRAMMING **9**

Introduction to programming paradigms - Structure of C program - C programming: Data Types - variables - Storage classes - Constants - Enumeration Constants - Keywords - Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements - Decision making statements - Switch statement - Looping statements - Pre-processor directives - Compilation process.

UNIT II ARRAYS AND STRINGS **9**

Introduction to Arrays: Declaration, Initialization - One dimensional array - Example Program**:** Computing Mean, Median and Mode - Two dimensional arrays - Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String operations: length, compare, concatenate, copy - Sorting - Selection sort, Insertion sort, Merge sort, quick sort -Searching - linear and binary search.

UNIT III FUNCTIONS AND POINTERS **9**

Introduction to functions: Function prototype, function call, Built-n functions (string functions, math functions) - Recursion - Example Program: Computation of Sine series, Scientific calculator using built-in functions - Pointers - Pointer operators - Arrays and pointers - Example Program: Sorting of names - Parameter passing: Pass by value, Pass by reference - Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.

UNIT IV STRUCTURES **9**

Structure - Example Programs - Nested structures - Pointer in Structures - Array of structures - Example Program using structures and pointers - Self referential structures - Dynamic memory allocation.

UNIT V FILE PROCESSING **9**

Files - Operations of File - Types of file processing: Sequential access, Random access - Sequential access file - Random access file - Command line arguments.

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Programs using I/O statements, expressions and decision–making constructs.
2. Write a program to find whether the given year is leap year or Not.
3. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
4. Check whether a given number is Armstrong number or not?
5. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions.
   a) 5 if it is a perfect cube.
   b) 4 if it is a multiple of 4 and divisible by 6.
   c) 3 if it is a prime number.
6. Sort the numbers based on the weight in the increasing order as shown below <10,its weight>, <36,its weight> <89,its weight>
7. Populate an array with height of persons and find how many persons are above the average height.
8. From a given paragraph perform the following using built–in functions:(i)Find the total number of words.(ii)Capitalize the first word of each sentence.(iii)Replace a given word with another word.
9. Solve towers of Hanoi using recursion.
10. Locate and Display the Contents of an Array using Pointers.
11. Generate salary slip of employees using structures and pointers.
12. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

TOTAL: 45 +15 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to,

- Develop C programs for simple applications making use of basic constructs,
- Implement C programs for simple applications making use of basic arrays and strings.
- Construct C programs involving functions, recursion and pointers
- Write C programs using structures.
- Design applications using sequential and random access file processing.
- Do problem solving by applying various programming methodologies.

TEXT BOOKS

1. E.Balagurusamy,"Programming in ANSI C", Tata McGraw Hill, 8th Edition, 2019.
2. Kernighan, B.W and Ritchie,D.M,"The C Programming language", 2nd Edition, Pearson Education, 2006.

REFERENCES

1. ReemaThareja, "Programming in C", Oxford University Press, 2nd Edition, 2016.
2. Juneja, B. L and Anita Seth, "Programming in C", CENGAGE Learning India pvt.Ltd., 2011.

E – RESOURCES

1. https://nptel.ac.in/courses/106/105/106105085/ (Introduction to C Programming)
2. https://nptel.ac.in/courses/106/106/106106210/ (Stack Operations)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	2	1	2	1	1	1	2	-	3	2	1	2	-
2	2	2	2	1	2	1	1	1	2	-	3	3	2	2	-
3	2	3	2	1	2	1	1	1	2	-	3	2	2	2	-
4	3	2	2	1	3	1	1	1	2	-	3	3	2	2	-
5	2	3	3	1	2	1	2	1	2	-	3	2	2	3	-
6	2	2	3	2	1	2	-	-	2	1	2	2	2	2	-
AVG	2	2.3	2.3	1.16	2	1.7	1	1	2	1	2.8	2.3	1.8	2.2	-

1-Low 2-Medium 3-High '-' – No Correlation.

SEMESTER II

23HST201	PROFESSIONAL ENGLISH - II	L T P C
	(Common to all B.E. & B.Tech. Branches)	3 0 0 3

OBJECTIVES

- To use grammatical components effectively in written communication.
- To read and understand on comprehend technical writing.
- To develop skills for writing email, business letters, Job Application Letter and Resume.
- To write checklist, recommendation, transcoding graphics and letter.
- To speak fluently in real contexts.

UNIT I GRAMMAR **9**

Articles - Prepositions - Compound words - Conditionals - Subject verb agreement - Active and Passive voice - Impersonal Passive Voice.

UNIT II LISTENING & READING **9**

Syllabification - Reading Vocabulary - Reading Newspapers - Listening to Youtube Documentaries - Listening to Podcast - Listening to Motivational Movies.

UNIT III BUSINESS WRITING **9**

E-mail writing - fixing an appointment, cancelling appointment, conference details, training programme details, paper submission for seminars and conferences - Job Application Letter and Résumé.

UNIT IV WRITING **9**

Checklist - Writing Recommendations - Transcoding Graphics - Bar Chart, Flow Chart, Pie Chart and Tables - Formal Letter Writing - inviting dignitaries and declining invitations.

UNIT V SPEAKING **9**

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging - Suggesting - Comparing and Contrasting – Expressing - Finding out facts, attitudes and opinions - Situational Role-play.

TOTAL: 45 PERIODS

Mandatory activity: PowerPoint Presentation

OUTCOMES

Upon completion of the course, the students will be able to:

- Use grammar to frame sentences and write sentences in passive forms
- Read vocabulary, newspaper and improve listening skills
- Draft emails, write business letters, construct resume with job application letter.
- Frame checklist, write recommendation and Transcoding graphical representation.
- Develop speaking skill for taking part in Collaborative task and Situational Role-play.

TEXT BOOKS

1. S. Sumant Maven Learning. Technical English II.
2. KN Shoba, Lourdes Joavani Rayen. Communicative English. Published by Cambridge university, 2017.

REFERENCES

1. Dr K Elango, Dr. Veena Selvam, Dr. Sujatha Priyadarshini, "Resonance English for Engineers and Technologists", Cambridge University Press, 1st Edition, Foundation Books, New Delhi, 2013.
2. Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.
3. Norman Whitby, Business Benchmark- Pre-Intermediate to Intermediate, Students book, Cambridge University Press, 2006.

E-RESOURCES

1. https://www.fluentu.com/Blog/english/english-small-talk
2. https://www.britishcouncil.com

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	1	1	-	2	3	-	3	-	-	-
2	-	-	-	-	2	1	1	1	2	3	-	3	-	-	-
3	-	-	-	-	2	1	2	1	2	3	-	3	-	-	-
4	-	-	-	-	-	1	1	1	1	3	-	3	-	-	-
5	-	-	-	-	-	2	1	1	3	3	-	3	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	-	-	-	-	2.00	1.20	1.20	1.00	2.00	3.00	-	3.00	-	-	-

1- Low 2-Medium 3-High '-' – No Correlation

23MAT201 STATISTICS AND NUMERICAL METHODS WITH MATLAB LT P C

(Common to all B.E. & B.Tech. Branches) **3 1 0 4**

OBJECTIVES

- To provide the necessary basic concepts in testing of hypothesis for small and large samples which plays an important role in real life problems.
- To acquaint the knowledge of classifications of design of experiments.
- To extend the basic concepts of solving algebraic and transcendental equations.
- To apply the numerical techniques of interpolation and integration.
- To produce the knowledge of various techniques in solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 9+3

Sampling distribution - Testing of significance for single proportion, single mean and difference of means - Test of significance for small samples by 't' test - Snedecor's F- test of significance - Chi-square test : Chi-square test of goodness of fit - Independent of attributes.

UNIT II DESIGN OF EXPERIMENTS 9+3

Basic principles of experimental design - Completely randomised design - Analysis of vaiance for one way classification - Randomised block design - Analysis of variation for two factor experiments variations - Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations by Newton Raphson method - Solution of simultaneous algebraic equations by Gauss elimination, Gauss Jordan and Gauss Seidel methods - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method.

UNIT IV INTERPOLATION AND NUMERICAL INTEGRATION 9+3

Interpolation: Newton's forward and backward interpolation formulae - Lagrange's interpolation formula - Newton's divided difference formula - Numerical integration by Trapezoidal and Simpson's 1/3 rule - Numerical double integration by Trapezoidal rule.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

Euler's method - Modified Euler's method - Fourth order Runge - Kutta method for solving first order equations - Taylor's series method - Predictor-corrector methods: Milne's method - Adams-Bash forth method.

LIST OF TUTORIALS

1. Solving one sample and paired sample't' test.
2. Determination of roots of a polynomial.
3. Solution of linear system of equations by Gauss Seidel methods.
4. Evaluation of line integrals by Trapezoidal rule.
5. Solution of ordinary differential equations by Euler's method.

TOTAL: 45+15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Summarize the numerical techniques of interpolation in various intervals and apply the numerical techniques of integration for engineering problems.
- Produce various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial conditions by using certain techniques with engineering applications.

TEXT BOOKS

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2. Dr.Kandasamy. P, Dr.Thilagavathy . K and Dr. Gunavathy .K., "Statistics and Numerical Methods", S. Chand and Company Ltd., NewDelhi, 2010.

REFERENCES

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Gupta S.C. and Kapoor V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, 12th Edition, New Delhi, 2020.

E-RESOURCES

1. https://nptel.ac.in/courses/111/105/111105041/ (Statistics)
2. https://nptel.ac.in/courses/111/107/111107105/ (Numerical Methods)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-
2	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-
3	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-
4	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-
5	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	3	1	1	2	-	-	-	1	-	2	3	-	-	-

1-Low 2-Medium 3-High '-' – No Correlation

23PHT203 ADVANCED PHYSICS FOR ELECTRONICS ENGINEERING L T P C
(Common to ECE, EEE & Medical Electronics) **3 0 0 3**

OBJECTIVES

- To Learn the basic conduction process in conducting materials
- To understand the fundamentals of semiconducting materials and plastic electronics.
- To develop the knowledge in Magnetic and Superconducting materials.
- To grab the concept of Spintronics & Nano Electronic Devices
- To know the basics of Biophotonics and Biomaterials.

UNIT I CONDUCTING MATERIALS & DIELECTRIC MATERIALS 9

Conductors - Classical Free Electron Theory of Metals - Electrical and Thermal Conductivity - Wiedemann - Franz law, Lorentz number - Draw backs of Classical Theory - Fermi Dirac distribution function - Density of energy states - Carrier concentration in metal. Dielectric Materials: Electrical Susceptibility - Dielectric constant - Electronic, Ionic, Orientation and Space Charge Polarization - Internal filed and Clausius-Mosotti Relation.

UNIT II SEMICONDUCTING MATERIALS & PLASTIC ELCTRONICS 9

Elemental and Compound Semiconductors - Intrinsic Semiconductor - Carrier concentration derivation in Intrinsic Semiconductor - Extrinsic semiconductor - Derivation of carrier concentration in N-type and P-type semiconductor (qualitative) - Hall effect and applications.

Plastic Electronics: Principle of Organic Materials (OMs) - Properties of OMs, Including Electronic and Optical Properties - Organic devices and working principles (*ex.* Transistors, Diodes, Sensors, Solar cells) - Applications of organic materials and Devices.

UNIT III MAGNETIC & SUPERCONDUCTING MATERIALS 9

Electron theory of magnetism; Dia, Para, Ferromagnetism and their Properties - Domain theory of Ferromagnetism - Hard and Soft magnetic Materials - Ferrites - Superconductivity: Properties - Type I and Type II Superconductors - BCS theory of superconductivity - General applications of Superconductors - Cryotron and Magnetic levitation.

UNIT IV SPINTRONICS & NANO ELECTRONIC DEVICES 9

Introduction - Quantum confinement- Quantum well, Quantum Wire and Quantum Dot structure - Tunnelling: Single Electron Phenomena and Single Electron Transistor (SET) - Spintronics - Quantum Dot Laser - Quantum Bits (qubits)- Quantum Computing - Carbon Nano Tubes (CNT) structure, Properties and applications - Concepts of Graphene Transistor - Carbon nano tube transistor (qualitative) - Applications of Nanodevices and Nanosensors.

UNIT V BIOPHOTONICS & BIOMATERIALS 9

Biophotonics: Basic principles of light - Reflection - Refraction - Absorption - Polarization - Interference - Coherence- Principles of Optical biosensing - Immobilization of Bio-recognition elements-Types of Optical Biosensor

Biomaterials: Definition and classification of Bio-Material - Viscoelasticity and biomaterial performance- Stainless Steel Alloys and its applications - Biopolymers and its Applications - Shape Memory Alloy.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, students will be able to;

- Obtain knowledge from conducting and dielectric properties of materials.
- Learn the fundamentals of plastic electronics, semiconductor physics, and how these technologies are used in many types of electronic devices.
- Utilise the uses of magnetic and superconducting materials.
- Demonstrate knowledge and understanding of spintronics and nano electronic devices
- Identify and explain the fundamentals of biophotonics and biomaterials.

TEXT BOOK

1. Rajendran V. "Engineering Physics". Tata McGraw Hill Publications, 2012.
2. R,Murugesan, Er,Kiruthiga sivaprasath Modern physics, S.chand, seventh Edition.2013
3. Gupta and Kumar, "Solid State Physics" K. Nath & Co. (2018)

REFERENCES

1. Sujata V. Bhatt, "Biomaterials", Second Edition, Narosa Publishing House, 2005.
2. Avadhanulu M.N & Kshirsagar P.G "Text Book of Engineering Physics". S.Chand, 2006.
3. Charles Kittel "Introduction to Solid State Physics", Wiley (2019)
4. D.N. Vasudeva "Electricity and Magnetism" S.Chand&Co, twelfth edition (2007)

E – RESOURCES

1. https://archive.nptel.ac.in/courses/115/101/115101092/
2. https://nptel.ac.in/courses/108104113

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	1	1	1	1	1	-	-	-	-	-	-	-	-
2	3	2	1	1	1	1	1	-	-	-	-	-	-	-	-
3	3	2	1	1	1	1	1	-	-	-	-	-	-	-	-
4	3	2	1	1	1	1	1	-	-	-	-	-	-	-	-
5	3	2	1	1	1	1	1	-	-	-	-	-	-	-	-
6	3	2	1	1	1	1	1	-	-	-	-	-	-	-	-
AVG	3	2	1	1	1	1	1	-	-	-	-	-	-	-	-

1- Low 2-Medium 3-High '-' – No Correlation

23CYT201 ENVIRONMENTAL SCIENCE AND SUSTAINABILITY LT P C

(Common to all B.E. & B.Tech. Branches) **3 0 0 3**

OBJECTIVES

- To understand the importance of the environment, ecosystem, biodiversity and its conservation.
- To impart knowledge on various kinds of pollutions, solid waste management and precautionary measures for disasters.
- To be familiar with the social issues and identify the possible way to improve the quality of the environment.
- To analyze the problems of overpopulation and understand the value education.
- To familiarize the concept of sustainability and implement sustainable practices in various fields.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 9

Definition, scope and importance of environment - Need for public awareness - Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, rivers, oceans) - Introduction to biodiversity definition: genetic, species and ecosystem diversity - Biogeographically classification of India - Value of biodiversity - India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity - Endangered and endemic species of India - Conservation of biodiversity: In-Situ and Ex-Situ conservation of biodiversity.

Activity: Biodiversity in and around the campus and report submission.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Solid waste management: causes, effects and control measures of municipal solid wastes - E-waste – Role of an individual in prevention of pollution - Pollution case studies – Disaster management: floods, earthquake and cyclone.

Activity: Local pollution case study and report submission.

UNIT III SOCIAL ISSUES AND THE ENVIRONMENT 9

From unsustainable to sustainable development – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, case studies - Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Wasteland reclamation – Green Chemistry and principles - Environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – Public awareness.

Activity: Creating environmental awareness.

UNIT IV HUMAN POPULATION AD THE ENVIRONMENT 9

Population growth, variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health – Case studies.

Activity: Visit to local primary health center.

UNIT V SUSTAINABLE MANAGEMENT 9

Sustainability-Concept, needs and challenges-economic, social and aspects of sustainability-From unsustainability to sustainability-Millennium development goals, and protocols-Sustainable Development Goals-Targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-Case studies. Zero waste and R concept, Material Life cycle assessment, Environmental Impact Assessment, Sustainable habitat: Energy efficiency, Sustainable transports.

Activity: Field trips to local organizations or facilities with sustainable practices in place.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Acquire knowledge on public awareness & about the environment, ecosystem and biodiversity.
- Find solutions for pollutions and waste management to improve the quality of environment.
- Identify the causes of social issues and apply the concept of green chemistry to maintaining a clean environment.
- Analyze the effects of human population and issues related to the environment and human health.
- Understand the different goals of sustainable development and apply them for suitable technological advancement and societal development.

TEXT BOOKS

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
3. Allen, D. T. and Shonnard, D. R., 'Sustainability Engineering: Concepts, Design and Case Studies', Prentice Hall.

REFERENCES

1. Erach Bharucha, 'Textbook of Environmental Studies', Universities Press(I) Pvt Ltd, Hydrabad, 2015.
2. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, 2007.
3. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

E-RESOURCES

1. https://nptel.ac.in/courses/122102006/
2. https://swayam.gov.in/nd1-noc19-ge22/preview

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	1	3	2	-	1	3	-	1	-	-	1	-	-	-
2	2	2	2	2	2	2	1	-	-	-	-	-	-	-	-
3	-	2	2	2	1	1	3	-	-	-	-	-	-	-	-
4	1	2	2	1	1	2	3	3	-	-	-	-	-	-	-
5	-	2	2	2	2	1	1	1	-	2	-	-	-	-	-
AVG	1.5	1.8	2.2	1.8	1.5	1.4	2.2	2	1	2	-	1	-	-	-

1-Low 2-Medium 3-High '-' – No Correlation

23HST202 **TAMILS AND TECHNOLOGY** **LT P C**
1 0 0 1

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)-ThirumalaiNayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project

TOTAL: 15 PERIODS

TEXT BOOKS

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)

7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

REFERENCE BOOKS

1. Heritage of Tamils, Published by:Yes Dee Publishing Pvt Ltd, Chennai
2. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

23HST202 **தமிழரும் தொழில்நுட்பமும்** **LT P C 1 0 0 1**

அலகு I **நெசவு மற்றும் பானைத் தொழில்நுட்பம்**: 3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II **வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்**: 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு III **உற்பத்தித் தொழில் நுட்பம்**: 3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV **வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்**: 3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு V **அறிவியல் தமிழ் மற்றும் கணித்தமிழ்**: 3

அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TOTAL: 15 PERIODS

TEXT BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)

REFERENCE BOOKS

1.தமிழரும் தொழில்நுட்பமும், முனைவர் கே பூபாலன் வி ஆர் பி பப்ளிஷர்ஸ்

23GEE201 **ENGINEERING GRAPHICS** **LT P C**

(Common to all B.E. & B.Tech. Branches) **3 0 2 4**

OBJECTIVES

- To acquire the knowledge of various curves.
- To learn projections of points, lines, planes viewed in different positions.
- To impart the graphic skills for converting pictorial views of solids in to orthographic views and perspective projections.
- To learn the principles of projection of simple solids.
- To gain the knowledge about the section of solids and development of surfaces of the given solids.

UNIT I PLANE CURVES (Manual drafting) **9+3**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, Types of Lines, Dimensioning Systems as per BIS conventions. **(Not for Examination)**
Construction of ellipse – Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the curves.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES (Manual drafting) **9+3**

Projection of points – Projection of straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to one reference planes.

UNIT III ORTHOGRAPHIC AND PERSPECTIVE PROJECTIONS (Manual drafting) **9+3**

Conversion of isometric projection into orthographic projection. Perspective projection of prisms, pyramids, cones and cylinders by visual ray method.

UNIT IV PROJECTION OF SOLIDS (CAD software) **9+3**

Projections of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT V SECTION OF SIMPLE SOLIDS AND DEVELOPMENT OF SURFACES (CAD software) **9+3**

Sectioning of simple solids like prisms – pyramids, cylinder and cone - Inclined to one reference plane. Development of lateral surfaces of simple and truncated solids: Prisms, Pyramids, Cylinders and Cones.

TOTAL: 45+15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Predict the construction of various curves.
- Analyze the principles of projection of various planes by different angle to project points, lines and plane surfaces.
- Draw the projection of three dimensional into two dimensional objects and perspective projections**.**
- Draw the principles of projection of simple solids by change of position method.
- Construct the sectional views of components and develop the component surface.

TEXT BOOKS

1. Venugopal K. and Prabhu Raja V., - "Engineering Graphics", 15th Edition, New Age International (P) Limited, 2018.
2. Natarajan K.V., "Engineering Graphics", 32nd Edition, Dhanalakshmi Publishers, 2019.
3. Bhatt N.D., "Engineering Drawing", 53rd Edition Charotar Publishing House Pvt. Ltd., 2014.

REFERENCES

1. K.R. Gopalakrishna, "Engineering Drawing Volume 1 & 2", 55th Edition, Subhas Publications, Bangalore, 2017.
2. T.Jeyapoovan., "Engineering Graphics using Auto CAD" 3rd Edition, vikas publishing house Pvt Ltd, New Delhi, 2017.
3. Dhananjay A. JoIhe, Engineering Drawing with an introduction to AutoCAD, Tata McGraw Hill Publishing Company Limited, 2008.

E- RESOURCES

1. https://nptel.ac.in/courses/112/103/112103019/ - (Geometric Constructions)
2. https://nptel.ac.in/courses/105/104/105104148/ - (Projections)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	2	-	2	2	-	-	-	2	-	2	2	2	2
2	3	2	2	-	2	2	-	-	-	2	-	2	2	2	2
3	3	2	2	-	2	2	-	-	-	2	-	2	2	2	2
4	3	2	2	-	2	2	-	-	-	2	-	2	2	2	2
5	3	2	2	-	2	2	-	-	-	2	-	2	2	2	2
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	2	2	-	2	2	-	-	-	2	-	2	2	2	2

1-Low 2-Medium 3-High '-' – No Correlation.

23EEE201 **CIRCUIT THEORY** **LT P C**

(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To introduce electric circuits and its analysis
- To impart knowledge on solving circuit equations using network theorems
- To introduce the phenomenon of resonance and coupled circuits
- To educate on obtaining the transient response of circuits
- To introduce Phasor diagrams and analysis of three phase circuits
- To simulate various electric circuits using MATLAB.

UNIT I BASIC CIRCUITS ANALYSIS **9**

Ohm's Law - Kirchhoff's laws - DC and AC Circuits - Resistors in series and parallel circuits - Mesh current and node voltage method of analysis for D.C and A.C. circuits - Sinusoidal steady State analysis of RL-RC-RLC circuits.

UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS **9**

Network reduction: Voltage and current division, source transformation – Star-Delta conversion. Thevenin's and Norton's Theorem - Superposition Theorem - Maximum power transfer theorem - Reciprocity Theorem with Matlab simulation - Application to DC and AC Circuits.

UNIT III RESONANCE AND COUPLED CIRCUITS **9**

Series and parallel resonance - Frequency response - Quality factor and Bandwidth - Self and mutual inductance - Dot rule - Coefficient of coupling - Tuned circuits - Single tuned circuits.

UNIT IV TRANSIENT ANALYSIS **9**

Natural response - Forced response - Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input - Characterization of two port networks in terms of Z, Y, h and ABCD parameters.

UNIT V THREE PHASE CIRCUITS **9**

Average and RMS value - Phasor diagram - Power, power factor and Energy - Analysis of three phase 3 - wire and 4 - wire circuits with star and delta connected loads, balanced & unbalanced - Phasor diagram of voltages and currents - Power and power factor measurements in three phase circuits.

LIST OF EXPERIMENTS

1. Simulation and Experimental verification of electrical circuit problems using Kirchhoff's voltage and current laws.
2. Simulation and Experimental verification of electrical circuit problems using Thevenin's theorem and Norton's theorem.
3. Simulation and Experimental verification of electric circuit problems using Superposition theorem and Maximum Power transfer Theorem.
4. Simulation and Experimental validation of R-C electric circuit transients

5. Simulation and Experimental validation of frequency response of RLC electric circuit.
6. Simulation of three phase balanced and unbalanced star, delta networks circuits
7. Calibration of single phase Energy meter.

TOTAL : 45+15 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Learn the basic concepts of DC and AC electrical circuits
- Understand and apply the knowledge of circuit theorems
- Acquire knowledge about resonance and coupled circuits
- Apply the concepts in transients
- Analyze the three phase circuits
- Understand and apply circuit theorems and concepts in engineering applications.

TEXT BOOKS:

1. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, New Delhi, 9th edition, 2020.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", McGraw Hill, 2nd Edition, 2019.

REFERENCES:

1. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpat Rai Publishing Co Pvt Ltd, New Delhi, 7th Edition, 2018.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, 5th Edition, 2017.

E-RESOURCES:

1. https://nptel.ac.in/courses/108102042/ - (Circuit Theory)
2. https://nptel.ac.in/courses/108104139/ - (Basic Electric Circuit)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	-	-	-	-	-	2	-	3	3	1	2
2	3	3	3	3	-	-	-	-	-	2	-	3	3	1	2
3	3	3	3	3	-	-	-	-	-	2	-	3	3	1	2
4	3	3	3	3	-	-	-	-	-	2	-	3	3	1	2
5	3	3	3	3	-	-	-	-	-	2	-	3	3	1	2
6	3	3	3	3	3	-	-	-	3	2	-	3	3	1	2
AVG	3	3	3	2.8	3	-	-	-	3	2	-	3	3	1	2

1-Low 2-Medium 3-High '-' – No Correlation.

23GEL201 ENGINEERING PRACTICES LABORATORY LT P C
0 0 4 2

OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in commonhousehold wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used inhousehold appliances.

WOOD WORK:

a) Sawing,
b) Planing and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

a) Introduction to switches, fuses, indicators and lamps - Basic switch boardwiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type usingDiac/Triac/quadrac)
g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:

Assembling a centrifugal pump.
Assembling a household mixer.
Assembling an airconditioner.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

Study an elements of smart phone..
Assembly and dismantle of LED TV.
Assembly and dismantle of computer/ laptop.

TOTAL: 60 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.

CO2: Wire various electrical joints in common household electrical wire work.

CO3: Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.

CO4: Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
2	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
3	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
4	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
5	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
AVG	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1

1-Low 2-Medium 3-High '-' – No Correlation.

23EEC201 **COMMUNICATION SKILLS** **L T P C**

(Common to all B.E. & B.Tech. branches) **0 0 4 2**

OBJECTIVE

- To use vocabularies appropriately in a sentence and various situations.
- To improve communicative competence through listening.
- To make effective presentations and group discussions.
- To read and recognize different context.
- To write paragraph, essay and special addresses.

Unit I VOCABULARY **6**

Vocabulary building – Articulate ideas and thoughts; usage of palindromes, greetings, wishes, festival related words - Vocabulary Words with Sentences. - Idiomatic Expressions.

Unit II LISTENING **6**

Listening Skill- Its importance – Purpose - Process - Types- Barriers - Effective Listening strategies- Listening to telephonic conversations – Watching Inspiring Speech videos on Youtube - Listening native speaker's videos for pronunciation - Listening to broadcast, messages, announcements - Listening to Instagram Videos.

Unit III SPEAKING **6**

JAM Talk - Role play - Debate - Conversational skills (formal and informal) - Conversation practice - Group Discussion and Interview Skills – Introducing oneself and others – Goal Settings - Immediate, Long term and short term.

Unit IV READING **6**

Reading for the Main idea- Finding Specific Information - Reading for Detail - Read and recognize different text types ranging from newspaper, articles, magazines, books and Reading autobiographies.

Unit V WRITING **6**

Paragraph Writing - Essay writing - Creative writing - Special Address on Specific topic - Welcome Address, vote of Thanks.

TOTAL: 30 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Improve vocabulary and express the same contextually.
- Listen and comprehend the general and technical text.
- Speak effectively in presentation, debate and group discussions.
- Read and understand the concept from newspapers, articles, magazines and books.
- Draft special addresses, welcome address, vote of thanks and write paragraph and essay.

TEXT BOOKS

1. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011
2. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011

REFERENCES

1. Davis, Jason and Rhonda LIss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan:
3. Anderson, Kenneth et al. Study Speaking: A Course in Spoken English for Academic Purposes. United Kingdom: Cambridge University Press 1992.
4. Technical communication by Asraf rezvi

EXTENSIVE READING

1. Dr. A. P. J. Abdul Kalam " Wings of Fire "

E-RESOURCES

1. https://youglish.com
2. https://newsinlevels.com
3. https://britishcouncil.org
4. https://writeandimprove.com

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	1	1	1	1	3	-	3	-	-	-
2	-	-	-	-	-	1	-	-	1	3	-	3	-	-	-
3	-	-	-	-	-	1	2	2	3	3	-	3	-	-	-
4	-	-	-	-	-	2	2	-	3	3	-	3	-	-	-
5	-	-	-	-	-	1	1	-	1	3	-	3	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	-	-	-	-	-	1.2	1.5	1.5	1.8	3	-	3	-	-	-

1- Low 2-Medium 3-High '-' – No Correlation

SEMESTER III

23MAT301	**TRANSFORMS AND COMPLEX FUNCTIONS**	**L T P C**
	(Common to all B.E. & B.Tech. Branches)	**3 0 2 4**

OBJECTIVES

- To explain Fourier transforms techniques used in wide variety of situations.
- To utilize the effective mathematical tools to develop Z transform techniques for discrete time systems.
- To apply the Fourier series analysis to many applications in engineering to solve boundary value problems.
- To develop the fundamental concepts in analytic functions, conformal mapping and bilinear transformations.
- To extend the standard techniques of complex integration.

UNIT I FOURIER TRANSFORMS **9+3**

Statement of Fourier integral theorem - Fourier transform - Fourier sine and cosine transforms - Properties of Fourier transform - Convolution theorem for Fourier transform - Parseval's identity for Fourier transform

UNIT II Z-TRANSFORMS AND DIFFERENCE EQUATIONS **9+3**

Z-transforms: Some standard Z-transforms - Elementary properties - Some useful Z-transforms and inverse Z- transforms - Convolution theorem - Evaluation of Inverse Z-transforms by partial fraction method - Application to difference equations.

UNIT III FOURIER SERIES **9+3**

Euler's formulae - Conditions for a Fourier expansion - Functions having points of discontinuity - Odd and even function - Half range series - Parseval's formula - Practical Harmonic analysis.

UNIT IV ANALYTIC FUNCTIONS **9+3**

Cauchy-Riemann equations - Analytic functions - Properties of analytic functions - Harmonic functions - Orthogonal system - Construction of analytic functions - Bilinear transformation - Conformal transformation by $w = 1/z$.

UNIT V COMPLEX INTEGRATION **9+3**

Cauchy's theorem - Cauchy's integral formula - Taylor's and Laurent's series - Residues: Residue theorem - Calculation of residues - Evaluation of real definite integrals: Integration around the unit circle.

LIST OF TUTORIALS

1. Calculate Fourier transform of simple functions.
2. Solve difference equations by Z transforms.
3. Computation of Fourier series coefficient.
4. Determination of Bilinear transformation for the given set of points.
5. Calculate complex line integration.

TOTAL: 45+15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze some of the physical problems of engineering by Fourier transforms.
- Apply Z transforms techniques in solving difference equation.
- Solve differential equations using Fourier series analysis.
- Develop the concept of analytic functions, conformal mapping and bilinear transformations.
- Evaluate integrals using Cauchy's integral formula and residue theorem.

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Erwin Kreyszig, "Advanced Engineering Mathematics ", 10thEdition, John Wiley, India, 2016.

REFERENCES

1. N.P. Bali. and Manish Goyal, "A Textbook of Engineering Mathematics", 9thEdition, Laxmi Publications Pvt. Ltd, 2014.
2. Dr.Kandasamy. P, Dr.Thilagavathy . K and Dr. Gunavathy .K., "Engineering Mathematics -Volume III", S. Chand and Company Ltd., NewDelhi, 2010.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/111/102/111102129/# (Transforms)
2. https://archive.nptel.ac.in/courses/111/105/111105134/ (Complex functions)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-
2	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-
3	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-
4	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-
5	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3	3	1	-	2	-	-	1	2	-	-	2	-	-	-

1-Low 2-Medium 3-High '-' – No Correlation

23EET301 ELECTROMAGNETIC THEORY LT P C
3 1 0 4

OBJECTIVES

- To provide the basic mathematical concepts related to electromagnetic vector fields.
- To impart knowledge on the concepts of Electrostatics and time varying fields.
- To discuss about the concepts of magnetostatics and time varying fields.
- To impart knowledge on the concepts of Faraday's law, induced emf and Maxwell's equations.
- To identify, formulate and solve fields and electromagnetic waves propagation problems.

UNIT I VECTOR ANALYSIS 9+3

Sources and effects of electromagnetic fields - Scalar and Vector fields - Coordinate systems: Rectangular, Cylindrical and Spherical - Relationship between coordinate systems - Gradient, Divergence and Curl - Divergence theorem - Stoke's theorem - MATLAB Simulation of coordinate systems.

UNIT II ELECTROSTATICS 9+3

Coulomb's Law - Electric field intensity and Electric potential: due to point and continuous charges - Electric field and potential due to finite line charge, circular disc and infinite sheet of charge, two concentric shells and coaxial cylinders - Electric flux density - Gauss's law and applications - Electric field in dielectric and equipotential plots - Electric Dipole - Electric field in multiple dielectrics - Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

UNIT III MAGNETOSTATICS 9+3

Lorentz force, Magnetic field intensity (H) - Biot–Savart's Law - Ampere's Circuit Law - H due to straight conductors, Circular loop, Infinite sheet of current, Magnetic flux density (B) - B in free space, conductor, magnetic materials - Magnetization, Magnetic field in multiple media - Boundary conditions, Scalar and Vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density - Finite Element Method Magnetic (FEMM) simulation tool - Applications.

UNIT IV ELECTRODYNAMIC FIELDS 9+3

Magnetic Circuits - Faraday's law - Transformer and motional EMF - Conduction and Displacement current - Maxwell's equations (Differential and Integral form) - Ohm's law in point form - Relation between field theory and circuit theory - Applications.

UNIT V ELECTROMAGNETIC WAVES 9+3

Electromagnetic wave generation and equations - Wave parameters, velocity, intrinsic impedance, propagation constant - Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector - Plane wave reflection and refraction - Standing Wave - Applications.

TOTAL : 60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Describe the basic mathematical concepts related to electromagnetic vector fields.
- Apply basic laws of electrostatics to various applications and to determine force, electric field intensity.
- Analyse the principles of magnetostatics to the solutions of problems relating to magnetostatic fields.
- Summarize the concepts of electrodynamics & to derive and discuss the Maxwell's equations.
- Apply Maxwell's equations to solutions of problems relating to wave propagation.

TEXT BOOKS

1. Mathew N. O. Sadiku, 'Principles of Electromagnetics', 6th Edition, Oxford University Press Inc.First India edition, 2015.
2. William H. Hayt and John A.Buck, 'Engineering Electromagnetics, Tata McGraw Hill 9th Revised edition, 2020.

REFERENCES

1. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, 2nd Edition (Schaum's Outline Series), Tata McGraw Hill, 2017.
2. K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; 8th Reprint: 2015.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/108/104/108104087/ - (Electromagnetic Theory).
2. https://nptel.ac.in/courses/108106157 - (Transmission lines and Electromagnetic Waves).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	-	2	1	-	1	-	2	3	-	3
2	3	3	3	2	-	-	2	1	-	1	-	2	3	-	3
3	3	3	3	2	2	-	2	1	-	1	-	2	3	-	3
4	3	3	3	2	-	-	2	1	-	1	-	2	3	-	3
5	3	3	3	2	-	-	2	1	-	1	-	2	3	-	3
AVG	3	3	3	2	2	-	2	1	-	1	-	2	3	-	3

1-Low 2-Medium 3-High '-' – No Correlation.

23EET302 MEASUREMENTS AND INSTRUMENTATION LT P C
3 0 0 3

OBJECTIVES

- To educate the fundamental concepts and characteristics of measurement and errors.
- To impart the knowledge on the functional aspects of measuring instruments
- To infer the importance of various bridge circuits used with measuring instruments.
- To summarize the overall measurement and instrumentation with the knowledge on digital instrumentation principles.
- To educate the fundamental working of sensors and transducers and their applications.

UNIT I INTRODUCTION 9

Functional elements of an instrument - Static characteristics: true value, static error, static correction,reproducibility, drift, repeatability, noise, signal to noise ratio, accuracy and precision, sensitivity, linearity, threshold, dead zone, resolution - Dynamic characteristics: speed of response, fidelity, lag, dynamic error - Errors: gross error, systematic error and random error - Statistical evaluation of measurement data – Standards and calibration.

UNIT II ELECTRICAL AND ELECTRONICS INSTRUMENTS 9

Principle and operation of analog voltmeters and ammeters: Moving iron: Attraction and repulsion type instruments. Moving coil instruments; PMMC, Dynamometer type, torque equation - Single phase dynamometer type watt meter, toque expression - Single phase induction type energy meters - Measurement of power using instrument transformers - Single phase electro-dynamometer power factor meters and Weston frequency meter.

UNIT III COMPARATIVE METHODS OF MEASUREMENTS 9

DC bridges: Wheatstone bridge, Kelvin's double bridge,Megger - AC bridges: Maxwell"s, Anderson,Schering, Wien - Transformer ratio & Self - balancing bridges - Interference & Screening - Multiple earths and earth loops - Electrostatic and electromagnetic interference - Grounding techniques - Basic Script based Matlab Programming

UNIT IV DIGITAL INSTRUMENTS AND DISPLAY DEVICES 9

Digital voltmeter: Ramp, Integrating and Successive approximation - Digital multi-meter - CRT display, dot matrix display, LED and LCD display - Digital energy meter - Digital Storage Oscilloscope (DSO) - Digital printers and plotters - Recorders: X-Y graphic recorders - Q-meter - Data loggers - Smart meters.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers - Selection of transducers - Resistive, capacitive and inductive transducers - Measurement of temperature - RTD, thermistors and thermocouples - Piezoelectric transducers - Digital transducers - Optical encoders - Elements of data acquisition system - A/D & D/A converters - Smart sensors.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Acquire knowledge on Basic functional elements of instrumentation.
- Understand the concepts of Fundamentals of electrical and electronic instrument.
- Compare between various measurements techniques.
- Acquire knowledge on various storage and display devices.
- Identify the various concept of transducers and data acquisition systems.

TEXT BOOKS

1. A.K.Sawhney, "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai & Co, 2 nd Edition, 2021.
2. R.K.Rajput, "Electrical Measurements and Measuring Instruments", S.Chand and Company Pvt. Ltd. 4th Edition, 2016.

REFERENCES

1. D.V.S. Moorthy, "Transducers and Instrumentation", Prentice Hall of India Pvt Ltd, 3 rd Edition 2022.
2. E.O.Doebelin, "Measurement Systems - Application and Design", Tata McGraw Hill Publishing Company, 6th Edition 2019.

E-RESOURCES

1. https:// nptel.ac.in/courses/108/105/108105064/- (Industrial Instrumentation)
2. https://nptel.ac.in/courses/108/105/108105153/- (Electrical Measurements)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	-	-	2		2	-	1	-	3	3	-	3
2	3	-	3	-	-	-	-	-	-	1	-	3	3	-	3
3	3	-	3	-	3	2	-	-	-	1	-	3	3	-	3
4	3	-	3	-	-	-	-	2	-	1	-	3	3	-	3
5	3	-	3	-	-	-	-	-	-	1	-	3	3	-	3
AVG	3	2	3	-	3	2	-	2	-	1	-	3	3	-	3

1-Low 2-Medium 3-High '-' – No Correlation

23EEE301 **DC MACHINES AND TRANSFORMERS** **LT P C**

(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To learn the working principles of electrical machines with concepts of electromechanical energy conversion.
- To realize construction, principle of operation and characteristics of DC generators
- To recognize the working principle, characteristic and starting of DC motor
- To know construction, working principles, testing and efficiency of Transformer.
- To study the performance of DC machines and transformers with different testing methods
- To expose the students to the operation of D.C. machines and transformers and give them experimental skill.

UNIT I BASIC CONCEPTS IN ROTATING MACHINES **9**

Magnetic circuits and calculations - Statically and dynamically induced EMF - Principle of electromechanical energy conversion forces and torque in magnetic field systems - Energy balance in magnetic circuits - Magnetic force- co-energy in singly excited and multi excited magnetic field system

UNIT II DC GENERATORS **9**

Construction - Principle of operation - Lap and wave winding - E.M.F equations - Types of DC Generators - Losses and Efficiency - Armature reaction - Methods of excitation - Commutation and inter poles - Compensating winding - Characteristics of DC generators - Simulation on DC Machine Characteristics.

UNIT III DC MOTORS **9**

Principle and operations - Types of DC motors - Characteristics of DC Motors - Stating and speed control of DC motors - Plugging, Dynamic and Regenerative braking - Simulation on speed control of DC motor.

UNIT IV TRANSFORMERS **9**

Construction - Principle of operation - Equivalent circuit - Inrush current - Three phase transformers connections - Phasing of transformer - Parallel operation of transformers - Auto transformer - Simulation on Three phase Transformers.

UNIT V TESTING OF DC MACHINES AND TRANSFORMERS **9**

Testing of DC Machines: Brake test, Swinburne's test, Retardation test, Hopkinson's test and Field's test for series motor - Testing of transformers: Load test, open circuit and short circuit test - Finding losses and efficiency of transformer.

LIST OF LAB EXPERIMENTS

1. Open circuit and load characteristics of Self-Excited DC shunt generator.
2. Load test of DC shunt and series motor.
3. Load test on DC compound motor.
4. Swinburne's test of DC shunt motor.
5. Speed control of DC shunt motor.

6. Load test on single-phase transformer and three - phase transformer.
7. Open circuit and short circuit tests on single phase transformer.

TOTAL: 45+15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Get the basic concepts of electro mechanical energy conversion and concepts in rotating machines.
- Understand construction, principle of operation, methods of excitation and characteristics of DC generators.
- Expand the knowledge on working principle, characteristic, starting and testing of DC motors.
- Acquire information about construction, working principles of Transformer
- Analyze load test and speed control in DC Machines and transformers.
- Construct the circuit with appropriate connections for the given DC machines and transformers.

TEXT BOOKS

1. B.L.Thereja and A.K.Theraja, "A Text of Electrical Technology", S.Chand publications, Volume 1 & 2, 2021.
2. D P Kothari and I.J Nagarath, "Electrical Machines", McGraw Hill Education(India) Private Limited, 10th Edition, 2017.

REFERENCES

1. P. S. Bimbhra,"Electrical Machinery", 2nd Edition, Khanna PublicationPvt.Ltd, 2021.
2. B.R.Gupta "Fundamental of Electric Machines" New age International Publishers, 3rd Edition Reprint, 2017.

E-RESOURCES

1. https://nptel.ac.in/courses/108102146 - (DC Machines & Transformers)
2. https://www.classrcentral.com/course – (Electrical Machines)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	-	-	-	-	-	-	1	-	3	3	1	2
2	3	3	2	-	2	-	-	-	-	1	-	3	3	1	2
3	3	3	2	-	2	-	-	-	-	1	-	3	3	1	2
4	3	3	2	-	-	-	-	-	-	1	-	3	3	1	2
5	3	3	2	-	-	-	-	-	-	1	-	3	3	1	2
6	3	3	2	2	-	-	-	-	3	3	-	3	3	1	2
AVG	3	3	2	2	2	-	-	-	3	1.3	-	3	3	1	2

1-Low 2-Medium 3-High '-' – No Correlation

23EEE302 **ANALOG ELECTRONICS AND CIRCUITS** **L T P C**
(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To understand the structure of basic electronic devices.
- To analyze the operation and applications of transistor like BJT and FET.
- To explore the characteristics of amplifier gain and frequency response.
- To familiarize the basic concepts of multi stage amplifier.
- To learn the required functionality of positive and negative feedback systems.
- To provide practical knowledge on the behaviour of semiconductor devices and Integrated ICs

UNIT I DIODE AND ITS APPLICATION **9**

PN junction diodes: structure, operation and V-I characteristics - Diffusion and transition capacitance - Clipping & Clamping circuits – Rectifiers: Half Wave and Full Wave Rectifier - Display devices: LED, Laser diodes - Zener diode: structure, operation and V-I characteristics, Reverse characteristics - Zener diode as regulator - MATLAB Simulation on VI Characteristics of Diode, Rectifiers.

UNIT II TRANSISTORS AND THYRISTORS **9**

BJT, JFET, MOSFET, IGBT and UJT - structure, operation, characteristics and Biasing, Thyristors - Structure and characteristics – MATLAB Simulation on Characteristics of BJT and MOSFET.

UNIT III AMPLIFIERS **9**

BJT small signal model - Analysis of CE, CB, CC amplifiers- Gain and frequency response - MOSFET small signal model - Analysis of CS and Source follower - Gain and frequency response - High frequency analysis – Introduction to power amplifier (qualitative treatment only).

UNIT IV DIFFERENTIAL AMPLIFIER AND SWITCHING CIRCUITS **9**

BIMOS cascade amplifier, Differential amplifier - Common mode and Difference mode analysis - Switching circuits; Multivibrators; Astable, Monostable, Bistable Multivibrator - Schmitt Trigger.

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS **9**

Advantages of negative feedback - Voltage / Current, Series, Shunt feedback - Positive feedback - Oscillatiors: RC phase shift, Wien bridge, Hartley, Colpitts and Crystal oscillators.

LIST OF EXPERIMENTS

1. Characteristics of PN junction diode and Zener diode.
2. Characteristics of a NPN Transistor under common emitter configurations.
3. Characteristics of a NPN Transistor under common collector configurations.
4. Characteristics of a NPN Transistor under common base configurations.
5. Characteristics of JFET
6. Characteristics of photo diode & photo transistor, Study of light activated relay circuit.
7. Design and testing of RC phase shift and LC oscillators.

8. Single Phase half-wave and full wave rectifiers with inductive and capacitive filters.

TOTAL : 45+15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Explain the structure and working operation of basic electronic devices.
- Identify and differentiate both active and passive elements
- Analyze the characteristics of different electronic devices such as diodes and transistors
- Choose and adapt the required components to construct an amplifier circuit.
- Acquire knowledge in design and analysis of oscillators
- Understand and analyse the practical electronics circuits

TEXT BOOKS

1. David A.Bell."Electronic devices and circuits",Oxford University higher education, 5th Edition, 2018.
2. S.Salivahanan, N.Sureshkumar, "Electronic devices and circuits", McGrawhill Education, 5th Edition, 2022.

REFERENCES

1. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition, 2018.
2. V.K.Mehta, Rohit Mehta, "Principles of Electronics", S.Chand Publishing, 12th Edition, 2020.

E-RESOURCES

1. https://nptel.ac.in/courses/108/102/108102095/ - (Analog Electronic Circuits)
2. https://nptel.ac.in/courses/108/102/108102097/ - (Introduction to Electronic Circuits)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	-	2	-	-	-	-	2	-	3	3	1	2
2	3	3	2	-	2	-	-	-	-	2	-	3	3	1	2
3	3	3	2	-	-	-	-	-	-	2	-	3	3	1	2
4	3	3	2	-	-	-	-	-	-	2	-	3	3	1	2
5	3	3	2	-	-	-	-	-	-	2	-	3	3	1	2
6	3	3	2	-	-	-	-	-	3	3	-	3	3	1	2
AVG	3	3	2	-	2	-	-	-	3	2.2	-	3	3	1	2

1-Low 2-Medium 3-High '-' – No Correlation

23EEE303 DIGITAL ELECTRONICS AND LINEAR INTEGRATED CIRCUITS LT P C

(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To study various number systems and basic theorems of Boolean algebra and gate level minimization and implementation
- To practice the design of various combinational digital circuits using logic gates
- To study the analysis and design procedures for synchronous Sequential circuits
- To learn linear and non linear applications of operational amplifiers
- To interpret the internal functional blocks and the applications of Application ICs
- To learn design, testing and characterizing of circuit behavior with digital ICs and Analog ICs

UNIT I NUMBER SYSTEMS AND BOOLEAN ALGEBRA 9

Review of number systems, Types and conversion, Binary codes - Error detection and correction codes (Parity and Hamming code). Boolean theorems and properties - DeMorgan's theorem, SOP and POS forms - Logic gates - Switching functions and minimization using K-maps - Simulation of logic gates using MATLAB.

UNIT II COMBINATIONAL CIRCUITS AND PROGRAMMBLE LOGIC DEVICES 9

Design of adders, subtractors - Multiplexers and Demultiplexers - Magnitude comparator - Code Converters - Encoders and Decoders - Introduction to Programmable Logic Devices: PROM, PLA, PAL, CPLD, FPGA - Simulation of Adder and Subtractor using MATLAB.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Sequential logic- SR, JK, D and T flip flops - Level triggering and edge triggering - Counters - Asynchronous and synchronous type - Modulo counters - Shift registers - Design of synchronous sequential circuits - Moore and Mealy models - Counters, state diagram; state reduction; state assignment.

UNIT IV OPERATIONAL AMPLIFIER CHARACTERISTICS & APPLICATIONS 9

Introduction to IC - Operational Amplifier: Ideal Op-Amp, DC and AC characteristics, Inverting and Non-inverting Amplifiers - Differentiator and integrator - Sample and Hold circuit - Schmitt trigger - Multivibrators - First and second order low pass and high pass active filters - D/A converter (R - 2R ladder and weighted resistor types) - A/D converter (Flash and Successive approximation types) - Simulation of Differentiator and integrator using MATLAB.

UNIT V APPLICATION ICs 9

AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators: LM78XX, LM79XX fixed series voltage regulator - LM317, LM723 adjustable voltage regulators - Switched mode power supply - ICL 8038 function generator IC.

LIST OF EXPERIMENTS

1. Verification of Boolean theorems using digital logic gates.
2. Design and implementation of adder, subtractor and parity generator / checker circuits.
3. Design and implementation of encoder, decoder, multiplexers and demultiplexers.
4. Design and implementation of 3-bit modulo counters as synchronous and Asynchronous types
5. Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes
6. Application of Op-Amp: Inverting and non-inverting amplifier, Adder.
7. Application of Op-Amp: Comparator, Integrator and Differentiator.
8. Timer IC application: Study of NE/SE 555 timer in Astability, Monostability operation.
9. Voltage to frequency characteristics of NE/ SE 566 IC.
10. Design and implementation of a simple digital system (Mini Project).

TOTAL: 45+15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Use electronic circuits involved in the design of logic gates
- Design various combinational digital circuits and PLDs
- Acquire and design synchronous sequential circuits using flip-flops
- Generate Waveforms using Op - Amp circuits
- Analyze the Application of ICs
- Design and implement circuits with digital ICs like decoders, multiplexers and analog ICs like timers, VCOs

TEXT BOOKS

1. M. Morris Mano, Michael D.Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", Pearson Education, 6th Edition, 2018.
2. D. Roy Choudhary, Shail B. Jain, "Linear Integrated Circuits", New Age International Publishers, 1st Edition, 2021.

REFERENCES

1. A. Anand Kumar, "Fundamentals of Digital Circuits", PHI Education, 4th Edition, 2016.
2. S.Salivahanan, V.S.Kanchan Bhaaskaran, "Linear Integrated Circuits", Tata McGraw Hill Education, 2nd Edition, 2017.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/117/105/117105080/ - (Digital Systems Design)
2. https://archive.nptel.ac.in/courses/108/108/108108111/ - (Integrated Circuits MOSFETs OP- Amps and their Applications

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	2	2	-	-	1	-	1	-	1	3	2	1
2	3	3	3	2	2	-	-	1	-	1	-	1	3	2	1
3	3	3	3	2	2	-	-	1	-	1	-	1	3	2	1
4	3	3	3	2	2	-	-	1	-	1	-	1	3	2	1
5	3	3	3	2	2	-	-	1	-	1	-	1	3	2	1
6	3	3	3	3	-	-	-	-	3	3	-	1	3	2	1
AVG	3	3	3	2.2	2	-	-	1	3	1.3	-	1	3	2	1

1-Low 2-Medium 3-High '-' – No Correlation

SEMESTER IV

23EET401 ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION LT P C
3 0 0 3

OBJECTIVES

- To study and develop expressions for the computation of transmission line parameters.
- To obtain the equivalent circuits for the transmission lines based on distance and to determine voltage regulation and efficiency.
- To understand the mechanical design of transmission lines and types ,voltage distribution of insulators .
- To impart the knowledge about types and grading of underground cables.
- To learn about different distribution systems, types of substations, methods of grounding, EHVAC, HVDC and FACTS.

UNIT I TRANSMISSION LINE PARAMETERS 9

Introduction to power generation - Parameters of single and three phase transmission lines with single and double circuits - Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition - Application of self and mutual GMD: skin and proximity effects - Effects of earth on the capacitance of the transmission line - interference with neighboring communication circuits.

UNIT II MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Performance of Transmission lines - Short line, medium line and long line - Equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance - Transmission efficiency and voltage regulation - Ferranti effect- Formation of Corona - Critical Voltages – Modeling of transmission line using MATLAB .

UNIT III MECHANICAL DESIGN OF LINES AND INSULATORS 9

Mechanical design of OH lines - Line Supports - Types of towers – Tension and Sag Calculation - Effects of Wind and Ice loading- Methods of grounding.
Insulators: Types, voltage distribution in insulator string, improvement of string efficiency- Testing of insulators.

UNIT IV UNDERGROUND CABLES 9

Underground cables - Types of cables - Construction of single core and 3 core cables - Insulation Resistance - Potential Gradient - Capacitance of Single-core and 3 core cables - Grading of cables - Power factor and heating of cables - DC cables

UNIT V DISTRIBUTION SYSTEMS 9

Distribution Systems - General Aspects - Kelvin‟s Law - AC and DC distributions - Distribution Loss -Types of Substations - Recent Trends in Transmission and Distribution: EHVAC,HVDC and FACTS (Qualitative treatment only) .

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Determine the electrical circuit parameters of transmission lines.
- Realize the performance of short, medium and long transmission lines.
- Acquire the sag and tension of transmission lines, string efficiency of insulator.
- Analyze capacitance and grading of under cables.
- Design the appropriate distribution system

TEXT BOOKS

1. V.K.Mehta, Rohit Mehta, "Principles of power system", S. Chand & Company Ltd, New Delhi, Revised Edition, 2021
2. B.R.Gupta, 'Power System Analysis and Design' S. Chand, New Delhi, Sixth Edition, 2011. 2. C.L.Wadhwa, "Electrical Power Systems", New Age International Publishers, 7 th Edition, 2016.

REFERENCES

1. A.Chakrabarti, M.L.Soni, P.V.Gupta, R.V.Bhatnagar, "A Text book on Power System Engineering" ,Dhanpat Rai & Co (limited), New Delhi, 2 nd Edition, 2016.
2. D.P.Kothari, I.J. Nagarath, "Power System Engineering " , McGraw-Hill Publishing Company limited, New Delhi, 3rd Edition, 2019.

E-RESOURCES

1. https://nptel.ac.in/courses/108/102/108102047/ - (Power System Generation, Transmission and Distribution)
2. https://archive.nptel.ac.in/courses/108/105/108105104/ - (Power System Engineering)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	2	-	1	-	1	-	1	-	2	3	-	2
2	3	3	2	2	1	1	-	1	-	1	-	2	3	-	2
3	3	3	2	2	-	1	-	1	-	1	-	2	3	-	2
4	3	3	2	2	-	1	-	1	-	1	-	2	3	-	2
5	3	3	2	2	-	1	-	1	-	1	-	2	3	-	2
AVG	3	3	2	2	1	1	-	1	-	1	-	2	3	-	2

1-Low 2-Medium 3-High '-' – No Correlation

23EET402 **POWER ELECTRONICS** **LT P C**
3 0 0 3

OBJECTIVES

- To realize the characteristics of power semiconductor devices and commutation circuit.
- To study and design single phase and three phase controlled converter.
- To work in teams and independently for the design, development and testing of power electronics.
- To understand the basic requirements of industrial power electronics by using the concept of inverters.
- To impact knowledge on the basis and importance of AC-AC converters.

UNIT I OVERVIEW OF POWER ELECTRONICS AND POWER DEVICES 9

Structure, operation and characteristics of SCR, Power transistor, MOSFET,MCT and IGBT - Firing circuit for thyristor - Voltage and Current commutation of thyristor - Gate drive circuit for MOSFET and IGBT - Design of driver and snubber circuit.

UNIT II AC TO DC CONVERTERS 9

2-pulse, 3-pulse and 6-pulse converters - Performance parameters - Effect of source inductance-Gate Circuit Schemes for Phase Control - Dual converters, Applications of controlled rectifiers.

UNIT III DC TO DC CONVERTERS 9

Step-down and step-up chopper - Control strategy - Switched mode regulators - Buck, boost, buck- boost converter, Introduction to Resonant Converters.

UNIT IV DC TO AC CONVERTERS 9

Single phase and three phase voltage source inverters (both 120^0 mode and 180^0 mode) - Voltage & harmonic control - PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM - Introduction to space vector modulation –Current source inverter.

UNIT V AC TO AC CONVERTERS 9

Single phase and Three phase AC voltage controllers - Control strategy - Power Factor Control - Multistage sequence control - Single phase and three phase cyclo converters - Introduction to Matrix converters, Applications of cyclo converter.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Apply the knowledge of power electronic devices and converters.
- Acquire the performance of converters and power semiconductor devices.
- Analyze the performance of DC-DC converters.
- Understand the operation of inverter circuits.
- Enrich the knowledge of ac regulator and cycloconverter.

TEXT BOOKS

1. M.H.Rashid, 'Power Electronics: Circuits, Devices and Applications', Pearson Education, PHI 4th Edition, New Delhi, 2017.
2. P.S.Bimbra "Power Electronics" Khanna Publishers, 6th Edition, 2018.

REFERENCES

1. Ned Mohan, Tore. M. Underland, William. P. Robbins,' Power Electronics: Converters, Applications and Design', John Wiley and sons, 4th Edition, 2015.
2. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, 3rd Edition 2017.

E-RESOURCES

1. https://nptel.ac.in/courses/108/102/108102145/ - (Power Electronics)
2. https://nptel.ac.in/courses/108/105/108105066/ - (Power Electronics)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	2	1	-	1	-	2	3	-	2
2	3	3	3	3	-	-	-	1	-	1	-	-	3	-	2
3	3	3	3	3	-	-	2	1	-	1	-	-	3	-	2
4	3	3	3	3	-	-	1	1	-	1	-	2	3	-	2
5	3	3	3	3	-	-	1	1	-	1	-	2	3	-	2
AVG	3	3	3	3	-	-	1.6	1	-	1	-	2	3	-	2

1-Low 2-Medium 3-High '-' – No Correlation

23EET403 MICROPROCESSOR AND MICROCONTROLLERS LT P C
3 0 0 3

OBJECTIVES

- To study the hardware architecture and interrupts of 8085
- To acquire knowledge in addressing modes and instruction sets of 8051
- To develop skill in simple applications development with programming 8051
- To build a prototype using Arduino Uno.
- To identify and understand the function of different blocks of PIC microcontroller

UNIT I 8085 MICROPROCESSOR 9

Introduction to Microprocessor - Hardware Architecture of 8085 - Signals - Memory interfacing - I/O ports and data transfer concepts - Timing Diagram - Interrupt structure - Instruction format and Addressing modes - Instruction sets.

UNIT II 8051 MICROCONTROLLER 9

Hardware Architecture - Pin Description - Memory Organization - Timer - I/O ports - Addressing modes and Instruction sets - Interrupt structure - Simple programming.

UNIT III 8051 PROGRAMMING AND APPLICATIONS 9

A/D and D/A interfacing - Keyboard and display interface - Temperature control system - Stepper motor control - Washing Machine Control - Simulation of stepper motor control and Traffic light control using MATLAB.

UNIT IV ARDUINO 9

Introduction to the Arduino - Creating an Arduino programming Environment - Using the Arduino IDE - Creating an Arduino program - Using Libraries - Working with Digital Interfaces - Interfacing with Analog devices - Adding Interrupts - Communicating with devices - Using sensors - Working with Motors - Using an LCD.

UNIT V PIC MICROCONTROLLER 9

Introduction to PIC Microcontroller - PIC16C6X: Architecture - Data and program memory organization - Addressing modes -Instruction set - Timers - I/O Ports - Interrupt Programming - Speed Control of Induction Motor.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Understand the internal operations of 8085 processor
- Develop skills in writing assembly language programs
- Analyze and simulate the microcontroller based system
- Acquire the prototypes using Arduino with external devices
- Construct simple programs using PIC microcontroller

TEXT BOOKS

1. R.S.Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", Penram International Publishing, 6th Edition, 2013.
2. Krishna Kant, "Microprocessor and Microcontrollers Architecture, Programming and System design 8085, 8086, 8051, 8096 ", Prentice Hall of India, New Delhi, 3rd Edition, 2017.

REFERENCES

1. Richard Blum, "Arduino Programming in 24 Hours",Sams Teach Yourself, 1st Edition, 2017.
2. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey "PIC Microcontroller and Embedded Systems using Assembly and C for PIC18", Pearson Education, 2nd Edition, 2021.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/108/105/108105102/ - (Microprocessors and Microcontrollers)
2. https://archive.nptel.ac.in/courses/117/104/117104072/- (Microcontrollers and Applications)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	3	-	-	-	1	-	1	-	3	3	-	3
2	2	1	2	3	-	-	-	1	-	1	-	3	3	-	3
3	2	1	2	3	3	-	-	1	-	1	-	3	3	-	3
4	2	1	2	3	-	-	-	1	-	1	-	3	3	-	3
5	2	1	2	3	-	-	-	1	-	1	-	3	3	-	3
AVG	2	1	2	3	3	-	-	1	-	1	-	3	3	-	3

1-Low 2-Medium 3-High '-' – No Correlation

23EEE401 **CONTROL SYSTEMS ENGINEERING** **L T P C**
(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To derive the transfer function of a given system using mathematical models.
- To assess the system performance using time domain analysis
- To import knowledge in obtaining the open lop and closed–loop frequency responses of systems
- To determine and analyze the stability of given system.
- To learn the various approaches for the state variable analysis.
- To provide practical knowledge on analysis and design of control system along with basics of instrumentation.

UNIT I BASIC CONCEPTS AND SYSTEM REPRESENTATION 9

Introduction - Open Loop and Closed Loop Systems - Mathematical Model of Control Systems - Transfer Functions - Mechanical Translational Systems - Mechanical Rotational Systems - Block Diagram - Signal Flow Graph - Synchro's.

UNIT II TIME RESPONSE ANALYSIS 9

Standard Test Signals - Type and Order of Control System - Time Response of First order and Second order System for Unit Step, Unit Ramp and Impulse Input - Time Domain Specifications - Steady State Error and Static Error Constants - P, PI and PID Controllers - Simulation of study of first and second order systems.

UNIT III FREQUENCY RESPONSE ANALYSIS 9

Frequency Response - Frequency Domain Specifications - Resonant Peak - Resonant Frequency - Bandwidth - Cut-off Rate - Gain margin and Phase margin - Frequency response plots - Bode plot - Polar plot - Correlation between time and Frequency response.

UNIT IV STABILITY ANALYSIS 9

Concepts of Stability - Necessary Conditions for Stability - Relative Stability - Routh Hurwitz Stability Criterion - Root Locus - Effect of Addition of Poles - Effect of Addition of Zeros - Nyquist Stability Criterion – MATLAB Simulation on stability analysis.

UNIT V COMPENSATORS AND STATE SPACE ANALYSIS 9

Compensators: Introduction – Types, Lag ,Lead and Lag-Lead Design using Bode Plots. State Space Analysis: Concepts of State - State Variables and State phase Model for Linear Time Invariant System - Controllability and Observability.

LIST OF EXPERIMENTS

1. Simulation of Control Systems by Mathematical development tools
2. Simulation on stability analysis
3. Design of Lag, Lead and Lag-Lead Compensators
4. Position Control Systems
5. Synchro-transmitter – Receiver and Characteristics
6. Bridge networks AC and DC bridges.

7. Dynamics of Sensors /Transducers.
   a. Temperature b. Pressure c. Displacement

TOTAL: 45+15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Develop various representations of system based on the knowledge of Mathematics, Science and Engineering fundamentals.
- Determine the transient and steady state behavior of systems subjected to standard test signals.
- Analyze the various frequency response plots and its systems.
- Relate the concepts of various system stability criterions.
- Design the various compensators and digital control system using state variable models.
- Apply advanced control theory to practical engineering problems and their applications to various industries.

TEXT BOOKS

1. I.J.Nagrath and M.Gopal, "Control Systems Engineering", 6 th Edition, New Age International (P)Ltd,Publishers, 2017.
2. K. Ogata "Modern Control Engineering", 4 thEdition, Prentice Hall, 2015.

REFERENCES

1. M.Gopal, Control Systems, "Principles and Design", 4 th Edition, Tata McGraw Hill, New Delhi, 2014.
2. A.Nagoorkani, "Control Systems Engineering", 3 rd Edition, RBA Publications, 2021.

E-RESOURCES

1. http://www.nptel.ac.in/courses/107/106/107106081 - (Introduction of Control Systems)
2. http://www.nptel.ac.in/courses/108/106/108106098 - (Introduction of system and control)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	-	-	-	1	-	2	-	-	3	3	3
2	3	3	3	3	3	-	-	1	-	2	-	-	3	3	3
3	3	3	3	3	-	-	-	1	-	2	-	-	3	3	3
4	3	3	3	3	3	-	-	1	-	2	-	-	3	3	3
5	3	3	3	3	-	-	-	1	-	2	-	-	3	3	3
6	3	3	3	3	3	-	-	1	3	2	-	-	3	3	3
AVG	3	3	3	3	3	-	-	1	3	2	-	-	3	3	3

1-Low 2-Medium 3-High '-' – No Correlation

23EEE402 **INDUCTION AND SYNCHRONOUS MACHINES** **L T PC**
(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To construct and perform the salient and non – salient type synchronous generators.
- To learn the principle of operation and performance of synchronous motor.
- To study the construction, principle of operation and performance of induction machines.
- To understand the starting and speed control of three-phase induction motors.
- To import the knowledge about the construction, principle of operation and performance of single phase induction motors and special Machines
- To know about the operating characteristics, losses and efficiency, speed control of synchronous and induction machines.

UNIT I SYNCHRONOUS GENERATOR **9**

Constructional details - Types of rotors - winding factors - EMF equation - Synchronous reactance - Armature reaction - Phasor diagrams of non-salient pole synchronous generator connected to infinite bus - Synchronizing and parallel operation - Synchronizing torque - Change of excitation and mechanical input - Voltage regulation - EMF, MMF, ZPF and A.S.A method - steady state power angle characteristics - Two reaction theory - Slip test - short circuit transients - Capability Curves.

UNIT II SYNCHRONOUS MOTOR **9**

Principle of operation - Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power Developed-Hunting – Natural frequency of oscillations – Damper windings - Synchronous condenser - Simulation of Torque equation of synchronous motor using MATLAB.

UNIT III THREE PHASE INDUCTION MOTOR **9**

Constructional details - Types of rotors - Principle of operation - Slip - Cogging and crawling - Equivalent circuit - Torque-Slip characteristics - Condition for maximum torque - Losses and efficiency - Load test - No load and blocked rotor tests - Circle diagram - Separation of losses - Double cage induction motors - Induction generators - Synchronous induction motor - Simulation of circle diagram using MATLAB

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 9

Need for starting - Types of starters - DOL, Rotor resistance, Autotransformer and Star delta starters - Speed control - Voltage control, Frequency control and pole changing - Cascaded Connection-V/f control - Slip power recovery Scheme - Braking of three phase induction motor.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 9

Constructional details of single phase induction motor - Double field revolving theory and operation - Equivalent circuit - No load and blocked rotor test - Performance analysis - Starting methods of single-phase induction motors - Capacitor-start capacitor run Induction motor - Shaded pole induction motor - Linear induction motor - Repulsion motor - Hysteresis motor – AC series motor- Servo motors- Stepper motors - Introduction to magnetic levitation systems. (MAGLEV)

LIST OF EXPERIMENTS

1. Regulation of three phase alternator by EMF and MMF methods.
2. Regulation of three phase alternator by ZPF and ASA methods.
3. V and Inverted V curves of Three Phase Synchronous Motor
4. Load test on three-phase induction motor.
5. No load and blocked rotor tests on three-phase induction motor. (Determination of equivalent circuit parameters).
6. Separation of No-load losses of three-phase induction motor.
7. Load test on single-phase induction motor.
8. No load and blocked rotor test on single-phase induction motor.

TOTAL: 45+15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Understand the construction and working principle of synchronous generator.
- Acquire knowledge on synchronous motor.
- Understand the construction and working principle of different types of 3 phase induction motor.
- Understand the starting and speed control and braking of AC machines.
- Recognize the construction and working principle of single phase induction & special electrical machines.
- Predetermine the performance and operating characteristics of induction and synchronous machines.

TEXT BOOKS

1. D.P. Kothari and I.J. Nagrath, 'Electric Machines', McGraw Hill Publishing Company Ltd, 5th Edition 2017
2. P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, 2nd edition, 2021.

REFERENCES

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, 'Electric Machines' Pearson India Education, 2017.
2. B.R.Gupta, 'Fundamental of Electric Machines' New age International Publishers, 3rd Edition, Reprint 2015.

E – RESOURCES

1. https://nptel.ac.in/courses/108/106/108106072/ (Introduction on Induction Machines)
2. https://archive.nptel.ac.in/courses/108/105/108105131/ (Electrical machines II)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	2	3	-	-	-	1	-	2	-	2	3	3	2
2	3	3	2	3	3	-	-	1	-	2	-	2	3	3	2
3	3	3	2	3	3	-	-	1	-	2	-	2	3	3	2
4	3	3	2	3	-	-	-	1	-	2	-	2	3	3	2
5	3	3	1	1	-	-	-	1	-	2	-	2	3	3	2
6	3	3	1	1	-	-	-	1	3	2	-	2	3	3	2
AVG	3	3	1.6	2.3	3	-	-	1	3	2	-	2	3	3	2

1-Low 2-Medium 3-High '-' – No Correlation

23GEE302 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C

(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures-lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python
- To understand the modules and python Packages.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing - Identification of Computational Problems - Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation

UNIT V FILES, MODULES, PACKAGES & DATA VISUALIZATION 9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file - Importing Matplotlib - Line plots - Scatter plots - visualizing errors - density and contour plots - Histograms.

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time /technical applications using Lists, Tuples. (Items present in a library / Components of a car/ Materials required for construction of a building – operations of list & tuples)
5. Implementing real-time / technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time / technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time / technicall applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)

TOTAL : 45+15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Develop algorithmic solutions to simple computational problems.
- Develop and execute simple Python programs.
- Write simple Python programs using conditional sand loops for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, dictionaries etc.
- Read and write data from/to files in Python programs.

TEXTBOOKS

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.

E – RESOURCES

1. https://nptel.ac.in/courses/106104074 (Introduction to Algorithms)
2. https://archive.nptel.ac.in/courses/106/106/106106182/ (Joy of Computing)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	2	-	-	-	-	-	2	2	3	3	-
2	3	3	3	3	2	-	-	-	-	-	2	2	3	-	-
3	3	3	3	3	2	-	-	-	-	-	2	-	3	-	-
4	2	2	-	2	2	-	-	-	-	-	1	-	3	-	-
5	1	2	-	-	1	-	-	-	-	-	1	-	2	-	-
6	2	2	-	-	2	-	-	-	-	-	1	-	2	-	-
AVG	2.3	2.5	1.5	1.8	1.8	-	-	-	-	-	1.5	0.7	2.7	0.5	-

1-Low 2-Medium 3-High '-' – No Correlation

SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

MINOR DEGREE / HONOURS

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(MINOR/HONOURS DEGREE – ELECTRIC VEHICLES)

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEEV01	Electric & Hybrid Vehicles	PC	3	0	0	3	40	60	100
23EEEV02	Energy Storage System For EV	PC	3	0	0	3	40	60	100
23EEEV03	Electric Drives and Controls for Electric Vehicles	PC	3	0	0	3	40	60	100
23EEE01	Modeling and Simulation of EHV	PC	3	0	2	4	50	50	100
23EEEP01	Project Work	EEC	0	0	12	6	40	60	100
Total			19						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
OE : Open Elective
GE : General Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

SEMESTER III

23EEEV01	ELECTRIC AND HYBRID VEHICLES	LT P C
		3 0 0 3

OBJECTIVES

- To understand the concept of electric vehicles.
- To study about the motors & drives for electric vehicles.
- To realize the electronics and sensors in electric vehicles.
- To know the concept of hybrid vehicles.
- To study about fuel cell for electric vehicles.

UNIT I INTRODUCTION TO ELECTRIC VEHICLE 9

Electric Vehicle – Need - Types – Cost and Emissions – End of life. Electric Vehicle Technology – layouts, cables, components, Controls. Batteries – overview and its types. Battery plug-in and life.Ultra-capacitor, Charging – Methods and Standards. Alternate charging sources – Wireless &Solar.

UNIT II ELECTRIC VEHICLE MOTORS 9

Motors (DC, Induction, BLDC) – Types, Principle, Construction, Control. Electric Drive Trains (EDT) – Series HEDT (Electrical Coupling) – Power Rating Design, Peak Power Source (PPS); Parallel HEDT (Mechanical Coupling) – Torque Coupling and Speed Coupling. Switched Reluctance Motors (SRM) Drives – Basic structure, Drive Convertor, Design.

UNIT III ELECTRONICS AND SENSORS – LESS CONTROL IN EV 9

Basic Electronics Devices – Diodes, Thyristors, BJTs, MOSFETs, IGBTs, Convertors, Inverters.Safety – Risks and Guidance, Precautions, High Voltage safety, Hazard management. Sensors - Autonomous EV cars, Selfdrive Cars, Hacking; Sensor less – Control methods- Phase Flux Linkage-Based Method, Phase Inductance Based, Modulated Signal Injection, Mutually Induced Voltage-Based, Observer-Based.

UNIT IV HYBRID VEHICLES 9

Hybrid Electric vehicles – Classification – Micro, Mild, Full, Plug-in, EV.Layout and Architecture – Series, Parallel and Series-Parallel Hybrid, Propulsion systems and components.Regenerative Braking, Economy, Vibration and Noise reduction. Hybrid Electric Vehicles System – Analysis and its Types, Controls.

UNIT V FUEL CELLS FOR ELECTRIC VEHICLES 9

Fuel cell – Introduction, Technologies & Types, Obstacles. Operation principles, Potential and I-V curve, Fuel and Oxidation Consumption, Fuel cell Characteristics – Efficiency, Durability, Specific power, Factors affecting, Power design of fuel Cell Vehicle and freeze capacity. Lifetime cost of Fuel cell Vehicle – System, Components, maintenance.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Describe about working principle of electric vehicles.
- Explain the construction and working principle of various motors used in electric vehicles.
- Understand about working principle of electronics and sensor less control in electric vehicles.
- Describe the different types and working principle of hybrid vehicles.
- Illustrate the various types and working principle of fuel cells.

TEXT BOOKS

1. Jack Erjavec and Jeff Arias, "Hybrid, Electric and Fuel Cell Vehicles", Cengage Learning, 2012.
2. Jack Erjavec and Jeff Arias, "Alternative Fuel Technology – Electric, Hybrid and Fuel Cell Vehicles",Cengage Learning Pvt. Ltd., New Delhi, 2007

REFERENCES

1. Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley &Sons, Inc., 2017.
2. Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017.

E-RESOURCES

1. https://nptel.ac.in/courses/108103009 -(Hybrids and Electric Vehicle)
2. https://nptel.ac.in/courses/108102121 -(Electric Vehicle)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
2	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
3	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
4	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
5	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
AVG	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3

1-Low 2-Medium 3-High '-' – No Correlation.

SEMESTER IV

23EEEV02 ENERGY STORAGE SYSTEM FOR EV LT P C
3 0 0 3

OBJECTIVES

- To understand the different types of energy storage system.
- To study about the battery characteristic & parameters.
- To model the types of batteries.
- To know the concepts of battery management system and design the battery pack.
- To study about the battery testing, disposal and recycling.

UNIT I ENERGY STORAGE SYSTEM 9

Batteries: Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zine Chloride battery; Ultra capacitors; Flywheel Energy Storage System; Hydraulic Energy Storage System; Comparison of different Energy Storage System.

UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS 9

Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics; Efficiency of batteries; Electrical parameters- Heat generation- Battery design- Performance criteria for Electric vehicles batteries- Vehicle propulsion factors- Power and energy requirements of batteries Meeting battery performance criteria- setting new targets for battery performance.

UNIT III BATTERY MODELLING 9

General approach to modelling batteries, simulation model of a rechargeable Li-ion battery, simulation model of a rechargeable NiCd battery, Parameterization of the NiCd battery model, Simulation examples.

UNIT IV BATTERY BACK AND BATTERY MANAGEMENT SYSTEM 9

Selection of battery for EVs & HEVs, Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation methods, Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation, Battery thermal management system, Battery Management System: Definition, Parts: Power Module, Battery, DC/DC Converter, load, communication channel, Battery Pack Safety, Battery Standards & Tests

UNIT V BATTERY TESTING, DISPOSAL AND RECYCLING 9

Chemical & structure material properties for cell safety and battery design, battery testing, limitations for transport and storage of cells and batteries, Recycling, disposal and second use of batteries.

Battery Leakage: gas generation in batteries, leakage path, leakage rates. Ruptures: Mechanical stress and pressure tolerance of cells, safety vents,

Explosions: Causes of battery explosions, explosive process, Environment and Human Health impact assessments of batteries, General recycling issues and drivers, methods of recycling of EV batteries.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Discuss about the different types of energy storage system.
- Describe about the battery characteristic & parameters.
- Model different types of batteries
- Apply the concepts of battery management system and design the battery pack.
- Explain about the battery testing, disposal and recycling.

TEXT BOOKS

1. Ibrahim Dinçer, Halil S. Hamut and Nader Javani, "Thermal Management of Electric Vehicle BatterySystems", John Wiley& Sons Ltd., 2016.
2. Chris Mi, AbulMasrur& David WenzhongGao, "Hybrid electric Vehicle- Principles & Applications withPractical Properties", Wiley, 2011.

REFERENCES

1. G. Pistoia, J.P. Wiaux, S.P. Wolsky, "Used Battery Collection and Recycling", Elsevier, 2001. (ISBN: 0-444-50562-8)
2. Guangjin Zhao, "Reuse and Recycling of Lithium-Ion Power Batteries", John Wiley & Sons. 2017. (ISBN:978-1-1193-2185-9)

E-RESOURCES

1. https://nptel.ac.in/courses/113105102 - (Battery Modelling)
2. https://nptel.ac.in/courses/108102047 - (Energy Storage)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	3	-	-	-	1	-	1	-	3	3	-	3
2	2	1	2	3	-	-	-	1	-	1	-	3	3	-	3
3	2	1	2	3	-	-	-	1	-	1	-	3	3	-	3
4	2	1	2	3	-	-	-	1	-	1	-	3	3	-	3
5	2	1	2	3	-	-	-	1	-	1	-	3	3	-	3
AVG	2	1	2	3	-	-	-	1	-	1	-	3	3	-	3

1-Low 2-Medium 3-High '-' – No Correlation.

SEMESTER V

23EEET03 ELECTRIC DRIVES AND CONTROLS FOR ELECTRIC VEHICLES L T P C
3 0 0 3

OBJECTIVES

- To study about the motor & device characteristics & parameters.
- To know the various electric drive concepts.
- To have a knowledge of DC drive mechanism.
- To have a knowledge of AC drive mechanism.
- To understand about drives for special electrical machines.

UNIT I MOTOR AND DEVICE CHARACTERISTICS 9

Review of motor principles, motor load dynamics, starting, braking & speed control of dc and ac motors power semiconductor SCRs, IGBTs and MOSFETs .

UNIT II ELECTRIC DRIVE CONCEPTS 9

Basic drive, choice of electric drives, advantages, nature and classification of drives, control and stability of electric drives, feedback control of drives, thermal effects in electrical machines, selection of motor and rating.

UNIT III DC DRIVES 9

Transient analysis of separately excited dc motors, converter - single phase uncontrolled, half and fully controlled rectifiers, chopper control, closed loop control of solid-state DC drives.

UNIT IV AC DRIVES 9

Operation of induction and induction motor, direct torque and flux control of induction motor drives, starting methods and speed control of single-phase induction motors, self-controlled synchronous motor drive, selection of motor and rating vector control of synchronous motor.

UNIT V DRIVES FOR SPECIAL ELECTRICAL MACHINES 9

Drives for variable reluctance motors, microprocessor/ microcontroller –gate trigger signal generation applications to special electrical machines, switched reluctance motor drives, brushless DC motor drives, permanent magnet drives.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Describe about the motor & device characteristics & parameters.
- Explain about various electric drive concepts .
- Understand the DC drive mechanism.
- Understand the AC drive mechanism.
- Explain about drives for special electrical machines.

TEXT BOOKS

1. Gopal K D, "Fundamentals of Electric Drives", Narosa Publishing House Pvt. Ltd., 2011.
2. Pillai S K, "A first course on Electrical Drives", Wiley Eastern Ltd, Bombay 2011.

REFERENCES

1. Ali Elamadi, "Handbook Automotive Power Electronics and Drives", CRC publishers, 2012.
2. Bimal K Bose, "Modern Power Electronics and Drives", Elsevier publishers, Butterworth Hinnemann, 2012.

E- RESOURCES

1 https://nptel.ac.in/courses/108104140 -(Electric Drives)

2 https://nptel.ac.in/courses/108102121-(Electric Vehicle)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
2	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
3	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
4	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
5	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
AVG	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3

1-Low 2-Medium 3-High '-' – No Correlation.

SEMESTER VI

23EEEE01 MODELLING AND SIMULATION OF EHV L T P C
(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To understand the modelling of vehicle performance parameters.
- To model battery electric vehicles.
- To describe the drivetrain characteristics.
- To identify the concepts of energy management system.
- To know the vehicle dynamic control systems.
- To simulate the mathematical model of Electric Vehicle various aspects.

UNIT I MODELLING IN PERFORMANCE PARAMETER 9

Modelling Vehicle Acceleration - Acceleration performance parameters, modelling the acceleration of an electric scooter, modelling the acceleration of a small car.

UNIT II MODELLING OF BATTERY ELECTRIC VEHICLES 9

Electric Vehicle Modelling - Tractive Effort, Rolling resistance force, Aerodynamic drag, Hill climbing force,Acceleration force, Total tractive effort, Modelling Electric Vehicle Range - Driving cycles, Range modelling of battery electric vehicles, Constant velocity range modelling, Range modelling of fuel cell vehicles, Range modelling of hybrid electric vehicles.

UNIT III DRIVE TRAIN CHARACTERISTICS 9

Modelling and Characteristics of EV/HEV Powertrains Components- ICE Performance Characteristics, Electric Motor Performance Characteristics - Battery Performance Characteristics-Transmission and Drivetrain Characteristics-Regenerative Braking Characteristics-Driving Cycles Modelling and Analysis of Electric and Hybrid Electric Vehicles Propulsion and Braking - Longitudinal Dynamics Equation of Motion - Vehicle Propulsion Modelling and Analysis - Vehicle Braking Modelling and Analysis.

UNIT IV ENERGY MANAGEMENT 9

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.

UNIT V VEHICLE DYNAMIC CONTROL 9

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 Bus. Simulation Tools: Matlab/Simulink, ADVISOR and AVL Cruise.

LIST OF EXPERIMENTS

1. Various strategies for improving vehicle energy/fuel efficiency.
2. Vehicle chassis mathematical model in various operation conditions (steady motion, acceleration, regenerating braking, coasting, moving up and down a hill)
3. Series HE powertrain mathematical model.

4. Computer model of the HEV.
5. Computer Workshop. Fuel efficiency evaluation of a series HEV in city and high-way cycles: study and analyze two strategies for ICE/Battery power split.

TOTAL: 45+15 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Understand the modelling of vehicle performance parameters.
- Model battery electric vehicles.
- Describe the drivetrain characteristics.
- Apply the concepts of energy management system.
- Explain the vehicle dynamic control systems.
- Model the Electric Vehicle .

TEXT BOOKS

1. James Larminie, John Lowry, "Electric Vehicle Technology Explained", John Wiley & Sons Ltd, 2003.
2. Amir Khajepour, Saber Fallah and AvestaGoodarzi, "Electric and Hybrid Vehicles Technologies, Modelling and Control: A Mechatronic Approach", John Wiley & Sons Ltd, 2014.

REFERENCES

1. Antoni Szumanowski, "Hybrid Electric Power Train Engineering and Technology: Modelling, Control,and Simulation", IGI Global, 2013.
2. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles_Fundamentals, Theory, and Design, Second Edition", CRC Press, 2010.

E-RESOURCES

1 https://nptel.ac.in/courses/108102121-(Electric Vehicle)
2 https://nptel.ac.in/courses/113105102 -(Battery Modelling)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
2	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
3	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
4	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
5	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3
AVG	2	1	2	3	-	1	1	1	-	1	-	1	3	-	3

1-Low 2-Medium 3-High '-' – No Correlation.

SEMESTER VII

23EEEP01 **PROJECT WORK** **L T P C**
0 0 12 6

OBJECTIVES

- To develop skills to formulate a technical project.
- To develop the ability to solve specific problem.
- To teach use of new tools, algorithms and techniques required to carry out the projects.
- To give guidance on the various procedures for validation of the product and analyze the costeffectiveness.
- To provide guidelines to prepare technical report of the project.

GUIDELINE FOR REVIEW AND EVALUATION

The students in a group of 3 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 180 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Formulate a real world problem, identify the requirement and develop the design solutions.
- Identify technical ideas, strategies and methodologies.
- Test and validate through conformance of the developed prototype and analysis the costeffectiveness.
- Prepare technical report and oral presentations.
- On completion of the project work students will be in a position to take up any challenging practicalproblem in the field of engineering and find better solutions to it.

Mapping of Cos-Pos & PSOs

CO	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	3	-	-	-	-	-	-	3	-	-
3	-	-	-	-	-	-	3	-	3	-	-	-	-	-	3
4	-	-	-	-	-	-	-	3	3	3	3	-	-	-	3
5	-	-	-	-	-	-	-	-	-	-	-	3	3	3	3
AVG	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low 2-Medium 3-High '-' – No Correlation.

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(MINOR/HONOURS DEGREE – SENSORS TECHNOLOGY)

B.E. - ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEST01	Nanomaterials and Sensors	PC	3	0	0	3	40	60	100
23EEST02	Wireless Sensor Networks	PC	3	0	0	3	40	60	100
23EEST03	Flexible and Wearable Sensors	PC	3	0	0	3	40	60	100
23EESE01	Principles of Sensors	PC	3	0	2	4	50	50	100
23EESP01	Project Work	EEC	0	0	12	6	40	60	100
Total			19						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
OE : Open Elective
GE : General Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

SEMESTER III

23EEST01 NANOMATERIALS AND SENSORS L T P C
3 0 0 3

OBJECTIVES

- To provide an insight of nanomaterials and its synthesis and to expose the students to the different methods being used for nanomaterials characterization.
- To educate the students about the process involved in the fabrication of sensors using metallic nanoparticles and nanowires and the need for using special materials like CNTs for sensor development.
- To impart the knowledge of developing sensors using different nano structures of metal oxides.
- To make the students to understand the developments in the nano polymers and its role insensors.
- To provide an insight of quantum dots and its potential application in sensor development.

UNIT I INTRODUCTION TO NANOTECHNOLOGY 9

Definition of nanotechnology - Main features of nano-materials - Types of nano structures (0D,1D, and 2D structures) - Synthesis of nano-materials and nano-composites - Chemical/Physical/Electrical/Optical properties of nano-materials and composites.

UNIT II CHARACTERIZATION OF NANOMATERIALS 9

Methods for characterizing the nano-materials: Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and spectroscopy - spectrometry based surface analysis techniques.

UNIT III METAL NANOPARTICLE AND NANOWIRE BASED SENSORS 9

Definition of nanoparticle - Features of nanoparticles - Production of nanoparticles by physical and chemical approaches – Definition of nanowires - Features of nanowires - Fabrication of individual nanowire by top – Down approaches and bottom–up approaches - Fabrication of nanowire arrays (fluidic channel, blown bubble film, contact printing, spray coating, etc.).

UNIT IV CARBON NANOTUBE BASED SENSORS 9

Definition of carbon nanotube - Features of carbon nanotubes - Synthesis of carbon nanotubes - Fabrication and working principles of sensors based on individual carbon nanotube - Fabrication and working principles of sensors based on random array of carbon nanotubes.

UNIT V SENSOR BASED NANOSTRUCTURES OF METAL OXIDE 9

Synthesis of metal oxide structures by dry and wet methods - Types of metal oxide gas sensors (0D, 1D and 2D) - Defect chemistry of the metal oxide sensors - Sensing mechanism of metal - Oxide gas sensors - Porous metal - Oxide structures for improved sensing applications.

TOTAL : 45 PERIODS

OUTCOMES

Upon Completion of the course, the students will be able to:

- Acquire an insight of nanomaterials and its synthesis.
- Visualize the different methods being used forn a nomaterials characterization.
- Understand the process involved in the fabrication of sensors using metallic nanoparticles and nanowires.
- Describe the different sensors used for carbon nanotube.
- Develop sensors using different nanostructures of metal oxides for making it more specific

TEXT BOOKS

1. Dieter Vollath, "Nanomaterials: An Introduction to Synthesis, Properties and Applications", Wiley, New Jersey, 2nd Edition, 2014.
2. Guozhong Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications", Imperial College Press, London, 2nd Edition, 2011.

REFERENCES

1. Martin Pumera, "Nanomaterials for Electrochemical Sensing and Bio sensing", Pan Stanford, 1st Edition, 2014.
2. Michael A. Carpenter, Sanjay Mathur, Andrei Kolmakov, "Metal Oxide Nanomaterials for Chemical Sensors", Springer, NewYork, 1st Edition, 2013.

E-RESOURCES

1. https://nptel.ac.in/courses/118104008-(nanomaterial)
2. https://nptel.ac.in/courses/108106173-(sensor)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
2	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
3	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
4	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
5	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
AVG	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3

1-Low 2-Medium 3-High '-' – No Correlation.

SEMESTER IV

23EEST02 WIRELESS SENSOR NETWORKS LT P C
3 0 0 3

OBJECTIVES

- To identify and expose the students to the central elements in the design of communication protocols for the WSNs.
- To disseminate the design knowledge in analyzing the specific requirements for applications in WSNs regarding energy supply, memory, processing and transmission capacity.
- To get the perception of mobile ad hoc networks, design, implementation issues, and solutions.
- To impart the knowledge based on different algorithms and protocols for power management, sensordata routing and query processing.
- To associate, hardware platforms and software frame works used to realize dynamic Wireless sensor network.

UNIT I NETWORK EMBEDDED SYSTEMS 9

RS232,RS485,SPI,I2C,CAN, LIN,FLEXRAY.

UNIT II EMBEDDED WIRELESS COMMUNICATION AND IP BASED WSN 9

Bluetooth, Zigbee, Wifi, UWB Circuit switching, packet switching, concept of IPV4, IPV6, 6 LOW PAN and IP, IP based WSN, 6 LOW PAN based WSN, IOT.

UNIT III WIRELESS SENSOR NETWORK (WSN) 9

Characteristic and challenges, WSN vs Adhoc Networks, Sensor node architecture, Physical layer and transceiverde sign considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

UNIT IV WSN (Medium Access Control) 9

Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts, Contention Based protocols, Schedule-based protocols - SMAC - BMAC, Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MACprotocol.

UNIT V SENSOR NETWORK ARCHITECTURE 9

Data Dissemination, Flooding and Gossiping - Data gathering Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design Principles for WSNs - Gateway Concepts, Need for gateway, WSN and Internet Communication, WSN Tunneling

TOTAL: 45 PERIODS

OUTCOMES

Upon Completion of the course, the students will be able to:

- Design the applicability and limitations of communication protocols for are altime WSN application.
- Conforms the behavior of Mobile Adhoc Networks (MANETs) and correlates the infrastructure-based networks.
- Understand the routing protocols function and their implications on data transmission delay and bandwidth.
- Analyze networks with an attempt to reduce issue of broad cast and flooding techniques.
- Acquire appropriate algorithms to improve existing or to develop new wireless sensor network applications.

TEXT BOOKS

1. Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, NewJersey, 1st Edition, 2011.
2. Jun Zheng, Abbas Jamalipour, "Wireless Sensor Networks: A Networking Perspective", Wiley-IEEE Press, USA, 1st Edition, 2014.

REFERENCES

1. Waltenegus W.Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", John Wiley & Sons, NewJersey, 1st Edition, 2014.
2. Ian F. Akyildiz, Mehmet Can Vuran, "Wireless Sensor Networks", John Wiley & Sons, NewJersey, 1st Edition, 2011.

E-RESOURCES

1. https://nptel.ac.in/courses/106106167 - (Introduction to wireless communications)
2. https://nptel.ac.in/courses/106105160 -(wireless Ad Hoc and Sensor Network)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
2	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
3	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
4	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
5	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
AVG	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3

1-Low 2-Medium 3-High '-' – No Correlation.

SEMESTER V

23EEST03 FLEXIBLE AND WEARABLE SENSORS LT P C
3 0 0 3

OBJECTIVES

- To provide the overview of flexible electronics technology and the issues with materials processing for thin film electronics.
- To expose the students for the materials selection and patterning methods for thin film electronics development.
- To describe the process involved in transferring the flexible electronics from foils to textiles and also the challenges, opportunities and the future of wearable devices.
- To expose the students to the design, challenges of wearable sensors employed for sensing the physical and biological parameters.
- To impart the knowledge on the process involved in the conversion of conducting and semiconducting fibers to smart textiles.

UNIT I OVERVIEW OF FLEXIBLE ELECTRONICS TECHNOLOGY 9

History of flexible electronics - Materials for flexible electronics: degrees of flexiblility, substrates, backplane electronics, front plane technologies, encapsulation - Fabrication technology for flexible electronics - Fabrication on sheets by batch processing, fabrication on web by Roll-to-Roll processing - Additive printing.

UNIT II MATERIALS AND NOVEL PATTERNING METHODS FOR FLEXIBLE ELECTRONICS 9

Materials considerations for flexible electronics: Overview, Inorganics semiconductors and dielectrics, organic semiconductors and dielectrics, conductors - Print processing options for device fabrication: Overview, control of feature sizes of jet printed liquids, jet printing for etchmask patterning, methods for minimizing feature size, printing active materials.

UNIT III FLEXIBLE ELECTRONICS FROM FOILS TO TEXTILES 9

Introduction -Thin film transistors: Materials and Technologies - Review of semiconductors employed in flexible electronics - Thin film transistors based on IGZO - Plastic electronics for smart textiles - Improvements and limitations.

UNIT IV WEARABLE HAPTICS 9

World of wearables - Attributes of wearables - Textiles and clothing: The meta wearable Challenges and opportunities - Future of wearables - Need for wearable haptic devices - Categories of wearable haptic and tactile display.

UNIT V KNITTED ELECTRONIC TEXTILES 9

From fibers to textile sensors - Interlaced network -Textile sensors for physiological state monitoring - Biomechanical sensing - Noninvasive sweat monitoring by textile sensors and other applications. FBG sensor in Intelligent Clothing and Biomechanics.

TOTAL: 45 PERIODS

OUTCOMES

Upon Completion of the course, the students will be able to:

- Realize the technology developments in the flexible electronics technology.
- Ability to identify the suitable materials and its processing for the development of thin film electronics.
- Ability to design the pattern and develop with suitable patterning methods.
- Realize the process involved in the transformation of electronics from foils to textiles
- Acquire the design knowledge for developing wearable sensors for physical and chemicalparameters

TEXTBOOKS

1. Michael J. McGrath, Cliodhna Ni Scanaill, Dawn Nafus, "Sensor Technologies: Healthcare, Wellness and Environmental Applications", 201, 1st Edition , Apress Media LLC, New York.
2. William S. Wong, Alberto Salleo, Flexible Electronics: Materials and Applications, 2011, 1st Edition, Springer, New York.

REFERENCES

1. Edward Sazonov, Michael R. Newman, "Wearable Sensors: Fundamentals, Implementation and Applications", 2014, 1st Edition, Academic Press, Cambridge.
2. Kate Hartman, "Make: Wearable Electronics: Design, prototype, and wear your interactive garments", 2014, 1st Edition, Marker Media, Netherlands.

E-RESOURCES

1. https://nptel.ac.in/courses/108108112-(Semiconductor Device)
2. https://nptel.ac.in/courses/108108031-(Electronics Systems)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
2	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
3	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
4	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
5	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
AVG	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3

1-Low 2-Medium 3-High '-' – No Correlation.

SEMESTER VI

23EESE01 PRINCIPLES OF SENSORS LT P C
3 0 4 4

OBJECTIVES

- To provide in depth knowledge in physical principles applied in sensing, measurement and a comprehensive understanding on how measurement systems are designed, calibrated, characterised, and analysed.
- To ability to understand the various sources and detectors of various Optical sensing mechanisms.
- To provide in-depth understanding of the principle of measurement, and theory of instruments andsensors for measuring velocity and acceleration.
- To impart the fundamental knowledge on the basic laws and phenomena on which operation of sensortransformation of energy is based.
- To impart a reasonable level of competence in the design, construction, and execution ofmechanical measurements strain, force, torque and pressure.

UNIT I SENSOR FUNDAMENTALS AND OPTICAL DETECTORS 9

Sensor Classification, Performance and Types, Error Analysis characteristics Electronic and Optical properties of semiconductor as sensors, LED, Semiconductor lasers,Fiber optic sensors, thermal detectors, photo multipliers, photoconductive detectors, photodiodes, avalanche photodiodes, CCDs.

UNIT II INTENSITY POLARIZATION AND INTERFEROMETRIC SENSORS 9

Intensity sensor, Microbending concept, Interferometers, Phase sensor: Phase detection, Polarization maintaining fibers.

UNIT III VELOCITY AND ACCELERATION SENSORS 9

Electromagnetic velocity sensor, Doppler with sound, light, Accelerometer characteristics, capacitive, piezo-resistive, piezoelectric accelerometer, thermal accelerometer, rotor, monolithic and optical gyroscopes.

UNIT IV POSITION, DIRECTION, DISPLACEMENT AND LEVEL SENSORS 9

Potentiometric and capacitive sensors, Inductive and magnetic sensor, LVDT, RVDT, eddy current, transverse inductive, Hall effect, magneto resistive, magneto strictive sensors. Fiber opticliquid level sensing, Fabry Perot sensor, ultrasonic sensor, capacitive liquid level sensor.

UNIT V FLOW, TEMPERATURE AND ACOUSTIC SENSORS 9

Flow sensors: pressure gradient technique, thermal transport, ultrasonic, electromagnetic and Laser anemometer. microflow sensor, coriolis mass flow and drag flow sensor. Temperature sensors - thermoresistive, thermoelectric, semiconductor and optical. Piezoelectric temperature sensor. Acoustic sensors - microphones-resistive, capacitive, piezoelectric, fiber optic, solid state - electrect microphone.

List of Experiments

1. Strain, Force, pressure, and torque measurement
   Strain measurement with Bridge Circuit
   Develop a displacement measurement system with the following sensors:
   i. Inductive transducer (LVDT)
   ii. Hall effect sensor
2. After studying the characteristics of temperature sensors listed below,develop a temperature measurement system for a particular application using the suitable sensor.
   i. Thermocouple principles
   ii. Thermistor and linearization of NTC Thermistor
3. Develop a sensor system for force measurement using piezoelectric transducer.
4. Measurement of shear strain and angle twist using strain gauge is notsuitable for many applications. Based on other sensing experiments carried out suggest a non- contact method and try to complete its proof of concept.

TOTAL: 45 + 15 PERIODS

OUTCOMES

Upon Completion of the course, the students will be able to:

- Use concepts in common methods for converting a physical parameter into an electrical quantity
- Choose an appropriate sensor comparing different standards and guidelines to make sensitivemeasurements of physical parameters like pressure, flow, acceleration, etc
- Design and develop sensors using optical methods with desired properties
- Evaluate performance characteristics of different types of sensors
- Locate different type of sensors used in real life applications and paraphrase their importance
- Create analytical design and development solutions for sensors.

TEXTBOOKS

1. Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", 2015, 3rd edition, Springer, New York.
2. Jon. S. Wilson, "Sensor Technology Hand Book", 2011, 1st edition, Elsevier, Netherland.

REFERENCES

1. Gerd Keiser,"Optical Fiber Communications", 2012, 4th edition, McGraw-Hill Science, Delhi.
2. John G Webster, "Measurement, Instrumentation and sensor Handbook", 2014, 2nd edition, CRC Press, Florida

E-RESOURCES

1. https://nptel.ac.in/courses/105101206 (Remote sensing)
2. https://nptel.ac.in/courses/115107122 (Optical Sensor)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
2	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
3	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
4	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
5	2	1	2	3	-	1	1	1	-	1	-	3	3	-	3
6	2	1	2	3	-	1	1	1	3	1	-	3	3	-	3
AVG	2	1	2	3	-	1	1	1	3	1	-	3	3	-	3

1-Low 2-Medium 3-High '-' – No Correlation.

SEMESTER VII

23EESP01 **PROJECT** **L T P C**
0 0 12 6

OBJECTIVES

- To identify a specific problem for the current need of the society and collecting information related to thesame through detailed review of literature.
- To build up skills to formulate a technical project.
- To develop the methodology to solve the identified problem.
- To teach use of new tools, algorithms and techniques required to carry out the projects.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

GUIDELINE FOR REVIEW AND EVALUATION

The students in a group of 3 works on a topic approved by the head of the department under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of engineering design. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 180 PERIODS

OUTCOMES

Upon Completion of the course, the students will be able to:

- Formulate a real world problem, identify the requirement and develop the design solutions.
- Identify technical ideas, strategies and methodologies.
- Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- Prepare technical report and oral presentations.
- At the end of the course the students will have a clear idea of their area of work and they will be in aposition to carry out the remaining phase II work in a systematic way.

Mapping of Cos-Pos & PSOs

CO	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	3	-	-	-	-	-	-	3	-	-
3	-	-	-	-	-	-	3	-	3	-	-	-	-	-	3
4	-	-	-	-	-	-	-	3	3	3	3	-	-	-	3
5	-	-	-	-	-	-	-	-	-	-	-	3	3	3	3
AVG	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low 2-Medium 3-High '-' – No Correlation.

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(MINOR DEGREE /HONOURS – ELECTRIC VEHICLES)

CREDIT SUMMARY

B.E. –ELECTRICAL AND ELECTRONICSENGINEERING

Category	Credits Per Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
PC	-	-	3	3	3	4	-	-	13
EEC	-	-	-	-	-	-	6	-	6
Total	-	-	3	3	3	4	6	-	19

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(MINOR DEGREE /HONOURS - SENSORS TECHNOLOGY)

CREDIT SUMMARY

B.E. – ELECTRICAL AND ELECTRONICS ENGINEERING

Category	Credits Per Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
PC	-	-	3	3	3	4	-	-	13
EEC	-	-	-	-	-	-	6	-	6
Total	-	-	3	3	3	4	6	-	19