



SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade,
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



CURRICULUM & SYLLABI

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

(CHOICE BASED CREDIT SYSTEM)

REGULATIONS–2023

(REVISION II)

(I - VIII SEMESTER)

(For the students admitted from the Academic year 2023-2024 and 2024 - 2025 onwards)



Note: The regulations here under 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 programme under the same Regulation as may be decided by the Academic Council.





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



CURRICULUM & SYLLABI

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

(CHOICE BASED CREDIT SYSTEM)

REGULATIONS-2023

(REVISION II)

(I - VIII SEMESTER)

(For the students admitted from the Academic year 2023-2024 and 2024 - 2025 onwards)



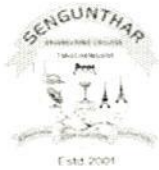
Note: The regulations here under are subject to amendments as may be decided by the Academic Council of the Sengunthar Engineering College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates including those already undergoing the programme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


Chairman - BoS


DEAN (ACADEMICS)
SENGUNTHAR ENGINEERING COLLEGE
TIRUCHENGODE-637 205




PRINCIPAL
SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
TIRUCHENGODE - 637 205



SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade,

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)

Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



INDEX			
UNDER GRADUATE (B.E. – ELECTRICAL AND ELECTRONICS ENGINEERING) PROGRAMMES			Page No.
I	SCHEME FOR CURRICULUM		
	Curriculum 1-8 Semester	---	1 – 16
	List of Humanities and Social Sciences	---	17
	List of Basic Sciences	---	17
	List of Engineering Science	---	17
	List of Professional Core	---	18
	List of Professional Elective Courses	---	18 – 20
	List of Open Elective Courses	---	20 – 22
	General Electives	---	22
	Elective - Management	---	23
	List of Employability Enhancement Courses	---	23
	List of Mandatory Courses	---	24
	Credit Summary	---	25
II	SCHEME FOR SYLLABI		
	I Semester Syllabi	---	26 – 50
	II Semester Syllabi	---	51 – 84
	III Semester Syllabi	---	85 – 103
	IV Semester Syllabi	---	104 - 122
	V Semester Syllabi	---	123 – 132





SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade,

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)

Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



	VI Semester Syllabi	---	133 – 137
	VII Semester Syllabi	---	138 – 142
	VIII Semester Syllabi	---	143 – 146
	Professional Elective - I	---	147 – 163
	Professional Elective - II	---	164 – 177
	Professional Elective - III	---	178 – 190
	Professional Elective - IV	---	191 – 205
	Professional Elective - V	---	206 – 220
	Professional Elective - VI	---	221 – 235
	Open Electives – I	---	236 – 267
	Open Electives – II	---	268 – 398
	Open Electives – III	---	299 – 329
	General Electives	---	330 – 342
	Elective Management	---	343 – 365
	Mandatory Courses - I	---	366 – 375
	Mandatory Courses - II	---	376 – 385
III	MINOR / HONOURS DEGREE		
	Electric Vehicles	---	386 – 400
	Sensors Technology	---	401 – 416
	Credit Summary	---	417



SCHEME FOR CURRICULUM

B.E. – Electrical and Electronics Engineering





REGULATIONS 2023
CHOICE BASED CREDIT SYSTEM
B. E. ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To develop globally competent Engineers in Electrical and Electronics Engineering by imparting cutting-edge knowledge, research and entrepreneurial skills for societal and sustainable development.

MISSION

- To provide a conducive learning environment that fosters academic excellence and the integration of cutting-edge knowledge in Electrical and Electronics Engineering.
- To enhance research and development initiatives that address societal challenges.
- To empower students with leadership excellence, entrepreneurial skills, moral and ethical values.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Program Educational Objectives (PEOs) broad statements describe the career and professional accomplishments that the graduates are expected to achieve within three to five years after graduation.

Graduates of B.E. - Electrical and Electronics Engineering program will

- Exhibit leadership qualities and the ability to work effectively in multidisciplinary teams to achieve organizational and project goals.
- Engage in higher studies, leveraging expertise across diverse domains to create impactful and sustainable solutions.
- Develop entrepreneurial skills and an innovative approach to identifying opportunities, creating value, and driving business ventures.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1	Engineering knowledge	Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
------------	------------------------------	--



PO2	Problem analysis	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4).
PO3	Design / development of solutions	Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	Conduct investigations of complex problems	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	Engineering tool usage	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	The engineer and The World	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7	Ethics	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8	Individual and Collaborative team work	Function effectively as an individual and as a member or leader in diverse/multi-disciplinary teams.
PO9	Communication	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10	Project management and finance	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	Life-long learning	Recognize the need for and have the preparation and ability for i) Independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOME (PSOs)

PSO1	Utilize cutting-edge tools, techniques, and methodologies to solve complex engineering challenges in areas such as Power Electronics and Automation.
PSO2	Develop and implement smart grid technologies and renewable energy solutions to ensure reliable and sustainable energy systems.



SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade.

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)

Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME

Year	Sem	Course Name	PO											PSO	
			1	2	3	4	5	6	7	8	9	10	11	1	2
I	I	23HST101 - Professional English	1	1	1.5	2	1	-	-	1.8	3	1.5	2	-	-
		23MAT101 - Matrices and Calculus	3	3	2	-	-	-	-	-	-	-	2	-	-
		23HST102 - தமிழர் மரபு /Heritage of Tamils	-	-	-	-	-	-	2	1	2	-	1	-	-
		23PHE103 - Applied Physics for Electronics Engineering	3	3	1	1	-	-	-	-	-	-	-	-	-
		23CYE101 - Engineering Chemistry	2.3	2.2	2.5	1.6	1.7	1.8	1.4	1.5	1.4	1.3	1.3	-	-
		23GEE101 – Programming in C	2.8	2.8	2.5	1.5	3.0	-	1.0	1.0	1.3	1.0	2.0	2.0	-
		23EEC101 – Soft Skills & Life Skills	1.3	1.6	1	1	3	1.4	2	2.6	2.8	2.6	2	-	-
		23MDC101 – Induction Program (2Weeks)	-	-	-	-	-	-	-	-	-	-	-	-	-
	II	23MAT202 - Differential Equations and Numerical Methods	3	2.4	2	1.4	2	-	-	-	-	-	2	-	-
		23PHT203 - Advanced Physics for Electronics Engineering	3	2	1	1	-	-	-	-	-	-	-	-	-
		23CYT201 - Environmental Science and Sustainability	2	1.4	3	1.6	2.2	3	3	0.8	1.6	2.4	2.2	-	-
		23HST202 - தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	-	-	-	-	-	-	2	1	-	-	1	-	-
		23HSE201 - English for Engineers: Theory and Practice	1	2	-	2	1	2	1.5	2.3	3	2	1.6	-	-
		23EEE201 - Electric Circuit Analysis	3	3	3	3	3	-	-	-	2	1	1	3	2
		23GEL201 – Engineering Practices Laboratory	3	2	-	-	1	1	-	-	-	-	2	2	1
		23GEL202 - Engineering Drawing for Electrical and Electronics	3	2	-	-	2	1	-	-	3	-	2	-	-
		23EEC201 - Indian Language (Except Mother Tongue) / Foreign Language													
		Hindi	-	-	-	-	-	1	1.3	1.6	2.8	-	1.6	-	-
		German	-	-	-	-	-	1	1.5	1.7	3	-	1.6	-	-
		Japanese	-	-	-	-	1.4	1.6	1	2	2.6	-	1	-	-
		23MDC201 – Aptitude Skills	-	-	-	-	-	-	-	-	-	-	-	-	-
II	III	23MAT301 - Transforms and Complex Functions	3	3	1	-	2	-	-	1	2	-	2	-	-
		23EET301 - Electromagnetic Theory	3	3	3	3	3	-	-	-	-	-	2	3	3
		23EET302 - Measurements and Instrumentation	3	3	3	3	3	-	-	-	-	-	2	3	3
		23EEE301 - DC Machines and Transformers	3	2.8	2.3	2.2	1.8	-	-	3	3	-	2	2	2





SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade,

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



IV	23EEE302 - Analog Electronics and Circuits	3	3	3	3	3	2	2	3	3	2	3	3	2
	23EEE303 - Digital Electronics and Linear Integrated Circuits	3	3	3	2.2	2	-	1	3	1.3	-	1	3	2
	23EEC301 – Professional Development	-	-	-	-	-	-	-	-	-	-	-	-	-
	23EET401 - Electrical Power Transmission and Distribution	3	3	3	2	2	1	1	-	2	-	2	1	3
	23EET402 - Power Electronics	3	3	3	3	3	-	-	-	-	-	3	3	3
	23EET403 - Control Systems Engineering	3	3	3	3	3	1	-	-	1	-	2	3	3
	23EEE401 – Microprocessor and Microcontrollers	2.8	2.8	2.6	2.4	3	2.2	-	3	3	3	2	3	2.6
	23EEE402 -Induction and Synchronous Machines	3	3	2.8	2.8	3	2.2	-	3	3	3	2	2.6	2.3
	23GEE301 - Problem Solving and Python Programming	2.8	2.7	2.2	1.5	2.8	-	1	1	1.5	1	2	3	1
	23EEC401 - Online Certification Courses	-	-	-	-	-	-	-	-	-	-	-	-	-
	23EET501 – Power System Analysis	3	3	3	3	2.2	1	-	-	-	-	2	3	3
	23EEE501 – Electrical Drives	3	3	3	3	3	2	2	3	3	2	3	2.7	3
	23EEE502 – Renewable Energy and Energy Storage System	3	3	3	3	3	2	2	3	3	2	2	3	3
	23EEC501 – Industrial Training	-	-	-	-	-	-	-	-	-	-	-	-	-
III	PROFESSIONAL ELECTIVE – I													
	23EEP501 - Under Ground Cable	3	3	3	2	2	-	2	1	-	1	-	3	2
	23EEP502 - Power Quality	3	3	3	3	2	-	3	3	-	3	-	3	3
	23EEP503 - Flexible AC Transmission Systems	3	3	3	2	2	-	2	1	-	1	-	3	2
	23EEP504 - High Voltage Engineering	3	2	2	2	-	2	-	2	-	2	-	3	2
	23EEP505 - Utilization of Electrical Energy	3	2	2	2	-	1	-	1	-	2	-	3	2
	23EEP506 - Smart Grid	3	3	2	3	3	-	-	1	-	-	-	3	3
	PROFESSIONAL ELECTIVE – II													
	23EEP507 - SMPS and UPS	3	3	3	2	-	-	2	1	-	2	-	3	2
	23EEP508 - Special Electrical Machines	3	3	2	2	1	1	-	1	-	2	-	3	3
	23EEP509 - Multi Level Power Converter	3	2	2	2	1	-	-	1	-	2	-	3	2
	23EEP510 - Protection and Switchgear	3	3	3	2	2	-	-	-	2	-	2	3	3
	23EEP511 - Modern Power Converters	3	2	3	3	3	-	3	1	-	2	-	3	2



23EEP512 - Power Electronics for Renewable Energy Systems	3	2	2	2	1	-	-	1	-	2	-	3	2
PROFESSIONAL ELECTIVE – III													
23EEP513 - Discrete Time System and Signal processing	3	3	3	2	-	-	2	1	-	-	-	3	2
23EEP514 - Embedded System Design	3	2.2	2	2.2	2	-	-	-	-	-	2	2.4	2
23EEP515 - Embedded C Programming	3	2.2	2	2.2	1	-	-	-	-	-	-	2	1.4
23EEP516 - Embedded Control for Electrical Drives	2.4	1.6	2.4	2.4	1.8	-	-	-	-	-	-	2	2
23EEP517 - Microcontroller Based System Design	3	2	2	2	2	-	-	-	-	1	-	3	1
23EEP518 - Embedded System for Automotive Applications	2.4	3	2.4	2.4	2	-	-	-	-	-	-	1.8	1.8
MANDATORY COURSE - I													
23MDC501 - Introduction to Women and Gender Studies	-	-	-	-	-	-	-	-	-	-	-	-	-
23MDC502 - Elements of Literature	-	-	-	-	-	-	-	-	-	-	-	-	-
23MDC503 - Film Appreciation	-	-	-	-	-	-	-	-	-	-	-	-	-
23MDC504 - Disaster Risk Reduction and Management	-	-	-	-	-	-	-	-	-	-	-	-	-
23MDC505 - Constitution of India	-	-	-	-	-	-	-	-	-	-	-	-	-
23EEE601 - Power System Operation and Control	3	3	3	3	3	2	2	3	1.3	2	2.2	2	3
23EEJ601 - Project Work – Phase I	3	3	3	3	3	3	3	3	3	3	3	3	3
PROFESSIONAL ELECTIVE – IV													
23EEP601 - Electric Vehicle Architecture	3	-	2	2	-	3	2	1	-	2	-	3	2
23EEP602 - .Electric Vehicle Design, Mechanics and Control	3	-	2	2	-	3	2	1	-	2	-	3	2
23EEP603 - Design of Electric Vehicle Charging System	3	2	3	2	-	3	2	1	-	2	-	3	1
23EEP604 - Design of Motor and Power Converters for Electric Vehicles	3	2	3	2	-	3	2	1	-	2	-	3	1
23EEP605 - Electric Vehicles	3	3	3	2	3	3	-	-	-	-	2	3	3
23EEP606 - Testing of Electric Vehicles	3	-	2	2	-	3	2	1	-	2	-	3	2
PROFESSIONAL ELECTIVE – V													
23EEP607 - Process Modeling and Simulation	3	2	2	3	2	1	-	-	-	-	1	2	2
23EEP608 - Soft Computing	3	3	3	3	3	-	-	-	2	-	-	2	2
23EEP609 - Optimal Control	2	2	1.8	2	1	1.3	-	-	-	-	1	2	2

23EEP610 - Adaptive Control	3	2.4	2.4	2.4	-	-	-	-	-	1.8	1	2	2
23EEP611 - Computer Control of Process	3	3	3	2.8	-	-	-	-	-	-	1	2	2
23EEP612 - Machine Monitoring System	3	3	3	2	2	1	-	-	-	-	1	2	2
PROFESSIONAL ELECTIVE – VI													
23EEP613 - Design of Electrical Apparatus	3	3	3	3	3	-	-	-	-	-	2	3	3
23EEP614 - Energy Storage Systems	3	3	2	2	2	-	-	-	-	-	2	3	2
23EEP615 - Grid Integrating Techniques and Challenges	3	3	2	2	2	2	-	-	-	-	2	3	2
23EEP616 - Hybrid Energy Technology	3	3	2	2	2	2	-	-	-	-	2	3	2
23EEP617 - Power Systems Transients	3	3	2	2	2	2	-	-	-	-	2	3	2
23EEP618 - PLC Programming	3	3	3	2	-	-	-	1	-	1	-	3	1
OPEN ELECTIVE - I													
23CEO607 – Environmental and Social Impact Assessment	3.0	3.0	2.4	2.0	2.0	2.2	3.0	-	-	-	2.3	-	-
23CSO610 - Introduction to Drone Technologies	2.6	2.8	2.4	1.8	3	-	-	1.5	-	-	2.6	-	-
23ECO602 - Fundamentals of Electronic Devices and Circuits	3	3	3	3	2.8	2.4	-	-	-	-	2.4	-	-
23EEO603 – Electric Vehicle Technology	3	3	3	3	3	-	-	-	-	-	2	-	-
23EEO604 – Renewable Energy Systems	3	3	3	3	3	1	1	-	1	-	2	-	-
23MEO601- Introduction to Industrial Engineering	3	3	2	-	-	-	-	-	-	-	2	-	-
23MEO605 - CNC Machining Technology	3	3	2	2	3	-	-	-	-	-	1	-	-
23MDO611 - Hospital Management	1	2.4	2	1.5	2	1.6	1.4	1.0	1.0	1.6	1.4	-	-
23RAO609 - Fundamentals of Robotics	3.0	2	-	2.8	3.0	2.0	1.0	2.0	2.0	2.3	2.0	-	-
23CSO612 - Cyber Forensics and Ethical Hacking	3	2.6	1.8	2.3	2.6	1.6	2.2	1	1.5	1	2	-	-
23PMO608 - Pharamaceutical Nanotechnology	2.4	2.6	2.4	2.8	2.4	1.8	2	1	-	1	2.2	-	-
23MAO606 - Graph Theory	3	2.8	2.3	1	-	-	-	-	-	-	1.4	-	-
23NCCL01 - NCC AIRFORCE LEVEL-1	2.5	2.3	2.2	2.0	2.0	3.0	2.8	2.3	2.6	2.2 5	2.0	-	-
23NCCL03 - NCC ARMY LEVEL-3	2	2	2.5	-	-	2.5	3	2.5	2.5	2	2	-	-
MANDATORY COURSE-II													



SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)

Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



IV		23MDC601 - Well Being with Traditional Practices - Yoga, Ayurveda and Siddha	-	-	-	-	-	-	-	-	-	-	-	-	
		23MDC602 - History of Science and Technology in India	-	-	-	-	-	-	-	-	-	-	-	-	
		23MDC603 - Political and Economical Thought for a Human Society	-	-	-	-	-	-	-	-	-	-	-	-	
		23MDC604 - State Nation Building and Politics in India	-	-	-	-	-	-	-	-	-	-	-	-	
		23MDC605 - Industrial Safety	-	-	-	-	-	-	-	-	-	-	-	-	
	VII	23HST701 – Human Values and Ethics	2	2.3	-	3	-	3	3	1	1.5	-	1.6	1	1
		23EEJ701 – Project Work – Phase II	3	3	3	3	3	3	3	3	3	3	3	3	3
		ELECTIVE MANAGEMENT													
		23MGT701 - Principles of Management	1.6	1	1	1.5	1.5	1	1	2	3	1	1	-	-
		23MGT702 - Total Quality Management	3	2	2	-	1	-	-	-	-	-	2	2	1
		23MGT703 - Engineering Economics and Financial Accounting	2	2.8	1.7	1	2.0	1.4	1	1	1.2	3	1.2	-	-
		23MGT704 - Human Resource Management	1	2	1.5	2	1.5	1.2	1.8	2.2	1.6	1.5	2	-	-
		23MGT705 - Knowledge Management	2	2.4	1.7	1.3	1.6	1.3	2.0	1.3	1.5	1.7	2.2	-	-
		23MGT706 - Industrial Management	1	2	1	-	1.5	1.3	1.3	1.5	1.5	3.7	1.3	-	-
		23MGT707 - Supply Chain Management	1.8	2	1.8	1.5	1.5	1.4	1	1	1.5	2	2.2	1	1
		23MGT708 - e-Waste Management	1.8	2.4	2.4	1.8	1.4	2	1.2	1.3	1.8	2	1.8	-	-
		OPEN ELECTIVE – II													
		23CEO704 - Remote Sensing Concepts	3	-	1	1	2	-	-	-	2	1	1	-	-
		23ECO708 - Energy Technology	2.2	2	1.8	3	3	1	1	1	1	1.6	3	-	-
		23EE07069 – Sensors, Actuators and its Application	3	3	3	3	3	-	-	-	-	-	2	-	-
		23MEO703 - Fundamentals of Mechatronics	3	2	2	-	-	-	-	-	-	-	1	-	-
		23MEO704 - Nano Technology	3	1.8	2.6	2.4	1	2	1.8	1	2.4	1.4	-	-	-
		23MEO712 - Smart Manufacturing	2	2.6	2.5	2	2.6	-	1.5	-	-	-	1.5	-	-
		23MDO705 - Ultrasound Principles and its Medical Applications	2.2	2.4	1.8	1.8	2.7	1.2	1	-	1	1	1.2	-	-
		23RAO707 - Mobile Robots	3	3	2.8	2.6	2.8	1.2	1	1	1.6	-	1.6	-	-
		23CSO711 - Introduction to Cyber Security	3	2.6	2.4	2.3	2.5	2	2	2.5	1.6	2	2	-	-





SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade,

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)

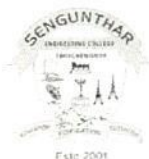
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



		23PMO706 - Intellectual Property Rights for Pharma Industry	2.4	2.2	2.2	1.2	2.2	1.8	1.6	2	1	1	1.8	-	-
		23MAO710 - Operations Research	2.8	3	2.4	1.8	2	1	-	-	-	-	2	-	-
		OPEN ELECTIVE - III													
		23CEO717 - Geographical Information System	3	2	2	-	3	2	-	-	2	2	1	-	-
		23CSO715 - Fundamentals of Blockchain Technology	2.8	2.4	2.2	2	2.8	-	-	-	1	-	2	-	-
		23ECO718 - VLSI Design	3	3	3	2	2	1.6	1	-	1	1	1	-	-
		23EEO716 - Electrical, Electronic and Magnetic Materials	3	3	3	3	3	-	-	-	-	-	2	-	-
		23MEO720 - Marine Vehicles	3	2	2	2	3	-	-	-	-	-	-	-	-
		23MDO719 - Wearable Technology	2.2	2.4	1.8	1.75	2.3	1.5	1	-	-	-	1.4	-	-
		23MDO723 - Medical Waste Management	2	2.4	1.8	1.75	1.8	2.8	2	1	1	1.2	1.2	-	-
		23MDO724 - Lifestyle Diseases	2	2.4	1.8	1.5	2	2.2	1.2	1	1	1.2	1.4	-	-
		23RAO721 - Robotics Process Automation	3	2.8	2.4	2.4	2.8	1.2	-	-	1.2	1.2	1.2	-	-
		23MAO714 - Advanced Numerical Methods	3	3	2.4	1.4	2	-	-	-	-	-	2	-	-
		23MGO722 - Cost management of Engineering Projects	3	3	3	-	1	-	1	1	1	1	1.5	2.6	3
		23NCCL02 - NCC AIRFORCE LEVEL - 2	2.5	2.5	2.2	2.3	2.5	2.8	2.5	2.3	2.5	2.3	2.0	-	-
		23NCCL04 - NCC ARMY LEVEL - 4	2	2	-	-	-	3	2	3	2	2	1	-	-
VIII		23EEJ801 - Product Development	3	3	3	3	3	3	3	3	3	3	3	3	3
		23EEC801 - Internship	-	-	-	-	-	-	-	-	-	-	-	-	-



**CURRICULUM****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
THEORY									
23HST101	Professional English	HS	3	0	0	3	40	60	100
23MAT101	Matrices and Calculus	BS	3	1	0	4	40	60	100
23HST102	தமிழர் மரபு /Heritage of Tamils	HS	1	0	0	1	40	60	100
EMBEDDED COURSE									
23PHE103	Applied Physics for Electronics Engineering	BS	3	0	2	4	40	60	100
23CYE101	Engineering Chemistry	BS	3	0	2	4	40	60	100
23GEE101	Programming in C	ES	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC101	Soft Skills & Life 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
PC	:	Professional Core
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



SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade,

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)

Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



CURRICULUM

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

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

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
THEORY									
23MAT202	Differential Equations and Numerical Methods	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									
23HSE201	English for Engineers: Theory and Practice	HS	3	0	2	4	50	50	100
23EEE201	Electric Circuit Analysis	PC	3	0	2	4	50	50	100
PRACTICALS									
23GEL201	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
23GEL202	Engineering Drawing for Electrical and Electronics	ES	0	0	4	2	60	40	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC201	Indian Language (Except Mother Tongue) / Foreign Language	EEC	0	0	4	2	100	-	100
MANDATORY COURSE									
23MDC201	Aptitude Skills	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - II						25			

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
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





CURRICULUM

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

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

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
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									
23EEEC301	Professional Development	EEC	0	0	2	1	100	-	100
TOTAL CREDITS IN SEMESTER III					24				

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
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



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

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

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

Course Code	Name of the Subject	Category	Periods / Week			Credit C	Maximum Marks		
			L	T	P		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	Control Systems Engineering	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23EEE401	Microprocessor and Microcontrollers	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	Online Certification Courses	EEC	3	0	0	3	100	-	100
TOTAL CREDITS IN SEMESTER IV					24				

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
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





SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade,
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956



TIRUCHENGODE- 637 205

CURRICULUM

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

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

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
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	Electrical Drives	PC	3	0	2	4	50	50	100
23EEE502	Renewable Energy and Energy Storage System	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC501	Industrial Training	EEC	0	0	4	2	100	-	100
MANDATORY COURSE									
	Mandatory Course -I	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER V						23			

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
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



CURRICULUM

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

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

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
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	Power System Operation and Control	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEJ601	Project Work – Phase I	EEC	0	0	8	4	60	40	100
MANDATORY COURSE									
	Mandatory Course - II	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER VI					20				

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
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



SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade.

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



CURRICULUM

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

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

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
THEORY									
23HST701	Human Values and 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									
23EEJ701	Project Work – Phase II	EEC	0	0	8	4	60	40	100
TOTAL CREDITS IN SEMESTER VII					16				

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
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



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

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

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
EMPLOYABILITY ENHANCEMENT COURSE									
23EEJ801	Product Development	EEC	0	0	12	6	60	40	100
23EEC801	Internship	EEC	0	0	4	2	100	-	100
TOTAL CREDITS IN SEMESTER VIII					8				

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
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



LIST OF HUMANITIES AND SOCIAL SCIENCES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
23HST101	Professional English	HS	3	0	0	3	40	60	100
23HST102	தமிழர்மரபு/Heritage of Tamils	HS	1	0	0	1	40	60	100
23CYT201	Environmental Sciences and Sustainability	HS	3	0	0	3	40	60	100
23HST202	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	HS	1	0	0	1	40	60	100
23HSE201	English for Engineers: Theory and Practice	HS	3	0	2	4	50	50	100
23HST701	Human Values and 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		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
23MAT202	Differential Equations and Numerical Methods	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		CIA	ESE	TOT
23GEE101	Programming in C	ES	3	0	2	4	50	50	100
23GEL201	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
23GEL202	Engineering Drawing for Electrical and Electronics	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		CIA	ESE	TOT
23EEE201	Electric Circuit Analysis	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 Power Transmission and Distribution	PC	3	0	0	3	40	60	100
23EET402	Power Electronics	PC	3	0	0	3	40	60	100
23EET403	Control Systems Engineering	PC	3	0	0	3	40	60	100
23EEE401	Microprocessors and Microcontrollers	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	Electrical Drives	PC	3	0	2	4	50	50	100
23EEE502	Renewable Energy and Energy Storage System	PC	3	0	2	4	50	50	100
23EEE601	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		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		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		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		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	Electric 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		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		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

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
CIVIL	23CEO607 / Environmental and Social Impact Assessment	OE	3	0	0	3	40	60	100
CSE	23CSO610 / Introduction to Drone Technologies	OE	3	0	0	3	40	60	100
ECE	23ECO602 / Fundamentals of Electronic Devices and Circuits	OE	3	0	0	3	40	60	100
EEE	23EEO603 / Electric Vehicle Technology	OE	3	0	0	3	40	60	100

	23EEO604 / Renewable Energy Systems	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO601 / Introduction to Industrial Engineering	OE	3	0	0	3	40	60	100
	23MEO605 / CNC Machining Technology	OE	3	0	0	3	40	60	100
MEDICAL ELECTRONICS	23MDO611 / Hospital Management	OE	3	0	0	3	40	60	100
ROBOTICS AND AUTOMATION	23RAO609 / Fundamentals of Robotics	OF	3	0	0	3	40	60	100
CSE(Cyber Security)	23CSO612 / Cyber Forensics and Ethical Hacking	OE	3	0	0	3	40	60	100
PHARMACEUTICAL TECHNOLOGY	23PMO608 / Pharamaceutical Nanotechnology	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO606 / Graph Theory	OE	3	0	0	3	40	60	100

OPEN ELECTIVE- II

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
CIVIL	23CEO704 / Remote Sensing Concepts	OE	3	0	0	3	40	60	100
ECE	23ECO708 / Energy Technology	OE	3	0	0	3	40	60	100
EEE	23EEO709 / Sensors, Actuators and its Application	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO703 / Fundamentals of Mechatronics	OE	3	0	0	3	40	60	100
	23MEO704 / Nano Technology	OE	3	0	0	3	40	60	100
	23MEO712 / Smart Manufacturing	OE	3	0	0	3	40	60	100
MEDICAL ELECTRONICS	23MDO705 / Ultrasound Principles and its Medical Applications	OE	3	0	0	3	40	60	100
ROBOTICS AND AUTOMATION	23RAO707 / Mobile Robots	OE	3	0	0	3	40	60	100
CSE(Cyber Security)	23CSO711 / Introduction to Cyber Security	OE	3	0	0	3	40	60	100
PHARMACEUTICAL TECHNOLOGY	23PMO706 / Intellectual Property Rights for Pharma Industry	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO710 / Operations Research	OE	3	0	0	3	40	60	100

OPEN ELECTIVE - III

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
CIVIL	23CEO717 / Geographical Information System	OE	3	0	0	3	40	60	100
CSE	23CSO715 / Fundamentals of Blockchain Technology	OE	3	0	0	3	40	60	100
ECE	23ECO718 / VLSI Design	OE	3	0	0	3	40	60	100
EEE	23EEO716 / Electrical, Electronic and Magnetic Materials	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO720 / Marine Vehicles	OE	3	0	0	3	40	60	100
MEDICAL ELECTRONICS	23MDO719 / Wearable Technology	OE	3	0	0	3	40	60	100
	23MDO723 / Medical Waste Management								
	23MDO724 / Lifestyle Diseases								
ROBOTICS AND AUTOMATION	23RAO721 / Robotics Process Automation	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO714 / Advanced Numerical Methods	OE	3	0	0	3	40	60	100
MANAGEMENT	23MGO722 / Cost management of Engineering Projects	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		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 WING LEVEL - 3	GE	3	0	0	3	40	60	100
23NCCL04	NCC ARMY WING 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		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	Supply Chain 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		CIA	ESE	TOT
23EEC101	Soft Skills & Life Skills	EEC	1	0	0	1	100	-	100
23EEC201	Indian Language (Except Mother Tongue / Foreign Language)	EEC	0	0	4	2	100	-	100
23EEC301	Professional Development	EEC	0	0	2	1	100	-	100
23EEC401	Online Certification Courses	EEC	3	0	0	3	100	-	100
23EEC501	Industrial Training	EEC	0	0	4	2	100	-	100
23EEJ601	Project Work - Phase I	EEC	0	0	8	4	60	40	100
23EEJ701	Project Work - Phase II	EEC	0	0	8	4	60	40	100
23EEJ801	Product Development	EEC	0	0	12	6	60	40	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		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		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	-	-	-

SCHEME

Credit Summary





CURRICULUM AND SYLLABI

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

(For the Students Admitted in the Academic Year 2025-2026 onwards)

CREDIT SUMMARY

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Category	Credits Per Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
HS	4	8	-	-	-	-	3	-	15
BS	12	9	4	-	-	-	-	-	25
ES	4	2	-	4	-	-	-	-	10
PC	-	4	19	17	12	4	-	-	56
PE	-	-	-	-	9	9	-	-	18
OE	-	-	-	-	-	3	6	-	9
GE	-	-	-	-	-	-	3	-	3
EEC	1	2	1	3	2	4	4	8	25
MC	-	-	-	-	0	0	-	-	0
Total	21	25	24	24	23	20	16	8	161



SCHEME FOR SYLLABI

B.E. – Electrical and Electronics Engineering





SEMESTER I

23HST101

PROFESSIONAL ENGLISH

L T P C

(Common to all B.E. & B.Tech. Branches)

3 0 0 3

OBJECTIVES

- To build vocabulary proficiency and familiarity with varied lexical and contextual usages.
- To strengthen grammatical accuracy for effective sentence construction and language application.
- To develop clarity and coherence in written communication across academic and business contexts.
- To enhance oral fluency, confidence, and interactive communication skills.
- To promote efficient reading strategies for comprehension, analysis, and note-making.

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

OUTCOMES

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

- Use a wide range of vocabulary effectively in oral and written communication.
- Frame grammatically and meaningful sentences.
- Write formal and informal letters, develop coherent paragraphs and essays, and engage in meaningful dialogues.
- Apply speaking skills for self-introduction, speeches, and technical presentations.
- Read, comprehend, and take organized notes from passages and technical content.

TEXT BOOKS

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

REFERENCES

1. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", First Edition, Orient Black Swan, 2012.
2. Krishna Mohan, Meera Banerji, "Developing Communication Skills", Paperback, MacMillan, 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	PSO1	PSO2
1	1	-	-	-	1	-	-	2	3	-	2	-	-
2	1	-	-	-	1	-	-	2	3	-	2	-	-
3	-	1	2	-	1	-	-	2	3	1	2	-	-
4	-	-	1	-	-	-	-	2	3	2	2	-	-
5	1	1	-	2	1	-	-	1	3	-	2	-	-
AVG	1	1	1.5	2	1	-	-	1.8	3	1.5	2	-	-

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

Chairman - BoS

23MAT101

MATRICES AND CALCULUS

L T P C

(Common to all B.E./B.Tech. Branches)

3 1 0 4

OBJECTIVES

- To develop the use of matrix algebra and its properties.
- To explore the techniques of differential and integral calculus.
- To categorize methods for functions of several variables.
- To introduce the use of multiple integrals and their applications.
- To provide knowledge of vector calculus.

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 EXPERIMENTS

1. Computation of Eigen values and Eigenvectors.
2. Matrix addition and multiplications.
3. Calculate differentiations of simple functions.
4. Calculate integrations of simple functions.
5. Determining Maxima and minima of functions for one variable.
6. Determining Maxima and minima of functions for two variables.
7. Evaluating double integral with constant limits.
8. Evaluating triple integral with constant limits.
9. Computing Gradient, divergence and curl of point functions.
10. Evaluating line integral in vector calculus.

TOTAL: 45+15 PERIODS

OUTCOMES

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

- Apply matrix algebra methods to solve practical problems.
- Apply the concepts of differential and integral calculus.
- Analyze the ideas of differential calculus for functions of several variables.
- Apply multiple integral ideas in solving areas and volumes.
- Solve the engineering problems using the concepts of vector calculus.

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, Forty Third Edition, New Delhi, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, Seventh 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, Seventh Edition, 2009.
2. Kanti B. Dutta., "Mathematical Methods of Science and Engineering – Aided with MATLAB", Cengage Learning, New Delhi, Second Edition, 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	PSO1	PSO2
1	3	3	2	-	-	-	-	-	-	-	2	-	-
2	3	3	2	-	-	-	-	-	-	-	2	-	-
3	3	3	2	-	-	-	-	-	-	-	2	-	-
4	3	3	2	-	-	-	-	-	-	-	2	-	-
5	3	3	2	-	-	-	-	-	-	-	2	-	-
AVG	3	3	2	-	-	-	-	-	-	-	2	-	-

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


Chairman - BoS

23HST102

HERITAGE OF TAMILS

L T P C

(Common to all Branches)

1 0 0 1

OBJECTIVES

- To familiarize the students on extensive literature of classical Tamil.
- To analyze rock art paintings to modern art.
- To acquire knowledge on folk and martial arts.
- To apply the concepts of Thinaï in Tamils.
- To realize the contribution of Tamils in Indian freedom struggle.

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, Villu Pattu, Kaniyan Koothu, 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.

OUTCOMES

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

- Analyze the extensive literature Tamil and classical nature.
- Understand the heritage of sculpture, painting and musical instruments.
- Classify the folk and martial arts of Tamil people.
- Examine Thinaï concepts, trade and victory of Chozha dynasty.
- Interpret the contribution of Tamils in Indian freedom struggle, Self-esteem movement and siddha medicine.

TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை
(வெளியீடு:தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
2. கீழடி - வைகைநதிக்கரையில் சங்ககால நகரநாகரிகம் (தொல்லியல்
துறைவெளியீடு)
3. பொருதை -ஆற்றங்கரைநாகரீகம். (தொல்லியல்துறைவெளியீடு).
4. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
5. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by:
International Institute of Tamil Studies).
6. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)
(Published by: International Institute of Tamil Studies).
7. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by:
International Institute of Tamil Studies.)
8. Keeladi – 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by:
Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation,
Tamilnadu.)
9. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published
by: The Author)
10. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook
and Educational Services Corporation, Tamilnadu.)
11. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference
Book.

Mapping of COs-POs & PSOs

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

1 - Low, 2 - Medium, 3 - High, "-" - No Correlation


Chairman - BoS

23HST102

தமிழர்மரபு

L T P C

(அனைத்து துறைகளுக்கும் பொதுவானது)

1 0 0 1

நோக்கங்கள்

மாணவர்கள் கண்டிப்பாக அறிய வேண்டுவன

- செம்மொழியான தமிழ்மொழியின் விரிவான இலக்கியத்தைப் பற்றி அறிதல்.
- பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை உள்ள கலைகளை பகுப்பாய்வு செய்தல்.
- நாட்டுப் புறக்கலைகள் மற்றும் வீர விளையாட்டுகளைப் புரிந்து கொள்ளுதல்.
- தமிழர்களின் திணைக் கோட்பாடுகளைச் செயல்படுத்துதல்.
- இந்திய விடுதலைப் போராட்டத்திற்கும் பண்பாட்டிற்கும் தமிழர்களின் பங்களிப்பை உணருதல்.

அலகு 1 மொழிமற்றும் இலக்கியம்

3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச்சார் பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழகக்காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கியவளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக்கலை

3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன்சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக்கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீரவிளையாட்டுகள்

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறைமுகங்களும் –சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு

3

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப்பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப் படிகள் – தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

TOTAL: 15 PERIODS

முடிவுகள்

பாடத்தின்முடிவில், மாணவர்கள் அறிந்து கொள்வன:

- தமிழ்மொழியின் செம்மொழி தன்மையையும் சங்க இலக்கியத்தின் முக்கியத்துவத்தையும் உணர்வார்கள்.
- தமிழர்களின் சிற்ப, ஓவிய, இசை மரபுகளை புரிந்து கொள்வார்கள்.
- நாட்டுப்புறக் கலைகளையும் வீர விளையாட்டுகளையும் வகைப்படுத்துவார்கள்.
- தமிழர்களின் திணைக்கோட்பாடுகளும் சங்ககால வர்த்தகமும் புரிந்து கொள்வார்கள்.
- இந்திய விடுதலைப் போராட்டம், சுயமரியாதை இயக்கம், சித்த மருத்துவம் ஆகியவற்றில் தமிழர்களின் பங்களிப்பை விளக்குவார்கள்.

உரைமற்றும்குறிப்புத்தகங்கள்

1. தமிழகவரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி – வைகைநதிக் கரையில் சங்ககால நகரநாகரிகம் (தொல்லியல் துறைவெளியீடு)
4. பொருறை -ஆற்றங்கரைநாகரீகம். (தொல்லியல்துறைவெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi – 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Mapping of COs-POs & PSOs

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

1 - Low, 2 - Medium, 3 - High, “-“ - No Correlation


Chairman - BoS

**23PHE103****APPLIED PHYSICS FOR ELECTRONICS ENGINEERING****L T P C**

(Common to ECE, EEE & Medical Electronics)

3 0 2 4**OBJECTIVES**

- To impart knowledge of different crystal lattices and crystal structures.
- To introduce the fundamental principles of lasers and their general scientific and engineering applications.
- To provide an understanding of the principles of optical fiber and its engineering applications.
- To explain the fundamentals and industrial applications of acoustics and ultrasonics.
- To enable students to understand the principles of quantum mechanics and Schrödinger's wave equation for analyzing complex physical phenomena.
- To understand and apply the fundamental principles of lasers, quantum mechanics, nanomaterials, digital circuits, and storage devices

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-Source of excitation- active medium, optical resonator - Derivation of Einstein's A and B co-efficient – Principle and Working of 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 - Digital Laser Material Processing Technology.

UNIT III FIBRE OPTICS**9**

Principle and Propagation light in Optical Fibres- Derivation of Numerical Aperture and Acceptance angle - Classification of Optical Fibres - Fibre optic sensors. (Pressure, Temperature Sensors)-Local area Network (qualitative) -Advantages & Application of Optical Fibre: Fibre Optic Communication System, Medical Endoscope



UNIT IV ACOUSTICS & ULTRASONICS

9

ACOUSTICS: Classification of Sound – Decibel - Weber Fechner law- Reverberation-Sabine's formula (Concept only) - 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.

UNIT V QUANTUM PHYSICS

9

Black Body Radiation – Planck's Theory (Derivation) – Electron Diffraction – Wave function and its Physical Significance – Schrödinger's Wave Equations: Time Independent and Time Dependent Equation – Scanning Electron Microscope - Transmission Electron Microscope - Quantum Tunnelling & Scanning Tunnelling Electron Microscope.

LIST OF EXPERIMENTS

(Any Eight experiments to be conducted)

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 = 60 PERIODS

OUTCOMES

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

- Apply crystallographic concepts to examine the structure of crystalline solids.
- Explain the principles of lasers and it's their applications.
- Explain the principles of optical fiber and its applications.
- Explain the fundamentals of sound waves and ultrasonic's and their engineering applications.

- Analyze the principles of quantum mechanics and Schrödinger's wave equation to identify complex physical phenomena.
- Demonstrate an understanding of the principles of lasers, quantum mechanics, nanomaterials, digital circuits, and storage devices.

TEXT BOOKS

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

REFERENCES

- Avadhanulu M.N & Kshirsagar P.G "Text Book of Engineering Physics". S.Chand, 2016.
- Wahab, M.A. "Solid State Physics: Structure and Properties of Materials" Narosa Publishing House, 2019
- K.Thyagarajan and A.Ghatak. "Lasers: Fundamentals and Applications", Laxmi Publications, (Indian Edition), 2019

E-RESOURCES

- <https://archive.nptel.ac.in/courses/122/107/122107035/>
- <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	PSO1	PSO2
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


Chairman - BoS

**23CYE101****ENGINEERING CHEMISTRY****L T P C****(Common to CSE, EEE, ECE, CSE (CS), MDE, AIDS, IT, PT& CSE (AIML) 3 0 2 4****OBJECTIVES**

- To introduce the characteristics of water and water treatment methods for industrial applications.
- To familiarize students with the types, properties, and applications of polymers and related materials.
- To employ the principles of phase rule, alloy formation, and heat treatment methods.
- To discuss the synthesis, characterization, and applications of nanomaterials.
- To apply electrochemical principles to understand corrosion mechanisms and corrosion control methods.
- 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 (phosphate, calgon and carbonate conditioning methods) – External conditioning – Zeolite process, Demineralization process – Desalination of brackish water by reverse osmosis.

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, Property of polymer: Glass transition temperature, Preparation, properties and uses of PVC, Nylon 6,6, Polyethylene - Rubbers – Types – Vulcanization of rubber – Plastics – Moulding constituents of plastics – Moulding of plastics – Compression and injection - 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- 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 alloy – Brass.



UNIT IV CHEMISTRY OF NANO MATERIALS

9

Nano chemistry – Basics (Surface area to volume ratio - 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 -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, 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 = 60 PERIODS

OUTCOMES

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

- Explain the quality parameters of water and identify appropriate methods for removing impurities for both domestic and industrial applications.
- Describe various types of polymers, their polymerization processes, and discuss their special properties and engineering applications.

- Apply the phase rule to understand alloy formation and its relevance in engineering applications.
- Discuss the fundamentals of nanomaterials and apply the core concepts of nanochemistry to engineering problems.
- Analyze the causes of corrosion and propose effective prevention and control strategies.
- Determine the water quality parameters and perform quantitative chemical analysis by pH meter, flame photometry, conductometry and potentiometry.

TEXT BOOKS

1. Jain P.C and Monika Jain, "Engineering Chemistry", Seventeenth Edition, Dhanpet Rai Publishing Company (P) Ltd. New Delhi, 2015.
2. Viswanathan B, "Nanomaterials" First Edition, Alpha Science International Ltd, 2009.

REFERENCES

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", Tenth Edition, S. Chand & Company Ltd, New Delhi, 2015.
2. Sivasankar B., "Engineering Chemistry", Second Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.

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	PSO1	PSO2
1	2	1	3	-	1	-	3	-	-	-	-	-	-
2	1	2	2	2	1	1	-	2	1	2	1	-	-
3	3	3	3	2	2	2	1	1	2	1	1	-	-
4	2	2	2	1	2	2	1	-	1	1	1	-	-
5	3	2	3	2	3	2	1	2	1	-	2	-	-
6	3	3	2	1	1	2	1	1	2	-	-	-	-
AVG	2.3	2.2	2.5	1.6	1.7	1.8	1.4	1.5	1.4	1.3	1.3	-	-

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


Chairman - BoS

23GEE101

PROGRAMMING IN C

L T P C

(Lab Embedded Theory Course)

3 0 2 4

OBJECTIVES

- To impart fundamental knowledge of C programming concepts, syntax, data types, operators, control structures, and program development.
- To develop students' understanding of arrays, strings, searching, and sorting techniques for solving computational problems.
- To train students in designing modular programs using functions, recursion, pointers, and parameter passing mechanisms.
- To familiarize students with structures, unions, dynamic memory allocation, and their applications in software development.
- To enable students to perform file handling operations and develop efficient C programs using sequential and random file processing.
- To develop C programs to solve real-world programming problems.

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.

Coding practices :

1. Develop a program to find the largest of three numbers using nested if statements.
2. Develop a program to generate multiplication tables using loops.

Problem - solving assignments :

1. Write a program to calculate the area and perimeter of a rectangle, circle, and triangle.
2. Write a program to calculate simple interest and compound interest.

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.

Coding practices :

1. Develop a program to perform matrix addition and transpose using two-dimensional arrays.

2. Write a program to sort an array using Insertion Sort.

Problem - solving assignments :

1. Develop a program to perform matrix operations such as addition and transpose using two-dimensional arrays.
2. Write a program to search for an element in an array using Linear Search and Binary Search.

UNIT III FUNCTIONS AND POINTERS

9

Introduction to functions: Function prototype, function call, Built-in 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.

Coding practices :

1. Develop a recursive program to generate the Fibonacci series.
2. Develop a program to implement a scientific calculator using built-in mathematical functions.

Problem - solving assignments :

1. Write a program to perform arithmetic operations using user-defined functions.
2. Write a program to swap two numbers using pass-by-value and pass-by-reference.

UNIT IV STRUCTURES AND UNION

9

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

Coding practices :

1. Develop a program to generate an employee salary slip using structures and pointers.
2. Develop a program using nested structures to represent student academic details.

Problem - solving assignments :

1. Write a program to store and display employee details using an array of structures.
2. Develop a program to demonstrate dynamic memory allocation using structures.

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.

Coding practices :

1. Write a program to create, write, and read a text file.

2. Develop a program to copy the contents of one file to another.

Problem - solving assignments :

1. Write a program to create, write, and read student records using sequential file processing.
2. Write a program to implement command-line arguments for performing arithmetic operations or file processing.

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. Populate an array with height of persons and find how many persons are above the average height.
7. 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.
8. Solve towers of Hanoi using recursion.
9. Locate and Display the Contents of an Array using Pointers.
10. Generate salary slip of employees using structures and pointers.
11. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

TOTAL: 45 +15 = 60 PERIODS

OUTCOMES

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

- Explain the fundamental concepts of C programming and develop programs using data types, operators, expressions, and control structures.
- Develop C programs using arrays, strings, searching, and sorting techniques to solve computational problems.
- Construct modular C programs by applying functions, recursion, pointers, and parameter

passing techniques.

- Develop applications using structures, unions, pointers, and dynamic memory allocation for efficient data organization and manipulation.
- Analyze file processing techniques using sequential and random access methods to perform data storage and retrieval operations.
- Develop reliable software solutions using C programming for real-world applications

TEXT BOOKS

1. E.Balagurusamy,"Programming in ANSI C", Tata McGraw Hill, Eighth Edition, 2019.
2. Kernighan, B.W and Ritchie,D.M,"The C Programming Language", Pearson Education, Second Edition, 2006.

REFERENCES

1. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2. Juneja, B. L and Anita Seth, "Programming in C", CENGAGE Learning India pvt.Ltd., First Edition, 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/> (File operations)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	–	3	–	–	–	–	–	2	2	–
2	3	3	2	1	3	–	–	–	–	–	2	2	–
3	3	3	3	2	3	–	–	–	–	–	2	2	–
4	3	3	3	2	3	–	–	–	1	–	2	2	–
5	2	3	2	2	3	–	–	–	1	–	2	2	–
6	3	3	3	2	3	–	1	1	2	1	2	2	–
AVG	2.8	2.8	2.5	1.5	3	-	1	1	1.3	1	2	2.0	–

1 - Low, 2 - Medium, 3 - High, "–" - No Correlation


Chairman - BoS



23EEEC101

SOFT SKILLS & LIFE SKILLS

L T P C

(Common to all First year / First Semester B.E., B.Tech., Branches)

1 0 0 1

OBJECTIVES

- To understand the Universal Human Values
- To have an overview on Life skills required in their profession
- To manage the behavior with emotional intelligent skills
- To learn professional Skills required for 21st century
- To formulate and implement effective leadership strategies.

UNIT I UNIVERSAL HUMAN VALUES

3

Understanding harmony in the human being - understanding harmony in the family and society - understanding harmony in the nature and existence - understanding of harmony on professional ethics

UNIT II LIFE SKILLS

3

Soft Skills – Positive Attitude - Empathy - Effective Communication - Decision-Making Skills - Communication Skills - Problem Solving - Critical Thinking- Analytical thinking

UNIT III EMOTIONAL SKILLS

3

Self-Awareness - Interpersonal Relationship - Stress – Stress management - Focus and Self Control - Positive Thinking – Anger management

UNIT IV PROFESSIONAL SKILLS

3

21st century skills – Hard Skills - General computer skills - Spreadsheet proficiency - Career Skills - developing a long - term career plan – Team Work -- Time management

UNIT V LEADERSHIP SKILLS

3

Leadership, Levels of Leadership, Making of a leader, Types of leadership, describing a leadership style.

TOTAL: 15 PERIODS



OUTCOMES

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

- Treat and respect the human beings with harmony,
- Develop the capabilities needed to utilize their potential wherever required.
- Control their emotional feelings and manage the stress.
- Explore the career & professional skills.
- Become highly confident as a leader and find new ways of influencing the teams they lead.

TEXT BOOKS

1. Life Skills for Engineers, McGraw Hill Education (India) Private Ltd., 2016
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Sydänmaanlakka Pentti. "Intelligent leadership and leadership competencies". Dissertation Series.

REFERENCES

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxford Publishers.
2. Kalyana; (2015) "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd.

E-RESOURCES

1. <https://uhv.org.in/>
2. <https://nptel.ac.in>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	1	-	-	-	2	2	3	2	1	-	-	-
2	1	3	1	1	-	1	-	2	3	3	1	-	-
3	-	1	-	-	-	1	-	3	3	3	1	-	-
4	2	2	1	1	3	1	-	2	3	3	3	-	-
5	1	1	1	-	-	2	-	3	3	3	3	-	-
AVG	1.25	1.6	1	1	3	1.4	2	2.6	2.8	2.6	2	-	-

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


Chairman - BoS

**23MDC101****INDUCTION PROGRAMME (2 Weeks)**

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have a broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character."

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

Physical Activity

This would involve a daily routine of physical activity with games and sports etc.

Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, make decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don'ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.





Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the underprivileged.

Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References: Guide to Induction program from AICTE


Chairman - BoS



SEMESTER II

23MAT202

DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS

L T P C

[Common to Civil, EEE, ECE and MDE]

3 1 0 4

OBJECTIVES

- To explore techniques for solving ordinary differential equations and recurrence relations.
- To compose the purpose of using Laplace transforms to create a new domain in which problems can be handled more easily.
- To develop the concepts of solving algebraic, transcendental and system of linear equations.
- To introduce the numerical techniques of interpolation and integration.
- To explain various numerical methods of solving ordinary differential equations.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS AND RECURRENCE RELATIONS 9+3

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Legendre's linear equations – Simultaneous linear equations with constant coefficients – Recurrence relations: Solving linear homogeneous recurrence relations with constant coefficients.

UNIT II LAPLACE TRANSFORMS 9+3

Definition – Conditions for existence – Transforms of elementary functions – Properties of Laplace transforms – Transform of Periodic functions – Transforms of derivatives and integrals – Multiplication by t^n and division by 't' – Evaluation of integrals by Laplace transforms – Inverse transforms – Convolution theorem – Application to solution of linear second order ordinary differential equations with constant coefficients.

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 with equal intervals: Newton's forward interpolation formula – Newton's backward interpolation formula – Interpolation with unequal intervals: Lagrange's interpolation formula – Divided differences – Newton's divided difference formula – Numerical integration: Trapezoidal rule – Simpson's one-third rule – Numerical double integration by Trapezoidal rule.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

9+3

Taylor's series method –Euler's method – Modified Euler's method – Runge-Kutta method – Predictor-corrector methods: Milne's method – Adams-Bashforth method.

LIST OF EXPERIMENTS

1. Solving ordinary differential equations.
2. Compute homogeneous recurrence relations.
3. Calculate Laplace Transform of simple functions.
4. Calculate Inverse Laplace transform of a given function.
5. Solution of simultaneous algebraic equations by Gauss Seidel method.
6. Find the Eigen values of a matrix by Power method.
7. Illustrate Lagrange's interpolation formula.
8. Evaluation of line integral by Simpson's one-third rule.
9. Solving ordinary differential equations by Euler's method.
10. Solving ordinary differential equations by Runge-Kutta method.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

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

- Apply appropriate techniques to solve ordinary differential equations and recurrence relations.
- Solve engineering problems using the concept of Laplace transforms.
- Compute the numerical solution of algebraic, transcendental and system of linear equations.
- Apply the numerical techniques of interpolation and integration.
- Evaluate the numerical solution of ordinary differential equations.

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, Fourty Fourth Edition, 2022.
2. Grewal, B.S., "Numerical Methods in Engineering and Science", Khanna Publishers, Eleventh Edition, 2023.

REFERENCES

1. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, Tenth Edition, 2016.
2. Burden, R.L and Faires, J.D, "Numerical Analysis", Cengage Learning, Ninth Edition, 2016.

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/111/105/111105121/> - (Ordinary differential equations)
2. <https://nptel.ac.in/courses/111106139> - (Laplace transforms)
3. <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	PSO1	PSO2
1	3	3	2	2	2	-	-	-	-	-	2	-	-
2	3	3	2	2	2	-	-	-	-	-	2	-	-
3	3	2	2	1	2	-	-	-	-	-	2	-	-
4	3	2	2	1	2	-	-	-	-	-	2	-	-
5	3	2	2	1	2	-	-	-	-	-	2	-	-
AVG	3	2.4	2	1.4	2	-	-	-	-	-	2	-	-

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


Chairman - BoS

23PHT203

ADVANCED PHYSICS FOR ELECTRONICS ENGINEERING

L T P C

(Common to ECE, EEE & Medical Electronics)

3 0 0 3

OBJECTIVES

- To explain the fundamental conduction mechanisms in conducting and dielectric materials.
- To provide knowledge on semiconductor physics and the principles of plastic electronics and their technological applications.
- To teach the basic concepts and properties of magnetic and superconducting materials.
- To introduce the principles of spintronics and nanoelectronic devices.
- To impart understanding of the fundamentals of biophotonics and biomaterials for biomedical applications.

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. Dielectric Materials: Electrical Susceptibility – Dielectric constant – Electronic, Ionic, Orientation and Space Charge Polarization- Internal field and Clausius-Mosotti Relation.

UNIT II SEMICONDUCTING MATERIALS & PLASTIC ELECTRONICS

9

Elemental and Compound Semiconductors – Intrinsic Semiconductor & Extrinsic semiconductor – Carrier concentration derivation in Intrinsic Semiconductor - Hall effect and applications.

Plastic Electronics: Introduction - Materials for Plastic Electronics - Conducting Polymers and Organic Semiconductors - Fabrication Techniques - Organic Light Emitting Diodes (OLEDs) - Organic Field Effect Transistors (OFETs).

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 - High TC Superconductors – 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 Molecular Transistor & Graphene Transistor –

Carbon nano tube transistor (qualitative) - Applications of Nanodevices and Nanosensors.

UNIT V BIOPHOTONICS & BIOMATERIALS

9

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

Bio Materials: 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, the students will be able to

- Explain the conduction mechanisms in conducting and dielectric materials.
- Describe the fundamentals of semiconductor physics and plastic electronics and relate them to electronic device applications.
- Explain the properties and applications of magnetic and superconducting materials.
- Describe the working principles of spintronic and nanoelectronic devices.
- Explain the basic principles and applications of biophotonics and biomaterials.

TEXT BOOK

1. Rajendran V, "Engineering Physics", Tata McGraw Hill Publications, 2015.
2. Murugesan R, Kiruthiga Sivaprasath E, "Modern Physics", S.Chand, Tenth Edition, 2019.
3. Gupta and Kumar, "Solid State Physics", K. Nath & Co, 2018.

REFERENCES

1. Sujata V, Bhatt, "Biomaterials", Seventh Edition, Narosa Publishing House, 2016.
2. Avadhanulu M.N, Kshirsagar P.G, "Text Book of Engineering Physics", S.Chand, 2015.
3. Charles Kittel, "Introduction to Solid State Physics", Wiley, 2019.

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	PSO1	PSO2
1	3	2	1	1	-	-	-	-	-	-	-	-	-
2	3	2	1	1	-	-	-	-	-	-	-	-	-
3	3	2	1	1	-	-	-	-	-	-	-	-	-
4	3	2	1	1	-	-	-	-	-	-	-	-	-
5	3	2	1	1	-	-	-	-	-	-	-	-	-
AVG	3	2	1	1	-	-	-	-	-	-	-	-	-

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


Chairman - BoS

**23CYT201****ENVIRONMENTAL SCIENCE AND SUSTAINABILITY****L T P C**

(Common to All B.E. /B.Tech. Branches)

3 0 0 3**OBJECTIVES**

- To familiarize students with the concepts of environment, ecosystems, biodiversity, and their conservation.
- To create awareness about environmental pollution, individual responsibilities in pollution prevention, and basic disaster management.
- To impart knowledge about major social and environmental issues, environmental protection laws, and green chemistry principles.
- To analyze population-related issues, human health, social welfare, and the role of information technology in environmental and human health.
- To develop an understanding of sustainability concepts, climate change issues, and sustainable management practices for addressing environmental challenges.

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 (d) aquatic ecosystems (oceans) – Introduction to biodiversity definition: genetic, species and ecosystem diversity –Value 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 – 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**

Water conservation, rain water harvesting, watershed management – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Green Chemistry and principles - Environment production act – Air (Prevention and Control of Pollution) act



–Water (Prevention and control of Pollution) act

Activity: Creating environmental awareness.

UNIT IV HUMAN POPULATION AND 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—Sustainable Development Goals-Targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-Case studies. Zero waste, Material Life cycle 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, the students will be able to

- Explain the basics of environment, ecosystems, biodiversity, and conservation.
- Identify major sources of pollution and understand individual responsibilities in pollution prevention and disaster management.
- Describe key social and environmental issues, environmental laws, and green chemistry principles.
- Analyze population growth, human health, social welfare, and the role of IT in environmental and health management.
- Apply sustainability concepts, climate change mitigation, and sustainable management practices to environmental challenges.

TEXT BOOKS

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, 2019.
2. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Eighth Edition, Pearson Education, 2021.
3. Allen, D. T. and Shonnard, D. R., "Sustainability Engineering: Concepts, Design and Case Studies", Third Edition, Prentice Hall, 2018.

REFERENCES

1. Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) Pvt Ltd, 2016.
2. Dharmendra S. Sengar, "Environmental law", Prentice hall of India Pvt Ltd, 2018.
3. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2019.

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	PSO1	PSO2
1	2	2	3	-	-	3	3	-	-	2	1	-	-
2	2	2	3	2	3	3	3	-	-	3	3	-	-
3	2	1	3	2	2	3	3	-	2	3	3	-	-
4	2	1	3	2	3	3	3	2	3	2	2	-	-
5	2	1	3	2	3	3	3	2	3	2	2	-	-
AVG	2	1.4	3	2	2.8	3	3	2	2.7	2.4	2.2	-	-

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


Chairman - BoS

23HST202

TAMILS AND TECHNOLOGY

LT P C

1 0 0 1

OBJECTIVES

- To gain knowledge about weaving and ceramic Technology
- To create a design and construction Technology
- To analyze manufacturing Technology
- To apply agriculture and irrigation Technology
- To remember scientific and scientific Tamil and Tamil computing

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 beads - 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

OUTCOMES

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

- Understand weaving under ceramic Technology.
- Develop new design and construction Technology.
- Identify the manufacturing Technology.
- Understand agriculture and irrigation.
- Knowledge of scientific Tamil and Tamil computing.

TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை-
(வெளியீடு:தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம்
(தொல்லியல் துறைவெளியீடு)
4. பொருளை -ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL - (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) - Reference Book.

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23HST202

தமிழரும் தொழில்நுட்பமும்

L T P C

(அனைத்து துறைகளுக்கும் பொதுவானது)

1 0 0 1

நோக்கம்

மாணவர்கள் கண்டிப்பாக அறியவேண்டுவன:

- நெசவு மற்றும் பீங்கான் தொழில்நுட்பம் பற்றிய அறிவைப் பெறுதல்.
- வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பத்தை உருவாக்குதல்.
- உற்பத்தி தொழில்நுட்பத்தைப் பகுப்பாய்வு செய்தல்.
- விவசாயம் மற்றும் நீர்ப்பாசனத் தொழில்நுட்பத்தைப் பயன்படுத்துதல்.
- அறிவியல்மற்றும்அறிவியல்தமிழ்மற்றும்தமிழ்கணிப்பொறிதொடர்பானஅறிவைநினைவில்கொள்ளுதல்.

அலகு 1 நெசவு மற்றும் பாணை தொழில்நுட்பம்

3

சங்ககாலத்தில் நெசவுத்தொழில் - பாணை தொழில்நுட்பம் - கருப்பு, சிவப்பு பாண்டங்கள் - பாண்டுகளில் கீறல்குறியீடுகள்.

அலகு 2 வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்

3

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்ககாலத்தில் கட்டுமான பொருட்களும் நடு கல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்கள், கோவில்களும் - சோழர் காலத்தா பெருங்கோயில்கள் மற்றும் பிறவழிபாட்டுத் தலங்கள் நாயக்கர் கால கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை.

அலகு 3 உற்பத்தித் தொழில்நுட்பம்

3

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடிகள் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்பு துண்டுகள் -

தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு 4 வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பம்

3

அணை, குளங்கள், மடகு – சோழர் கால குமுளி தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு - மீன்வளம் – முத்து மற்றும் முத்துகுளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார்ச்சமுகம்.

அலகு 5 அறிவியல் தமிழ் மற்றும் கணித்தமிழ்

3

அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக்கல்விக்கழகம் - தமிழ்மின்னூலகம் – இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத்திட்டம்.

TOTAL: 15 PERIODS

முடிவுகள்

பாடத்தின் முடிவில், மாணவர்கள் அறிந்துகொள்வன

- பீங்கான் மற்றும் நெசவு தொழில்நுட்பத்தைப் புரிந்து கொள்ளுதல்.
- புதிய வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பத்தை உருவாக்குதல்.
- உற்பத்தித் தொழில்நுட்பத்தை அடையாளம் காணுதல்.
- விவசாயம் மற்றும் நீர்ப்பாசனத்தைப் புரிந்து கொள்ளுதல்.
- அறிவியல் தமிழ் மற்றும் தமிழ் கணிப்பொறி தொடர்பான அறிவை பெறுதல்.

உரைமற்றும் குறிப்புத்தகங்கள்

1. தமிழகவரலாறு - மக்களும்பண்பாடும் – கே. கே. பிள்ளை– (வெளியீடு:தமிழ்நாடுபாடநூல்மற்றும் கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி – வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருறை -ஆற்றங்கரைநாகரீகம். (தொல்லியல்துறைவெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in

print)

6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi – 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Mapping of COs-POs & PSOs

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

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


Chairman - BoS



23HSE201

ENGLISH FOR ENGINEERS: THEORY AND PRACTICE

L T P C

(Common to all B.E. & B.Tech. Branches)

3 0 2 4

OBJECTIVES

- To strengthen grammatical accuracy for effective communication.
- To develop listening and reading comprehension skills.
- To improve writing proficiency for academic and formal purposes.
- To train in business and professional correspondence.
- To enhance speaking abilities for social and professional contexts.
- To provide practical exposure through interactive language activities.

UNIT I GRAMMAR

9

Articles - Prepositions - Conditionals - Subject verb agreement- Error Spotting - Active and Passive voice.

UNIT II LISTENING & READING

9

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

UNIT III WRITING

9

Checklist - Recommendations - Formal letters – inviting guests – acceptance/declining letters

UNIT IV BUSINESS WRITING

9

E-mail writing - fixing an appointment, cancelling appointment, paper submission for seminars and conferences - Job Application Letter andRésumé.

UNIT V SPEAKING

9

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging - Suggesting - Comparing and Contrasting - Situational Role-play.





LIST OF EXERCISES

1. Stage Dynamics (Body Language and Paralanguage - Presentation)
2. Day today real time speaking exposures – Story narration, simple, general topics and incidents.
3. Group Discussion
4. Power Point Presentation (Corporate Skills & Public Speaking)
5. Loud Reading
6. Picture Description
7. Interview Skills (Mock Interview & Interview Etiquette)
8. Case Study Report

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

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

- Use correct grammar in speech and writing.
- Understand and interpret information from various audio and reading sources.
- Write clear, structured, and formal documents.
- Prepare professional emails, résumés, and job-related letters.
- Communicate effectively in group discussions and presentations.
- Apply communication skills confidently in real-time situations.

TEXT BOOKS

1. S. Sumant, "Technical English II", Maven Learning Private Limited, 2012.
2. Joshi, Manmohan, "Soft Skills", First Edition, Bookboon, 2017.

REFERENCES

1. Dr K Elango, Dr. Veena Selvam, Dr. Sujatha Priyadarshini, "Resonance English for Engineers and Technologists", Cambridge University Press, First Edition, 2013.
2. Seely, John. "Oxford Guide to Effective Writing and Speaking", Oxford University Press, UK, 2013.

E-RESOURCES

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



EXTENSIVE READING

1. Stephen R. Covey, " The 7 Habits of Highly Effective People", Simon & Schuster, 2019.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	-	-	-	1	-	-	2	3	-	2	-	-
2	1	2	-	2	-	-	-	-	3	-	1	-	-
3	1	-	-	-	-	-	1	-	3	2	2	-	-
4	-	-	-	-	1	-	2	-	3	2	2	-	-
5	-	-	-	-	-	-	1	3	3	2	1	-	-
6	-	-	-	-	-	2	2	2	3	-	2	-	-
AVG	1	2	-	2	1	2	1.5	2.3	3	2	1.6	-	-

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


Chairman - BoS



23EEE201

ELECTRIC CIRCUIT ANALYSIS

LT P C

(Lab Embedded Theory Course)

3 0 2 4

OBJECTIVES

- To instruct basic concepts, basic laws and methods of analysis of DC and AC circuits.
- To inculcate the various methods of circuit analysis using network theorems.
- To impart knowledge in resonance and coupled circuits.
- To develop the understanding of steady state and transient response of RLC circuits.
- To familiarize the balanced and unbalanced three phase circuits.
- To enhance the practical skills providing hands-on experience in applying network theorems and analyzing transient circuits.

UNIT I BASIC CIRCUIT ANALYSIS

9

Introduction DC and AC Circuits - Basic circuit elements - Ohm's Law - Kirchhoff's laws - Voltage and Current division - Source Transformation - Resistors in series and parallel circuits - Star-delta transformation - Mesh and nodal analysis for DC Circuits

UNIT II NETWORK THEOREMS FOR DC CIRCUITS

9

Thevenin's and Norton's Theorem - Superposition Theorem - Maximum power transfer theorem - Reciprocity Theorem

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 - Analysis of coupled 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 AC sinusoidal input.

UNIT V THREE PHASE CIRCUITS

9

Average and RMS value - Phasor diagram - Power, Power factor and Energy - Analysis of three phase star and delta connected circuits with balanced and unbalanced loads - Power and Power factor measurements.



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.
4. Simulation and Experimental verification of electric circuit problems using Maximum Power transfer Theorem.
5. Simulation and Experimental validation of R-C electric circuit transients
6. Simulation and Experimental validation of frequency response of RLC electric circuit.
7. Simulation of three phase balanced and unbalanced star, delta networks circuits

TOTAL :45+15 = 60 PERIODS

OUTCOMES

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

- Apply the basic concepts to solve and evaluate DC and AC electrical circuits.
- Analyze complex electric circuits by applying network theorems
- Analyze the performance of resonance and coupled circuits.
- Examine the transient response behavior of RL, RC and RLC electrical circuits.
- Examine the parameters balanced and unbalanced three phase circuits.
- Apply the circuit theorems and concepts in engineering applications.

TEXT BOOKS

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

REFERENCES

1. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpat Rai Publishing Co Pvt Ltd, New Delhi, Seventh Edition, 2018.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, Fifth Edition, 2021.

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	PSO1	PSO2
1	3	3	3	3	3	-	-	-	2	-	-	3	2
2	3	3	3	3	3	-	-	-	2	-	-	3	2
3	3	3	3	3	3	-	-	-	2	-	-	3	2
4	3	3	3	3	3	-	-	-	2	-	-	3	2
5	3	3	3	3	3	-	-	-	2	-	-	3	2
6	3	3	3	3	3	-	-	-	2	1	1	3	2
AVG	3	3	3	3	3	-	-	-	2	1	1	3	2

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


Chairman - BOS

23GEL201

ENGINEERING PRACTICES LABORATORY

(Lab Embedded Theory Course)

L T 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; planning; making joints in wood materials used in common household 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 in household appliances.

WOOD WORK:

- a) Sawing,
- b) Planning 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 using Diac /Triac /quadric)
- 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 air conditioner.

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	PSO1	PSO2
1	3	2	-	-	1	1	-	-	-	-	2	2	1
2	3	2	-	-	1	1	-	-	-	-	2	2	1
3	3	2	-	-	1	1	-	-	-	-	2	2	1
4	3	2	-	-	1	1	-	-	-	-	2	2	1
AVG	3	2	-	-	1	1	-	-	-	-	2	2	1

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


Chairman - BoS



23GEL202

ENGINEERING DRAWING FOR ELECTRICAL AND ELECTRONICS

(Common For ECE, EEE & MDE)

LT P C

0 0 4 2

OBJECTIVES

- To impart knowledge of engineering drawing concepts through multiple views of engineering components.
- To familiarize students with the projection of solids in different positions using engineering drawing principles.
- To develop the ability to prepare engineering drawings of electrical appliances.
- To familiarize students with computer-aided drafting and 3D modeling software for engineering components.
- To enhance students' knowledge of software tools used for designing human anatomy and orthopedic implant models.

LIST OF EXPERIMENTS

1. Conversion of isometric views into orthographic
2. Conversion of orthographic views into isometric
3. Projection of solids - Hexagonal pyramid.
4. Projection of solids - Square prism.
5. Draw Fluorescent lamp wiring diagram and layout.
6. Draw staircase wiring diagram and layout.
7. Design and Implementation of NOR/XOR
8. Layout diagram of CMOS inverter and CMOS NAND gate.
9. Design of Human Anatomical structures.
10. Design of orthotics model.

TOTAL: 30 PERIODS

OUTCOMES

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

- Construct multiple views of engineering components.
- Develop the projection of solids.
- Design and develop the circuit connections of an electrical appliance.
- Apply logic design principles to draw the layout of logic gates and CMOS inverter.
- Design a functional orthotic model based on human anatomy and biomechanics .



Mapping of COs-POs & PSOs

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

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

[Signature]
Chairman - BoS

23EEEC201 INDIAN LANGUAGE (EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE L T P C

(Common to all B.E. & B.Tech. Branches)

0 0 4 2

OBJECTIVES

- To learn the Hindi alphabet, pronunciation, and basic writing.
- To understand and use basic Hindi grammar correctly.
- To develop basic reading, writing, listening, and speaking skills in Hindi.
- To use Hindi for simple everyday communication.
- To prepare learners to successfully clear the Hindi Examination.

UNIT I वर्णमालाएवंमूलभूतव्याकरण (ALPHABET AND BASIC GRAMMAR)

5

Hindi Vowels (स्वर)- Hindi Consonants (व्यंजन) -Matras (मात्राएँ)- Barakhadi (बारहखड़ी)-Word Formation (शब्दनिर्माण)- Gender (लिंग)- Number (वचन)- Basic Sentence -Formation (सरलवाक्यरचना)

UNIT II शब्दभंडारएवंव्याकरण (VOCABULARY AND GRAMMAR)

7

Nouns (संज्ञा)- Pronouns (सर्वनाम) -Adjectives (विशेषण) -Verbs (क्रिया) -Tenses (काल- Present, Past, Future) - Opposite Words (विलोमशब्द) -Synonyms (पर्यायवाची) -One-word Substitutions (अनेकशब्दोंकेलिएएकशब्द)

UNIT III पठनएवंलेखनकौशल (READING AND WRITING SKILLS)

7

Reading Simple Hindi Passages -Comprehension (गद्यांश) -Paragraph Writing (अनुच्छेदलेखन)- Letter Writing (पत्रलेखन)- Dialogue Writing (संवादलेखन) -Picture Description (चित्रवर्णन) -Dictation Practice (श्रुतिलेख)

UNIT IV दैनिकजीवनमेंहिंदी (HINDI FOR EVERYDAY COMMUNICATION)

7

Greetings and Introductions -Family Members (परिवार)- Days, Months, Seasons -Numbers (१-१००) -Time and Date - Colours, Fruits, Vegetables - Shopping Conversations - School and Classroom Vocabulary -Common Everyday Conversations

UNIT V साहित्यएवंपुनरावृत्ति (LITERATURE AND REVISION)

4

Simple Poems (कविताएँ)- Short Stories (लघुकथाएँ)- Proverbs and Idioms (मुहावरेएवंलोकोक्तियाँ- basic) - Moral Stories - Translation (English/Tamil to Hindi - Simple Sentences) - Revision of Grammar - Model Question Papers and Practice Tests

OUTCOMES

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

- Write basic Hindi words and sentences.
- Apply fundamental Hindi grammar in simple communication.
- Develop basic reading, writing, listening, and speaking skills in Hindi.
- Use Hindi confidently in day-to-day conversations.
- Develop proficiency required to successfully clear the **Hindi Examination**.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	-	-	-	-	-	-	-	-	3	-	1	-	-
2	-	-	-	-	-	-	1	1	3	-	1	-	-
3	-	-	-	-	-	-	1	2	3	-	2	-	-
4	-	-	-	-	-	1	2	2	3	-	1	-	-
5	-	-	-	-	-	-	-	-	2	-	3	-	-
AVG	-	-	-	-	-	1.0	1.3	1.6	2.8	-	1.6	-	-

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

P. Gaiy
Chairman - BoS



23EEEC201 INDIAN LANGUAGE (EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE L T P C

(Common to all B.E. & B.Tech. Branches)

0 0 4 2

OBJECTIVES

- To learn the German alphabet, pronunciation, and basic communication.
- To understand and use basic German grammar and vocabulary.
- To communicate in German in simple everyday situations.
- To develop basic reading, writing, listening, and speaking skills in German.
- To apply basic German language skills confidently through practice and revision.

UNIT I INTRODUCTION TO GERMAN LANGUAGE

6

German alphabet and pronunciation – Greetings - Self-introduction (Name, age, nationality, profession) - Numbers (0–100) -Days, months, seasons, and dates - Basic classroom expressions - Personal pronouns -Verb **sein** (to be) -Simple sentence formation

UNIT II BASIC GRAMMAR AND VOCABULARY

7

Definite and indefinite articles (der, die, das; ein, eine) - Nouns and gender - Singular and plural forms - Verb conjugation (regular verbs) - Present tense - Question words (Wer, Was, Wo, Wann, Wie, Warum) - Negation (nicht, kein) - Vocabulary: Family, occupations, countries, languages, colors

UNIT III EVERYDAY COMMUNICATION

7

Daily routine - Time and clock reading - Food and beverages - Shopping conversations - Asking for and giving directions -Making simple requests -Modal verbs (möchten, können) -Vocabulary: Home, school, transportation, weather

UNIT IV READING, WRITING, LISTENING, AND SPEAKING SKILLS

5

Reading short dialogues - Listening to simple conversations - Writing short paragraphs - Describing people, places, and objects - Introducing family and friends

UNIT V PRACTICAL APPLICATIONS AND REVISION

5

Travel and tourism vocabulary - At the restaurant - At the railway station and airport - Revision of grammar topics - Translation of simple sentences (English to German and German to English)

TOTAL: 30 PERIODS



OUTCOMES

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

- Identify the German alphabet and pronounce basic German words correctly.
- Use basic German vocabulary and simple grammar in sentences.
- Practice in simple German for everyday situations.
- Understand basic German texts and conversations.
- Apply basic German language skills confidently in simple real-life situations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	-	-	-	-	-	-	-	-	3	-	1	-	-
2	-	-	-	-	-	-	1	1	3	-	1	-	-
3	-	-	-	-	-	1	2	2	3	-	2	-	-
4	-	-	-	-	-	-	1	2	3	-	2	-	-
5	-	-	-	-	-	1	2	2	3	-	2	-	-
AVG	-	-	-	-	-	1	1.5	1.7	3	-	1.6	-	-

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

P. Sathy
Chairman - BoS

**23EEEC201 INDIAN LANGUAGE (EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE L T P C**

(Common to all B.E. & B.Tech. Branches)

0 0 4 2**OBJECTIVES**

- To learn the Japanese writing system, pronunciation, and basic vocabulary.
- To understand and use basic Japanese grammar and sentence patterns.
- To communicate in Japanese in simple everyday situations.
- To develop basic reading, writing, listening, and speaking skills in Japanese.
- To apply basic Japanese language skills confidently through practice and real-life communication.

UNIT I WRITING SYSTEMS & PRONUNCIATION**5**

Hiragana chart reading and writing - Katakana chart reading and writing - Basic pronunciation rules (long vowels, double consonants) – Numbers - Colours, body parts, pets description

UNIT II KANJI & BASIC GRAMMAR**7**

First 50 Kanji (Numbers, Time & Days, Basic Directions & People) - Topic marker は (wa) - Identification sentences: Noun + です (desu) - Possession particle の (no) - Inclusion particle も (mo) - Subject marker が (ga) - Direction particles へ (he) and に (ni) - Self-introductions and greetings (Aisatsu) - Numbers, prices, shopping terms - Days, months, relative time - Family members and occupations

UNIT III KANJI & FUNCTIONAL GRAMMAR**8**

Next 50 Kanji (Nature, Core Verbs, Adjectives & Nouns) - Verb groups (Group 1, Group 2, Group 3) - Masu forms (Present, Past, Positive & Negative) - Te-form (~て): requests, connecting sentences, continuous actions (~ている) - Adjective conjugation (い & な adjectives) - Desires (~たい) and Invitations (~ましょう)

UNIT IV VOCABULARY & FUNCTIONAL COMMUNICATION**5**

Action verbs (daily routine, hobbies) - Adjectives for people, food, and places - Positional words (inside, outside, next to, between) - Transport, travel, and location vocabulary - Simple conversations in everyday situations

UNIT V READING & LISTENING COMPREHENSION**5**

Reading short sentences in Hiragana, Katakana, and basic Kanji - Understanding classroom instructions - Listening to slow, clear daily-life conversations - Understanding simple shopping



dialogues

TOTAL: 30 PERIODS

OUTCOMES

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

- Identify the Japanese writing system and pronounce basic Japanese words correctly.
- Use basic Japanese vocabulary and simple grammar in sentences.
- Communicate in simple Japanese for everyday situations.
- Read, write, listen to, and understand basic Japanese texts and conversations.
- Apply basic Japanese language skills confidently in simple real-life situations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	-	-	-	-	1	1	-	1	2	-	-	-	-
2	-	-	-	-	1	2	-	2	2	-	-	-	-
3	-	-	-	-	2	2	1	2	3	-	1	-	-
4	-	-	-	-	2	2	1	3	3	-	1	-	-
5	-	-	-	-	1	1	1	2	3	-	1	-	-
AVG	-	-	-	-	1.4	1.6	1	0.2	2.6	-	1	-	-

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

P. Karthikeyan
Chairman - BoS



23MDC201

APTITUDE SKILLS

(Common to all Branches)

L T P C

3 0 0 0

OBJECTIVES

- To introduce the basics concepts and techniques of numbers, Highest common factor and Least common multiple.
- To develop the use of decimal fraction and problems on ages.
- To introduce the basic concepts of time, work, distance, calendar and clock.
- To explain the student with the concept of simple and compound interest.
- To provide the knowledge of polynomial and quadratic equations.

UNIT I NUMBERS, HIGHEST COMMON FACTOR AND LEAST COMMON MULTIPLE 9

Numbers and their basic classification – Types of number – Basic operations of numbers – Progression – Tests of divisibility – Highest common factor – Least common multiple

UNIT II DECIMAL FRACTION AND PROBLEMS BASED ON AGES 9

Decimal fraction – Types of fraction – Comparison of fractions – Inserting fractions in between two given fractions – Relation between decimal fraction and normal fraction – Conversion of a decimal fraction into a vulgar fraction – Types of decimals – Conversion of mixed recurring decimal into a vulgar fraction – Standard form of decimal – Problems based on ages.

UNIT III TIME, WORK, DISTANCE, CALENDER AND CLOCK 9

General rule for time and work – General rule for work and wages – Speed – Unit of speed – Average speed – Some useful relations – Problems on Trains – Calendars and clocks – Odd days – Ordinary year – Leap year.

UNIT IV SIMPLE INTEREST, COMPOUND INTEREST AND ELEMENTARY ALGEBRA 9

Simple interest – Compound interest – Some useful relations – Difference between compound interest and simple interest – Short cut methods to solve special types of problems – Elementary Algebra and averages

UNIT V POLYNOMIAL AND QUADRATIC EQUATIONS 9

Polynomial introduction – Degree of a polynomial – Types of polynomial – Operations on polynomial – Remainder and factor theorem – Quadratic equation – Pure Quadratic equation – Discriminant – Roots of the Quadratic equations – Solution of Quadratic equation – Framing of a Quadratic





equation – Special types of roots.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply basic concepts and techniques highest common factor and least common multiple on numbers.
- Apply the concept of decimal fraction and problems on ages.
- Apply the concept of time, work, distance, calendar and clock.
- Develop proficiency in simple interest, compound interest and basic algebraic skills.
- Explain the concepts and properties of polynomial and quadratic equations.

TEXT BOOKS

1. Agarwal R.S., "Quantitative Aptitude", S. Chand & Company Ltd, New Delhi, 2012.
2. Dinesh Khattar, "Quantitative Aptitude for competitive examinations", Pearson India Education Services Pvt. Ltd., New Delhi, 2019.

REFERENCES

1. Praveen R.V., "Quantitative Aptitude and Reasoning", PHI Learning Private Limited, Delhi, 2013.
2. Gupta P, "A unique Approach to Quantitative Aptitude ", Unique Publishers (I) Pvt. Ltd, New Delhi, 2017.

E-RESOURCES

1. <https://youtube.com/playlist?list=RDQM5XI256aOq24>
2. <https://youtu.be/KE7tQf9spPg>


Chairman - BoS





SEMESTER III

23MAT301

TRANSFORMS AND COMPLEX FUNCTIONS

L T P C

3 1 0 4

OBJECTIVES

- To introduce the basics of Fourier transforms and their properties.
- To compute the Z-transforms of standard functions and their properties.
- To provide knowledge of Fourier series and half-range series.
- To explain analytic functions, bilinear transformations and conformal mapping.
- To explore 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.

TOTAL: 45+15 = 60 PERIODS



OUTCOMES

Upon completion of the course, Students will be able to

- Apply various Fourier transform techniques in physical problems of engineering.
- Solve engineering problems using the concept of Z transforms.
- Analyze Fourier series for periodic functions and functions with discrete data.
- Apply the concept of analytic functions, bilinear transformations and conformal mapping.
- Evaluate the integrals using Cauchy's integral formula and residue theorem.

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, Fourty Third Edition, 2014.
2. Erwin Kreyszig, "Advanced Engineering Mathematics ", John Wiley, India, Tenth Edition, 2016.

REFERENCES

1. N.P. Bali. and Manish Goyal, "A Textbook of Engineering Mathematics", Laxmi Publications Pvt. Limited, Nineth Edition, 2014.
1. Dr.Kandasamy. P, Dr.Thilagavathy . K and Dr. Gunavathy .K., "Engineering Mathematics – Volume III", S. Chand and Company Ltd., New Delhi, Fourth Edition, 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	PSO1	PSO2
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	-	-
AVG	3	3	1	-	2	-	-	1	2	-	2	-	-

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


Chairman - BOB

23EET301

ELECTROMAGNETIC THEORY

L T P C

3 1 0 4

OBJECTIVES

- To impart knowledge on vector analysis and coordinate systems used in electromagnetic field studies.
- To familiarize with electrostatic field concepts and their engineering applications.
- To acquire knowledge on magnetostatic fields and related physical laws.
- To enhance understanding of electromagnetic field variations and governing equations.
- To foster concepts of electromagnetic wave propagation in different media.

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 - Simulation on 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 : 45 + 15 = 60 PERIODS

OUTCOMES

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

- Explain the basic mathematical concepts related to electromagnetic vector fields.
- Apply basic laws of electrostatics to various applications and to determine force, electric field intensity.
- Analyze the principles of magnetostatics to the solutions of problems relating to magnetostatic fields.
- Examine 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", Oxford University Press Inc. First India, Seventh Edition, 2020.
2. William H. Hayt and John A. Buck, "Engineering Electromagnetics", Tata McGraw Hill Ninth Revised Edition, 2020.

REFERENCES

1. Joseph. A. Edminister, "Schaum's Outline of Electromagnetics", Schaum's Outline Series), Tata McGraw Hill, Second Edition, 2017.
2. K A Gangadhar, "Electromagnetic Field Theory", Khanna Publishers, Eighth Reprint, 2019.

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	PSO1	PSO2
1	3	3	3	3	3	-	-	-	-	-	2	3	3
2	3	3	3	3	3	-	-	-	-	-	2	3	3
3	3	3	3	3	3	-	-	-	-	-	2	3	3
4	3	3	3	3	3	-	-	-	-	-	2	3	3
5	3	3	3	3	3	-	-	-	-	-	2	3	3
AVG	3	3	3	3	3	-	-	-	-	-	2	3	3

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


Chairman - BoS

23EET302

MEASUREMENTS AND INSTRUMENTATION

L T P C

3 0 0 3

OBJECTIVES

- To familiarize the basic concepts, characteristics, errors, standards and calibration of electrical measurements.
- To impart knowledge on the working principles and operation of electrical and electronic measuring instruments.
- To inculcate comparative methods of electrical measurements using bridges, grounding techniques and basic MATLAB programming.
- To acquire knowledge of digital measuring instruments, display devices, oscilloscopes, recorders and smart meters.
- To enhance the principles, selection and applications of transducers and data acquisition systems.

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, torque 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) - Mixed Signal Oscilloscope (MSO) - 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 - Smart sensors.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the characteristics, errors, standards and calibration techniques used in electrical measurements.
- Apply the operating principles of electrical and electronic measuring instruments for measurement of technical quantities.
- Analyze the bridge methods, interference reduction techniques, grounding methods, and basic MATLAB programming for electrical measurements.
- Illustrate the performance of digital measuring instruments, display devices, oscilloscopes and smart meters.
- Identify the suitable transducers and data acquisition systems for measurement and monitoring applications.

TEXT BOOKS

1. A.K.Sawhney, "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai & Co, Second Edition, 2021.
2. R.K.Rajput, "Electrical Measurements and Measuring Instruments", S.Chand and Company Pvt. Ltd. Fourth Edition, 2018.

REFERENCES

1. D.V.S. Moorthy, "Transducers and Instrumentation", Prentice Hall of India Pvt Ltd, Third Edition, 2022.

2. E.O.Doebelin, "Measurement Systems - Application and Design", Tata McGraw Hill Publishing Company, Sixth Edition, 2019.

E-RESOURCES

1. <https://nptel.ac.in/courses/108105153/> - (Electrical Measurement and Electronic Instruments)
2. <https://archive.nptel.ac.in/courses/108/105/108105064/> - (Industrial Instrumentation)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS



23EEE301

DC MACHINES AND TRANSFORMERS

LT P C

(Lab Embedded Theory Course)

3 0 2 4

OBJECTIVES

- To enhance the magnetic circuits, energy conversion principles and magnetic field systems in rotating machines.
- To inculcate the construction, operation, characteristics and performance of DC generators.
- To familiarize the operation, characteristics, speed control and braking methods of DC motors.
- To acquire knowledge about transformer construction, operation, connections and performance analysis.
- To impart knowledge the testing methods used for DC machines and transformers.
- To provide knowledge about the testing, characteristics and performance analysis of DC machines and transformers.

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 - E.M.F equations - Types of DC Generators - Characteristics of DC generators - Losses and Efficiency - Armature reaction - Commutation and inter poles - Compensating winding - Simulation on DC Machine Characteristics.

UNIT III DC MOTORS

9

Principle and operations - Back E.M.F. - Types of DC motors - Characteristics of DC Motors - Starting and speed control of DC motors - Plugging, Dynamic and Regenerative braking - Types of Starter - Necessity of Starters - Applications of DC motors.

UNIT IV TRANSFORMERS

9

Construction - Principle of operation - E.M.F Equation - Transformer ratio - Transformer on no Load - Transformer on load - Equivalent circuit - Losses and Efficiency - All day efficiency.- Regulation -



- 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.

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. Speed control of DC shunt motor.
5. Swinburne's test of DC shunt motor.
6. Load test on single-phase transformer.
7. Open circuit and short circuit tests on single phase transformer.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

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

- Explain the magnetic circuits and electromechanical energy conversion principles.
- Analyze the operating principles and characteristics of DC generators.
- Apply the speed control and braking methods of DC motors.
- Identify the transformer operation and performance characteristics.
- Analyze the performance and efficiency of DC machines and transformers using testing methods.
- Apply the testing procedures to evaluate the performance of 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, Tenth Edition, 2017.

REFERENCES

1. P.S.Bimbhra, "Electrical Machinery", Khanna Publication Pvt. Ltd, Second Edition, 2021.
2. B.R.Gupta, "Fundamental of Electric Machines", New age International Publishers, Third Edition Reprint, 2019.

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	PSO1	PSO2
1	3	2	1	-	-	-	-	-	-	-	2	2	2
2	3	3	2	2	1	-	-	-	-	-	2	2	2
3	3	3	3	2	1	-	-	-	-	-	2	2	2
4	3	3	2	2	2	-	-	-	-	-	2	2	2
5	3	3	3	2	2	-	-	-	-	-	2	2	2
6	3	3	3	3	3	-	-	3	3	-	2	2	2
AVG	3	2.8	2.3	2.2	1.8	-	-	3	3	-	2	2	2

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


Chairman - BoS

23EEE302

ANALOG ELECTRONICS AND CIRCUITS

L T P C

(Lab Embedded Theory Course)

3 0 2 4

OBJECTIVES

- To impart knowledge on the structure, operation, and applications of diodes and rectifier circuits.
- To familiarize with the characteristics and biasing of BJT, JFET, and UJT.
- To acquire knowledge on amplifier models, configurations, and frequency response.
- To enhance understanding of differential amplifiers and switching circuits.
- To foster concepts of feedback amplifiers and oscillators.
- To inculcate practical skills in analyzing and verifying electronic circuits through laboratory experiments.

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.

UNIT II TRANSISTORS AND FET

9

BJT, JFET and UJT - structure, operation, characteristics and Biasing, Simulation on Characteristics of BJT.

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 - Oscillators: RC phase shift, Wien bridge, Hartley, Colpitts and Crystal oscillators.

LIST OF EXPERIMENTS

1. Characteristics of PN junction diode and Zener diode.
2. Design and Verification of Diode Clipper and Clampers.
3. Single Phase half-wave and full wave rectifiers with capacitive filter.
4. Characteristics of a NPN Transistor under CE configurations.
5. Characteristics of JFET and UJT.
6. Characteristics of photo diode and Photo Transistor.
7. Design and testing of RC phase shift and LC oscillators.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

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

- Explain the operation and characteristics of diodes and rectifier circuits.
- Apply biasing techniques to analyze transistor characteristics.
- Analyze amplifier configurations for gain and frequency response.
- Examine differential amplifiers and switching circuits.
- Analyze the performance of feedback amplifiers and oscillator circuits.
- Design and testing of electronic circuits through experiments

TEXT BOOKS

1. David A. Bell, "Electronic Devices and Circuits", Oxford University higher education, Fifth Edition, 2018.
2. S.Salivahanan, N.Sureshkumar, "Electronic devices and circuits", McGraw Hill Education, Fifth Edition, 2022.

REFERENCES

1. Thomas L.Floyd, "Electronic devices", Conventional current version, Pearson prentice hall, Tenth Edition, 2021.
2. V.K.Mehta, Rohit Mehta, "Principles of Electronics", S.Chand Publishing, Twelfth 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	PSO1	PSO2
1	3	3	3	3	3	-	-	-	-	-	3	3	2
2	3	3	3	3	3	-	-	-	-	-	3	3	2
3	3	3	3	3	3	-	-	-	-	-	3	3	2
4	3	3	3	3	3	-	-	-	-	-	3	3	2
5	3	3	3	3	3	-	-	-	-	-	3	3	2
6	3	3	3	3	3	2	2	3	3	2	3	3	2
AVG	3	3	3	3	3	2	2	3	3	2	3	3	2

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


Chairman - BoS

**23EEE303****DIGITAL ELECTRONICS AND LINEAR INTEGRATED CIRCUITS****LT P C**

(Lab Embedded Theory Course)

3 0 2 4**OBJECTIVES**

- To familiarize with various number systems, Boolean algebra theorems and logic minimization techniques.
- To impart knowledge on the design of various combinational digital circuits using logic gates.
- To inculcate the skills for the analysis and design for synchronous sequential circuits.
- To develop understanding of operational amplifier characteristics and their linear and nonlinear applications.
- To enhance the knowledge in application ICs.
- To acquire practical skills in designing, testing and characterizing circuits using digital 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 PROGRAMMABLE 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**

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



UNIT V APPLICATION ICs

9

IC voltage regulators: LM78XX, LM79XX fixed series voltage regulator - LM317, LM723 adjustable voltage regulators - Switched mode power supply - IC555 multivibrator - Phase Locked Loop - VCO.

LIST OF EXPERIMENTS

1. Verification of Boolean theorems using digital logic gates.
2. Design and implementation of adder, subtractor.
3. Design and implementation of 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, Subtractor.
7. Application of Op-Amp: Integrator and Differentiator.
8. Timer IC application: Study of NE/SE 555 timer in Astability, Monostability operation.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

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

- Analyze number systems, binary codes, and Boolean algebra to perform logic minimization.
- Construct the various combinational digital circuits and PLDs.
- Analyze and design the synchronous sequential circuits using flip-flops.
- Apply operational amplifier concepts to design waveform generation circuits.
- Examine the operation and applications of integrated circuits (ICs).
- Design digital and analog circuits using ICs such as decoders, multiplexers, timers and 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, Sixth Edition, 2019.
2. D. Roy Choudhary, Shail B. Jain, "Linear Integrated Circuits", New Age International Publishers, First Edition, 2021.

REFERENCES

1. A. Anand Kumar, "Fundamentals of Digital Circuits", PHI Education, Fourth Edition, 2020.
2. S.Salivahanan, V.S.Kanchan Bhaaskaran, "Linear Integrated Circuits", Tata McGraw Hill Education, Second 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)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23EEEC301

PROFESSIONAL DEVELOPMENT

L T P C

0 0 2 1

OBJECTIVES

To be proficient in important Microsoft Office tools: MS WORD, EXCEL and POWERPOINT.

- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD:

10 Hours

Create and format a document

Working with tables

Working with Bullets and Lists

Working with styles, shapes, smart art, charts

Inserting objects, charts and importing objects from other office tools

Creating and Using document templates

Inserting equations, symbols and special characters

Working with Table of contents and References, citations

Insert and review comments

Create bookmarks, hyperlinks, endnotes footnote

Viewing document in different modes

Working with document protection and security

Inspect document for accessibility

MS EXCEL:

10 Hours

Create worksheets, insert and format data

Work with different types of data: text, currency, date, numeric etc.

Split, validate, consolidate and Convert data

Sort and filter data

Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.)



Work with Lookup and reference formulae

Create and Work with different types of charts

Use pivot tables to summarize and analyze data

Perform data analysis using own formulae and functions

Combine data from multiple worksheets using own formulae and built-in functions to generate results

Export data and sheets to other file formats

Working with macros

Protecting data and Securing the workbook

MS POWERPOINT:

10 Hours

Select slide templates, layout and themes

Formatting slide content and using bullets and numbering

Insert and format images, smart art, tables, charts

Using Slide master, notes and handout master

Working with animation and transitions

Organize and Group slides

Import or create and use media objects: audio, video, animation

Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

OUTCOMES

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

- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements.
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding.
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.


Chairman - BoS



SEMESTER IV

23EET401

ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION

LT P C

3 0 0 3

OBJECTIVES

- To explore expressions for the computation of transmission line parameters.
- To gain knowledge of equivalent circuits for transmission lines, voltage regulation, and efficiency.
- To discuss mechanical design of transmission lines, types, and voltage distribution in insulators.
- To examine types and grading of underground cables.
- To provide knowledge of distribution systems, types of substations, grounding methods, and modern trends like EHVAC, HVDC, and FACTS

UNIT I TRANSMISSION LINE PARAMETERS

9

Introduction to power generation: Steam, Hydroelectric, Nuclear - 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

- Analyze the performance parameters of power generation systems and transmission lines under different operating conditions.
- Apply the performance of short, medium, and long transmission lines and apply MATLAB to model their behavior.
- Examine mechanical design principles of transmission lines and voltage distribution in insulators.
- Identify the types and grading of underground cables and their performance characteristics.
- Analyze distribution systems, substation types, grounding methods, and trends like EHVAC, HVDC, and FACTS.

TEXT BOOKS

1. V.K.Mehta, Rohit Mehta, "Principles of Power System", S. Chand & Company Ltd, New Delhi, Revised Edition, 2021
2. C.L.Wadhwa, "Electrical Power Systems", New Age International Publishers, Seventh 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, Second Edition, 2016.
2. D.P.Kothari, I.J. Nagarath, "Power System Engineering", McGraw - Hill Publishing Company limited, New Delhi, Third Edition, 2019.

E-RESOURCES

1. <https://nptel.ac.in/courses/108/102/108102047/> - (Power system)
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	PSO1	PSO2
1	3	3	3	2	-	1	1	-	2	-	2	1	3
2	3	3	3	2	2	1	1	-	2	-	2	1	3
3	3	3	3	2	-	1	1	-	2	-	2	1	3
4	3	3	3	2	-	1	1	-	2	-	2	1	3
5	3	3	3	2	-	1	1	-	2	-	2	1	3
AVG	3	3	3	2	2	1	1	-	2	-	2	1	3

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


Chairman - BoS

23EET402

POWER ELECTRONICS

LT P C

3 0 0 3

OBJECTIVES

- To impart knowledge on the structure, operation, characteristics, and control of power semiconductor devices and their associated circuits.
- To enhance the operation, performance, and applications of AC to DC converters and controlled rectifiers.
- To familiarize with DC to DC converters, control strategies, and switched mode power supplies.
- To develop understanding of DC to AC converters, PWM techniques, and harmonic control methods.
- To foster awareness of AC to AC converters, control strategies, and their industrial applications

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° mode and 180° 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, the students will be able to

- Apply the knowledge of power electronic devices and converters.
- Describe the performance of converters and power semiconductor devices.
- Analyze the performance of DC-DC converters.
- Discuss the operation of inverter circuits.
- Examine the performance of ac regulator and cycloconverter.

TEXT BOOKS

1. M. H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education, New Delhi, PHI Fourth Edition, 2020.
2. P. S. Bimbhra "Power Electronics", Khanna Publishers, Sixth Edition, 2018.

REFERENCES

1. Ned Mohan, Tore. M. Underland, William. P. Robbins, "Power Electronics: Converters, Applications and Design", John Wiley and sons, Fourth Edition, 2021.
2. M.D. Singh and K.B. Khanchandani, "Power Electronics," Mc Graw Hill India, Third Edition, 2019.

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	PSO1	PSO2
1	3	3	3	3	3	-	-	-	-	-	3	3	3
2	3	3	3	3	3	-	-	-	-	-	3	3	3
3	3	3	3	3	3	-	-	-	-	-	3	3	3
4	3	3	3	3	3	-	-	-	-	-	3	3	3
5	3	3	3	3	3	-	-	-	-	-	3	3	3
AVG	3	3	3	3	3	-	-	-	-	-	3	3	3

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



Chairman - BoS

23EET403

CONTROL SYSTEMS ENGINEERING

LT P C

3 0 2 4

OBJECTIVES

- To impart knowledge of the basic principles and system representations used in control engineering.
- To familiarize the time-domain behavior of control systems under standard test inputs.
- To acquire the system performance using frequency domain analysis
- To enhance the stability of control systems and methods of stability analysis
- To develop the compensator design and state-space modeling of control systems.

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.

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 and 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.

OUTCOMES

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

- Analyze the transfer function of mechanical system, Block diagram reduction and signal flow graph.
- Examine the time domain specifications and steady state error.
- Analyze the frequency response characteristics of open loop system response.
- Examine the system stability using Routh-Hurwitz, Root locus and Nyquist stability criterion.
- Design the compensator and state space modeling of linear time invariant systems.

TEXT BOOKS

1. I.J.Nagrath and M.Gopal, "Control Systems Engineering", New Age International (P) Ltd, Publishers, Sixth Edition, 2021.
2. K. Ogata, "Modern Control Engineering", Prentice Hall, Fourth Edition, 2018.

REFERENCES

1. M. Gopal, Control Systems, "Principles and Design", Tata McGraw Hill, New Delhi, Fourth Edition, 2019.
2. A. Nagoorkani, "Control Systems Engineering", RBA Publications, Third Edition, 2021.

E-RESOURCES

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

Mapping of COs-POs & PSOs

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

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



Chairman - BoS

23EEE401

MICROPROCESSOR AND MICROCONTROLLERS

LT P C

(Lab Embedded Theory Course)

3 0 2 4

OBJECTIVES

- To impart knowledge on the architecture, instruction set, and interfacing of the 8085 microprocessor.
- To familiarize with the architecture, memory organization, and programming features of the 8051 microcontroller.
- To develop understanding of 8051 programming and its applications in interfacing and control systems.
- To foster skills in Arduino programming, interfacing sensors, actuators, and peripheral devices
- To inculcate understanding of PIC microcontroller architecture, instructions, and peripheral operations.
- To perform assembly language programming and peripheral interfacing in microprocessor and microcontroller systems.

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.

LIST OF EXPERIMENTS

8085 Programs using kits

1. Basic arithmetic and Logical operations.
2. Code conversion, sorting and searching.

Peripherals and Interfacing Experiments

1. Stepper motor control.
2. Key board and Display.
3. A/D and D/A interface and Waveform Generation.

8051 Experiments using kits

1. Basic arithmetic and Logical operations.
2. Displaying a moving/ rolling message in the student arduino trainer kit's output device.
3. Programming PIC architecture with software tools.

TOTAL: 45 + 15 = 60 PERIODS

OUTCOMES

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

- Explain the architecture, timing, addressing modes, and instruction set of the 8085 microprocessor.
- Summarize the hardware, memory organization, interrupts, and programming concepts of the 8051.
- Analyze interfacing of A/D, D/A, motors, displays, and embedded applications using the 8051.
- Apply Arduino programming, libraries, and I/O interfacing techniques for real-time control.
- Identify the PIC architecture, memory structure, instructions, and peripheral functions including motor control.
- Develop the assembly language programs and interfacing of peripheral with microprocessor and microcontroller.

TEXT BOOKS

1. R.S.Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", Penram International Publishing, Sixth Edition, 2018.

2. Krishna Kant, "Microprocessor and Microcontrollers Architecture, Programming and System design 8085, 8086, 8051, 8096 ", Prentice Hall of India, New Delhi, Third Edition, 2021.

REFERENCES

1. Richard Blum, "Arduino Programming in 24 Hours", Sams Teach Yourself, Second Edition, 2022.
2. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey "PIC Microcontroller and Embedded Systems using Assembly and C for PIC18", Pearson Education, Second Edition, 2021.

E-RESOURCES

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

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	3	2	-	-	-	-	2	3	2
2	3	3	3	2	3	2	-	-	-	-	2	3	2
3	3	3	3	3	3	2	-	-	-	-	2	3	3
4	3	3	3	3	3	2	-	-	-	-	2	3	3
5	3	3	3	3	3	2	-	-	-	-	2	3	3
6	2	2	2	2	3	3	-	3	3	3	2	3	3
AVG	2.8	2.8	2.6	2.4	3	2.2	-	3	3	3	2	3	2.6

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



Chairman - BoS

23EEE402

INDUCTION AND SYNCHRONOUS MACHINES

LT P C

(Lab Embedded Theory Course)

3 0 2 4

OBJECTIVES

- To familiarize the construction, operation, performance and testing of three phase induction motors.
- To impart knowledge the starting methods, speed control techniques and braking of three phase induction motors.
- To enhance the operation, performance and applications of single-phase induction motors and special machines.
- To acquire knowledge of construction, operation, regulation and testing of synchronous generators.
- To inculcate the operating principles, performance characteristics and applications of synchronous motors.
- To provide knowledge about the operating characteristics, losses and efficiency, regulation, speed control of synchronous and induction machines.

UNIT I THREE PHASE INDUCTION MOTOR

9

Constructional details - Types of rotors - Principle of operation - Slip - Cogging and crawling - Equivalent circuit - Torque-Slip characteristics – Torque Equation - 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 II 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 III 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 - Working Principle: Stepper motors, Hysteresis motor, Reluctance motor, Universal motor, BLDC Motor.

UNIT IV 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 and ZPF method - Two reaction theory - Slip test.

UNIT V 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.

LIST OF EXPERIMENTS

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

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

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

- Analyze the torque-slip characteristics and performance of three phase induction motors.
- Explain the suitable starting and speed control methods for three phase induction motors.
- Identify the working principles of single-phase induction motors and special machines.
- Examine the performance and voltage regulation of synchronous generators.
- Summarize the synchronous motor concepts for power factor improvement and industrial applications.

- Analyze the performance and operating characteristics of induction and synchronous machines.

TEXT BOOKS

- D.P. Kothari and I.J. Nagrath, "Electric Machines", McGraw Hill Publishing Company Ltd, Fifth Edition, 2017
- P.S. Bhimbhra, "Electrical Machinery", Khanna Publishers, Second Edition, 2021.

REFERENCES

- Prithwiraj Purkait, Indrayudh Bandyopadhyay, "Electric Machines", Pearson India Education, 2017.
- B.R.Gupta, "Fundamental of Electric Machines" New age International Publishers, Third Edition, Reprint 2015.

E – RESOURCES

- <https://nptel.ac.in/courses/108/106/108106072/> - (Introduction on Induction Machines)
- [https://archive.nptel.ac.in/courses/108/105/108105131/-](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	PSO1	PSO2
1	3	3	2	2	3	2	-	-	-	-	2	2	2
2	3	3	3	3	3	2	-	-	-	-	2	3	2
3	3	3	3	3	3	2	-	-	-	-	2	3	3
4	3	3	3	3	3	2	-	-	-	-	2	3	2
5	3	3	3	3	3	2	-	-	-	-	2	2	3
6	3	3	3	3	3	3	-	3	3	3	2	2	2
AVG	3	3	2.8	2.8	3	2.2	-	3	3	3	2	2.6	2.3

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


Chairman - BoS

23GEE301

PROBLEM SOLVING AND PYTHON PROGRAMMING

L T P C

(Lab Embedded Theory Course)

3 0 2 4

OBJECTIVES

- To impart the fundamentals of computational thinking, algorithm design, and problem-solving techniques for developing efficient software solutions.
- To develop students proficiency in Python programming using data types, expressions, operators, statements, and debugging techniques.
- To enable students to apply control structures, functions, recursion, and string manipulation for solving computational problems.
- To train students to use lists, tuples, dictionaries, and advanced data processing techniques for structured programming.
- To inculcate the knowledge of file handling, exception handling, modules, packages, and data visualization for developing robust Python applications.
- To develop the students in analytical, programming, and computational skills through coding practices, and to solve real-world problems using Python.

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 (pseudocode, flowchart, 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.

Coding practices:

1. Develop Algorithm and flowchart to find the greatest of three numbers.
2. Develop Algorithm and flowchart to find a minimum number in a List.

Problem-solving Assignments:

1. Develop Algorithm and Flowchart to solve Towers of Hanoi Problem.
2. Develop Algorithm, Pseudo code and flowchart for finding factorial of a given number using recursion.

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

Coding practices:

1. Develop python program to find area of a Circle
2. Develop python program to convert Fahrenheit to Celsius.

Problem-solving Assignments:

1. Develop Python program to find Quadratic Equation

Develop Python program to find Student mark statement based on 5 subjects.

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.

Coding practices:

1. Develop python program to find GCD of a given number.
2. Develop python program to find factorial of a number.
3. Develop Python program to find sum of array of given numbers.

Problem-solving Assignments:

1. Develop Python program to find whether an element is found in the List by using (A) Linear Search and (B) Binary Search method
2. Develop Python program to print Fibonacci Series

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 and methods; advanced list processing – list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

Coding practices:

1. Develop python program for Insertion Sorting & Selection Sorting.
2. Develop python program for Histogram

Problem-solving Assignments:

1. Develop Python program for student mark statement using List
2. Develop Python program to print Retail bill statement

UNIT V FILES, MODULES, PACKAGES & DATAVISUALIZATION

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 – Introduction to plotting – visualizing errors – Histogram.

Coding practices:

1. Develop python program to append the contents of one file to another.
2. Develop python program to copy contents of one file to another file using command Line Arguments

Problem-solving Assignments:

1. Develop a python program for calculator using python packages.
2. Develop a suitable python program to demonstrate each case in Exceptional Handling.
3. Develop a suitable python program using Matplotlib for Visualizing Errors.

LIST OF EXPERIMENTS

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/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)

TOTAL: 45 +15 = 60 PERIODS

OUTCOMES

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

- Analyze computational problems to develop effective problem-solving strategies.
- Apply python constructs to develop programs for python applications.
- Apply control structures and functions to solve computational problems.
- Apply Python built-in data structures such as lists, tuples, and dictionaries to process and manipulate data efficiently.
- Analyze the operations of file handling, exception handling, modules, packages, and data visualization techniques for real-world applications.
- Implement python programs for solving various computational problems.

TEXTBOOKS

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

REFERENCES

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, First Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", Notion Press, First Edition, 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	PSO1	PSO2
1	3	3	2	1	2	-	-	-	-	-	2	3	1
2	3	2	2	-	3	-	-	-	-	-	2	3	1
3	3	3	2	1	3	-	-	-	-	-	2	3	1
4	3	2	2	-	3	-	-	-	-	-	2	3	1
5	2	3	2	2	3	-	-	-	1	-	2	3	1
6	3	3	3	2	3	-	1	1	2	1	2	3	1
AVG	2.8	2.7	2.2	1.5	2.8	-	1	1	1.5	1.	2	3	1

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


Chairman - BoS



Students may be permitted to study online courses (NPTEL, SWAYAM or any Proctored Assessment Certification Courses) with 3 credits during the 4th semester curriculum for all B.E./B.Tech. Programmes. Such courses offered to students shall be recommended by the Department Academic Committee (DAC). The DAC shall ensure that the courses offered are not core courses in their respective curriculum.

The number of credits and transfer of credits are based on the procedure explained in following Table. The mapping of marks with grades is applicable only if the student passes the course as per the guidelines of NPTEL.

S.No.	No. of Weeks	Credits
1	4	1
2	8	2
3	12	3
4	16	4


Chairman - BoS



SEMESTER V

23EET501

POWER SYSTEM ANALYSIS

LT P C

3 1 0 4

OBJECTIVES

- To familiarize the basic concepts, components, representation and per-unit quantities used in power systems.
- To enhance the formulation and solution of power flow problems using numerical methods.
- To impart knowledge about the principles and techniques used for symmetrical fault analysis in power systems.
- To provide knowledge of symmetrical components and unsymmetrical fault analysis techniques.
- To inculcate the concepts and methods used for power system stability assessment.

UNIT I POWER SYSTEM

9+3

Need for system planning and operational studies - Power scenario in India - Power system components - Representation - Single line diagram - Per unit quantities - Per unit impedance diagram - Per unit reactance diagram.

UNIT II POWER FLOW ANALYSIS

9+3

Formation of bus admittance matrix of large power network - Bus classification - Formulation of power flow problem in polar coordinates - Power flow solution using Gauss Seidel method - Handling of voltage controlled buses - Power flow solution by newton raphson method.

UNIT III SYMMETRICAL FAULT ANALYSIS

9+3

Assumptions in short circuit analysis - Formation of impedance bus - Symmetrical short circuit analysis using thevenin's theorem - Bus Impedance matrix building algorithm (without mutual coupling) - Symmetrical fault analysis through bus impedance matrix - Post fault bus voltages - Fault level.

UNIT IV UNSYMMETRICAL FAULT ANALYSIS

9+3

Symmetrical components - Sequence impedances - Sequence networks - Analysis of unsymmetrical faults at generator terminals: LG, LL and LLG - Unsymmetrical fault occurring at any point in a power system - Computation of post fault currents in symmetrical component and phasor domains.

UNIT V STABILITY ANALYSIS

9+3

Classification of power system stability - Rotor angle stability - Swing equation - Swing curve - Power angle equation - Equal area criterion - Critical clearing angle and time - Solution of the swing equation: Modified Euler Method & Runge Kutta Method

TOTAL : 45+15 = 60 PERIODS

OUTCOMES

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

- Apply the power system components and per-unit representation for power system analysis.
- Analyze the Gauss-Seidel and Newton-Raphson methods to determine bus voltages and power flow in power networks.
- Analyze the symmetrical faults and determine fault currents, fault levels and post-fault bus voltages.
- Identify the LG, LL, and LLG faults using sequence networks and compute fault currents and voltages.
- Analyze power system stability and determine critical clearing angle and time using stability criteria.

TEXT BOOKS

1. Kothari.D.P. and Nagrath.I.J., R K Saket , "Modern Power System Analysis", McGraw Hill Education Pvt. Ltd., New Delhi, Fifth Edition, 2022.
2. John J. Grainger, William D. Stevenson, JR, "Power System Analysis", McGraw Hill Education Pvt. Ltd., New Delhi, First Edition, 2018.

REFERENCES

1. Hadi Saadat, "Power System Analysis", McGraw Hill Education Pvt. Ltd., New Delhi, Third Edition, 2019.
2. Kundur P, "Power System Stability and Control", McGraw Hill Education Pvt. Ltd., New Delhi, Tenth reprint, 2018.

E-RESOURCES

1. <https://nptel.ac.in/courses/117/105/117105140/> - (Power System Analysis).
2. <https://nptel.ac.in/courses/108/104/108104051/> - (Power System Analysis).

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23EEE501

ELECTRICAL DRIVES

LT P C

(Lab Embedded Theory Course)

3 0 2 4

OBJECTIVES

- To familiarize with electric drive fundamentals and motor dynamics.
- To impart knowledge on the operation of the converter / chopper fed dc drive.
- To enhance understanding of the operation and performance of AC Induction motor drives.
- To develop knowledge on the operation and performance of AC Synchronous motor drives.
- To inculcate understanding of the current and speed controllers for a closed loop solid state DC motor drives.
- To acquire skills in simulating and controlling various electrical drive system.

UNIT I DRIVE CHARACTERISTICS

9

Electric drive – Equations governing motor load dynamics – Steady state stability – Multi quadrant Dynamics: acceleration, deceleration, starting & stopping – Typical load torque characteristics – Selection of motor.

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE

9

Steady state analysis of the single and three phase converter fed separately excited DC motor drive – Continuous and discontinuous conduction – Time ratio and current limit control – 4 quadrant operation of converter / chopper fed drive.

UNIT III INDUCTION MOTOR DRIVES

9

Stator voltage control – energy efficient drive – v/f control – Constant air gap flux – Field weakening mode – Voltage / Current fed inverter – Closed loop control,

UNIT IV SYNCHRONOUS MOTOR DRIVES

9

V/f control and self-control of synchronous motor: Margin angle control and power factor control – Permanent magnet synchronous motor.

UNIT V DESIGN OF CONTROLLERS FOR DRIVES

9

Transfer function for DC motor / load and converter – closed loop control with current and speed feedback – Armature voltage control and field weakening mode – Design of controllers; current controller and speed controller - Converter selection and characteristics.

LIST OF EXPERIMENTS

1. Simulation of converter and chopper fed DC drive.
2. Simulation of closed loop operation of stator voltage control and v/f control of induction motordrive
3. Simulation of synchronous motor drive.
4. PLC based single and three phase inverter.
5. Chopper controlled SED.
6. Speed control of BLDC motor.
7. Transfer function of SED.
8. Stability analysis of linear system.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

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

- Examine the operating characteristics and dynamics of electric drives.
- Analyze converter and chopper fed DC motor drives for different operating conditions.
- Analyze control strategies employed in induction motor drives.
- Examine the operating methods of synchronous motor drives.
- Apply controller design concepts for electrical drive systems.
- Apply the process in simulating and controlling various electrical drive system

TEXT BOOKS

1. Gopal K. Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House, Third Edition, 2016.
2. Bimal K. Bose. "Modern Power Electronics and AC Drives", Pearson Education, Second Edition, 2015.

REFERENCES

1. S.K.Pillai, "A First course on Electrical Drives", Wiley Eastern Limited, Fourth Edition 2022.
2. Mohammed A. El-Sharkawi, "Fundamentals of Electrical Drives", Prentice hall of India, Third Edition, 2018.

E-RESOURCES

1. <https://nptel.ac.in/courses/108/106/108106072/> - (AC Drives)
2. <https://archive.nptel.ac.in/courses/108/105/108105131/> - (Electric motor Drives)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	-	-	-	-	-	3	3	3
2	3	3	3	3	3	-	-	-	-	-	3	3	3
3	3	3	3	3	3	-	-	-	-	-	3	3	3
4	3	3	3	3	3	-	-	-	-	-	3	3	3
5	3	3	3	3	3	-	-	-	-	-	3	2	3
6	3	3	3	3	3	2	2	3	3	2	3	2	3
AVG	3	3	3	3	3	2	2	3	3	2	3	2.7	3

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


Chairman - BoS



23EEE502

RENEWABLE ENERGY AND ENERGY STORAGE SYSTEM

LT P C

(Lab Embedded Theory Course)

3 0 2 4

OBJECTIVES

- To impart knowledge on renewable energy sources and their role in sustainable development.
- To familiarize with wind and solar energy systems and their operating principles.
- To acquire knowledge on alternative energy sources and energy conversion methods.
- To enhance understanding of energy storage systems and battery technologies.
- To provide knowledge on battery modelling and battery management systems for EV applications.
- To inculcate practical skills in simulating and evaluating renewable energy systems through laboratory experiments.

UNIT I RENEWABLE ENERGY SOURCES

9

Environmental consequences of fossil fuel use - Importance of Renewable Sources (RE) of energy - Sustainable design and development - Types of RE sources - Limitations of RE sources - Present Indian and international energy scenario of conventional and RE sources.

UNIT II WIND AND SOLAR ENERGY

9

Power in the wind - Types of wind power plants(wpps) - Components of wpps - Working of wpps - Grid integration issues of wpps. Solar radiation - Radiation measurement - Solar ponds - Solar photovoltaic systems - Basic principle of spv conversion - Types of pv systems -Maximum power point tracking - Best free solar pv system simulation.

UNIT III OTHER ENERGY SOURCES

9

Introduction - Bio mass resources - Conversion processes - Biomass cogeneration - Environmental benefits - Geothermal energy - Geothermal electricity - Tidal energy - Energy from the tides - Barrage and non barrage tidal power systems - Wave energy .

UNIT IV ENERGY STORAGE SYSTEM

9

Batteries: Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zinc Chloride battery; Ultra capacitors; Hydrogen – Fuel cell.



UNIT V BATTERY MODELLING AND BMS

9

General approach to modelling batteries, Parameterization of the NiCd battery model, Simulation examples. Selection of battery for EVs & HEVs, Traction Battery Pack design, SOC Estimation, Energy & Power estimation, Battery Management System: Definition, Parts: Power Module, Battery, DC/DC Converter, load, communication channel, Battery Pack Safety, Battery Standards & Tests

LIST OF EXPERIMENTS

1. Simulation study on solar PV energy system and wind energy generator.
2. Experiment on VI-characteristics and efficiency of 1kWp solar PV system.
3. Test on shadowing effect & diode based solution in 1kWp solar PV system.
4. Experiment on performance assessment of micro wind energy generator.
5. Simulation study on hybrid (solar-wind) power system.
6. Simulate the battery pack
7. Simulate the Battery Management System

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

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

- Explain the significance of renewable energy sources in sustainable energy systems.
- Apply the operating principles of wind and solar energy systems.
- Analyze the performance of alternative energy conversion technologies.
- Examine energy storage systems and battery technologies used in modern applications.
- Analyze the battery modelling and battery management systems for electric vehicles.
- Apply simulation and experimental techniques for renewable energy and battery systems.

TEXT BOOKS

1. Mehmet Kanoglu, Yunus A. Cengel, John M. Cimbala, "Fundamentals and Applications of Renewable Energy", Indian Edition, McGraw Hill, First Edition, 2020.
2. Satyender Singh, "Energy Storage Systems: An Introduction Hardcover", Nova Science Publishers, First Edition, 2021 .

REFERENCES

1. D.P.Kothari, K.C.Singal, Rakesh Ranjan, "Renewable Energy Sources And Emerging Technologies", McGraw hill, Third Edition, 2022.

2. Davide Andrea, "Battery Management Systems for Large Lithium-Ion Battery Packs", ARTECH House, 2018.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_ch27/preview - (Renewable Energy Systems)
2. <https://nptel.ac.in/courses/113105102> - (Electrochemical Energy Storage System)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

**23EEEC501****INDUSTRIAL TRAINING****LT P C****0 0 4 2**

The students shall undergo Industrial Training during summer / winter vacation. The industry/organization shall be selected with the approval of the Head of the Department. A faculty member nominated by the Head of the Department shall act as the faculty coordinator and shall be responsible for monitoring and evaluation of the student's progress.

OUTCOMES

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

- Participate in the projects in industries during his or her industrial training.
- Describe the use of advanced tools and techniques encountered during the industrial training and visit.
- Interact with industrial personnel and follow engineering practices and discipline prescribed in the industry.
- Develop awareness about general workplace behaviour and build interpersonal and team skills.
- Prepare professional work reports and presentations.

Chairman - BoS

**SEMESTER VI****23EEE601****POWER SYSTEM OPERATION AND CONTROL****LT P C**

(Lab Embedded Theory Course)

3 0 2 4**OBJECTIVES**

- To impart knowledge on power system operation requirements, load variation, and dispatching concepts.
- To enhance frequency control mechanisms in single and two-area power systems.
- To familiarize about reactive power-voltage interaction and associated control strategies.
- To explore economic dispatch principles and unit commitment for cost-effective operation.
- To instruct the computer control, SCADA, and their applications in real-time system operation.
- To develop skills to model, analyze, and optimize power system operations, including transmission, stability, and economic dispatch.

UNIT I PRELIMINARIES ON POWER SYSTEM OPERATION AND CONTROL**9**

Power scenario in Indian grid - National and Regional load dispatching centers Requirements of good power system - Necessity of voltage and frequency regulation System load variation, load curves and basic concepts of load dispatching - Load forecasting Regulation of two generators in parallel.

UNIT II REAL POWER - FREQUENCY CONTROL**9**

Basics of speed governing mechanisms and modeling - Speed load characteristics Load Frequency Control (LFC) of single area system - Static and dynamic analysis of uncontrolled and controlled cases - LFC of two area system - Tie line modeling - Block diagram representation of two area system - Static and dynamic analysis.

UNIT III REACTIVE POWER - VOLTAGE CONTROL**9**

Generation and absorption of reactive power - Basics of reactive power control Types of excitation system - Block diagram representation of AVR loop - Static and dynamic analysis stability compensation Voltage drop in transmission line - Methods of reactive power injection tap changing transformer SVC (TCR + TSC) and STATCOM for voltage control.

UNIT IV ECONOMIC OPERATION OF POWER SYSTEM**9**

Statement of economic dispatch problem - Input and output characteristics of thermal plant Incremental cost curve Optimal operation of thermal units without and with transmission losses (no



derivation of transmission loss coefficients) - Statement of unit commitment (UC) problem - Constraints on UC problem Solution of UC problem using priority list.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS

9

Need of computer control of power systems Concept of energy control centers and functions system monitoring, data acquisition and controls - System hardware configurations - SCADA and EMS functions State estimation problem - Various operating states State transition diagram.

LIST OF EXPERIMENTS

1. Computation of transmission line parameters
2. Formation of bus admittance and impedance matrices
3. Power flow analysis using Gauss-seidel method and Newton raphson method
4. Symmetric and unsymmetrical fault analysis
5. Transient stability analysis of SMIB system
6. Economic dispatch in power systems
7. Simulation of load frequency dynamics of single- area and two-area power systems

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

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

- Explain the structure, load variation, and operational requirements of modern power systems.
- Analyze single-area and two-area Load Frequency Control systems under various conditions.
- Describe the reactive power control methods and AVR systems for effective voltage regulation.
- Examine the economic dispatch and unit commitment methods for optimal power system operation.
- Identify the use of SCADA, EMS, and state estimation processes in computer-controlled power systems.
- Apply computational techniques for power flow, fault analysis, stability studies, and load frequency control in real-time power systems.

TEXT BOOKS

1. Kundur P., "Power System Stability and Control", McGraw-Hill Education Pvt. Ltd., Tenth reprint, 2022.

2. Allen. J. Wood and Bruce F. Wollen berg, "Power Generation, Operation and Control", McGraw-Hill Education, Third Edition, 2019.

REFERENCES

1. Abhijit Chakrabarti and Sunita Halder, "Power System Analysis Operation and Control", PHI learning Pvt. Ltd., New Delhi, Fourth Edition, 2019.
2. Kothari D.P. and Nagrath I.J., "Power System Engineering", McGraw-Hill Education, Third Edition, 2019.

E-RESOURCES

1. <https://nptel.ac.in/courses/108/101/108101040/> - (Power System Operation and Control).
2. https://onlinecourses.nptel.ac.in/noc23_ee128/preview/ - (Economic operation and control of Power System).

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23EEJ601

PROJECT WORK – PHASE I

L T P C

0 0 8 4

OBJECTIVES

- To develop knowledge to formulate a real world problem and projects goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

PROCESS DESCRIPTION

- For Project work out of 100 marks, the maximum marks for Continuous Assessment is fixed as 60 and the End Semester Examination (ESE) carries 40 marks(project report evaluation and viva voce examination. Project work may be assigned to a single student or to a group of students, not exceeding 4 per group.
- The project work shall be undertaken by students either in industry or in the college.
- The total credit for project work in semester VI is 4.
- There shall be three reviews (Zeroth Review,(Review I and Review II, each 100 marks)) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee.
- The committee shall consist of the Supervisor, Project Coordinator and one of the faculty members.
- Sixty percentage of the Capstone Project work to be completed in this Project Work - Phase I.
- The student is expected to submit the project report on or before the last working day of the semester. The project report shall be submitted as per the approved guidelines given by Controller of Examinations. The COE shall appoint an External Examiner for the ESE of the Project Work. The ESE for the project work shall be evaluated by both the external examiner and an internal examiner. The project coordinator shall be the internal examiner.

OUTCOMES

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

- Formulate real-world problems
- Design and express technical solutions using appropriate tools and techniques
- Test and validate prototypes for efficiency and cost-effectiveness, and present their work effectively through reports and oral demonstrations.

Mapping of COs-POs & PSOs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, "-" - No Correlation


Chairman - BoS

**SEMESTER VII****23HST701****HUMAN VALUES AND ETHICS****L T P C****3 0 0 3****OBJECTIVES**

- To introduce students to the core democratic values such as equality, liberty, justice, pluralism, and citizen participation through key world democratic movements.
- To familiarize students with the concept of secular values and the interpretation of secularism in the Indian context, emphasizing state neutrality and non-discrimination.
- To develop scientific values by introducing scientific thinking, methods of inquiry, hypothesis testing, skepticism, empiricism, and rationalism.
- To sensitize students to social ethics by applying ethical reasoning to issues such as gender bias, violence, social discrimination, and inclusive practices.
- To impart an understanding of scientific ethics by emphasizing transparency, fairness, and the social responsibility of scientists in the application of scientific inventions.

UNIT I DEMOCRATIC VALUES**9**

Understanding Democratic values: Equality, Liberty, Fraternity, Freedom, Justice, Pluralism, Tolerance, Respect for All, Freedom of Expression, Citizen Participation in Governance – World Democracies: French Revolution, American Independence, Indian Freedom Movement.

UNIT II SECULAR VALUES**9**

Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices. Reading Text: Excerpt from Secularism in India: Concept and Practice by Ram Puniyani.

UNIT III SCIENTIFIC VALUES**9**

Scientific thinking and method: Inductive and Deductive thinking, Proposing and testing Hypothesis, Validating facts using evidence based approach – Skepticism and Empiricism – Rationalism and Scientific Temper.

UNIT IV SOCIAL ETHICS**9**

Application of ethical reasoning to social problems – Gender bias and issues – Gender violence – Social discrimination – Constitutional protection and policies – Inclusive practices.



UNIT V SCIENTIFIC ETHICS

9

Transparency and Fairness in scientific pursuits – Scientific inventions for the betterment of society
- Unfair application of scientific inventions – Role and Responsibility of Scientist in the modern society.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain fundamental democratic values and analyze their application in the French Revolution, American Independence, and Indian Freedom Movement.
- Explain secularism in India and demonstrate an understanding of religious neutrality, acceptance of all faiths, and non-discriminatory practices.
- Apply scientific methods and evidence-based reasoning to analyze problems, validate facts, and demonstrate scientific temper.
- Analyze social problems using ethical frameworks and identify constitutional protections and policies that promote equity and inclusion.
- Evaluate ethical issues in scientific practices and demonstrate responsible decision-making for the societal use of scientific advancements.

TEXT BOOKS

1. Luke W. Galen, "The Nonreligious: Understanding Secular People and Societies", Oxford University Press, 2016.
2. Bullivant, Stephen; Lee Lois, "Secularism: A Dictionary of Atheism", Oxford University Press, 2016.

REFERENCES

1. John R. Shook, "The Oxford Handbook of Secularism", Oxford University Press, 2017. Gabriel A. Almond and Sidney Verba, "The Civic Culture: Political Attitudes and Democracy in Five Nations", Princeton University Press, 2016.
2. Dr.E.Gnanasekaran, "Human values and ethics", Lakshmi Publication, 2021

E-RESOURCES

1. <https://nptel.ac.in/courses/109104068> (Exploring Human Values)
2. <https://nptel.ac.in/courses/109106117> (Ethical Theory)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	-	-	-	-	-	3	3	-	2	-	2	1	1
2	-	-	-	-	-	3	3	-	2	-	2	1	1
3	2	3	-	3	-	-	-	-	-	-	2	1	1
4	-	2	-	-	-	3	3	1	1	-	1	1	1
5	-	2	-	-	-	3	3	1	1	-	1	1	1
AVG.	2	2.3	-	3	-	3	3	1	1.5	-	1.6	1	1

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



Chairman - BoS



23EEJ701

PROJECT WORK – PHASE II

L T P C

0 0 8 4

OBJECTIVES

- To develop knowledge to formulate a real world problem and projects goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

PROCESS DESCRIPTION

- Continuation of Project Work – Phase I.
- For Project work out of 100 marks, the maximum marks for Continuous Internal Assessment is fixed as 60 and the End Semester Examination (project report evaluation and viva voce examination) carries 40 marks.
- The total credit for project work in semester VII is 4.
- There shall be two reviews (Review I and Review II, each 100 marks) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee.
- The committee shall consist of the Supervisor, Project Coordinator and one of the faculty members.
- The student is expected to submit the project report on or before the last working day of the semester. The project report shall be submitted as per the approved guidelines given by Controller of Examinations. The COE shall appoint an External Examiner for the ESE of the Project Work. The ESE for the project work shall be evaluated by both the external examiner and an internal examiner. The project coordinator shall be the internal examiner.

OUTCOMES

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

- Formulate real-world problems
- Design and express technical solutions using appropriate tools and techniques
- Test and validate prototypes for efficiency and cost-effectiveness, and present their work effectively through reports and oral demonstrations.



Mapping of COs-POs & PSOs

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
3	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, "-" - No Correlation


Chairman - BoS

**SEMESTER VIII****23EEJ801****PRODUCT DEVELOPMENT****L T P C****0 0 12 6****OBJECTIVES**

- To convert the completed project into a functional product or working prototype.
- To improve the product by incorporating necessary modifications.
- To prepare the required technical documents for the developed product.
- To understand the basic aspects of product quality, usability and maintenance.
- To develop professional skills through product demonstration and presentation.

COURSE DESCRIPTION

This course is the continuation of the Capstone Project completed in Project Work – Phase II. Students shall enhance the completed project into a functional product or working prototype by improving its design, performance and usability wherever applicable. The course emphasizes testing, refinement, documentation and presentation of the developed product. Students are encouraged to demonstrate the final outcome before the evaluation committee.

PROCESS DESCRIPTION

- The Product Development course shall be based on the Capstone Project completed during Project Work – Phase II.
- Students shall improve the completed project by incorporating suitable modifications and documentation to develop a functional product or working prototype, wherever applicable.
- The work may be carried out individually or in groups not exceeding four students.
- The total credits for Product Development in Semester VIII shall be 6.
- For Product Development, the maximum marks shall be 100, of which Continuous Internal Assessment (CIA) carries 60 marks and the End Semester Examination (ESE) carries 40 marks.
- There shall be three reviews during the semester by a Review Committee constituted by the Head of the Department.
- The Review Committee shall consist of:
 - Supervisor
 - Product Development Coordinator
 - One Senior faculty member



Review I

- Progress of product development
- Design improvements
- Implementation status

Review II

- Performance improvements
- Action taken on previous review suggestions.
- Documentation progress

Review III

- Final product or prototype demonstration
- Technical documentation
- Presentation
- Students shall submit a Product Development Report as per the guidelines prescribed by the Controller of Examinations.
- The End Semester Examination shall consist of product/prototype demonstration, report evaluation and viva-voce examination.
- The End Semester Examination shall be jointly evaluated by both an External Examiner and an Internal Examiner.

OUTCOMES

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

- Develop a functional product or working prototype based on the completed project.
- Improve the product to meet the intended requirements.
- Prepare technical documentation for the developed product.
- Explain the basic aspects of product quality, maintenance and future improvements.
- Demonstrate the developed product effectively through presentation and viva-voce.

Assessment Scheme

- For Product Development, out of 100 marks, the maximum marks for Continuous Internal Assessment (CIA) is fixed as 60 and the End Semester Examination (ESE) carries 40 marks.
- Continuous Assessment shall be based on the progress of product development, technical contribution, documentation and presentations made during the three reviews conducted by the Review Committee constituted by the Head of the Department.



- The End Semester Examination shall consist of the evaluation of the Product Development Report, demonstration of the developed product/prototype or the work completed, and Viva-Voce Examination.
- The evaluation shall focus on the student's understanding of the work carried out, technical knowledge, documentation, presentation and overall contribution. The completion of a commercially deployable product shall not be a mandatory requirement for successful completion of the course.
- The End Semester Examination shall be jointly evaluated by an External Examiner appointed by the Controller of Examinations and an Internal Examiner nominated by the Head of the Department.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, “-” - No Correlation

Chairman - BoS



23EEC801

INTERNSHIP

L T P C

0 0 4 2

Students shall undergo internship of 4 weeks with 2 credits during 8th semester curriculum for all B.E. / B.Tech Programmes. The industry / organization is to be selected with the approval of Head of the Department. One faculty member approved by the Head of the department shall be responsible for the periodic monitoring and evaluation of the students' progress in the course.

Duration of Industrial Training	Credits
2 Weeks	1
4 Weeks	2

*1 week of Industrial Training = 40 hours.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, "-" - No Correlation


Chairman - BoS

**PROFESSIONAL ELECTIVE – I**

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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



**23EEP501****UNDER GROUND CABLE****LT P C****3 0 0 3****OBJECTIVES**

- To impart knowledge on the development of underground electrical power cables.
- To familiarize with cable architecture, dielectric theory, and cable characteristics.
- To acquire knowledge on supply distribution systems and distribution cables.
- To enhance understanding of transmission cable systems and their accessories.
- To foster awareness of cable installation, testing, maintenance, and condition monitoring.

UNIT I INTRODUCTION TO ELECTRICAL POWER CABLE**9**

Development of Underground Cables - Electric Lighting- Distribution of Energy for Lighting- - Paper Insulated Cables - Underground Residential Distribution Systems- Underground Residential Distribution Systems- Medium Voltage Cable Development.

UNIT II CABLE ARCHITECTURE, DIELECTRIC THEORY AND CABLE CHARACTERISTICS**9**

Architecture of Underground Cabling System - Basic Dielectric Theory of Cable —Conductors - Armour and Protective Finishes - Cable Characteristics: Electrical- Fundamentals of Electrical Insulation Materials - Electrical Properties of Cable Insulating Materials - Cable Standards and Quality Assurance - Cable design parameters- Current Carrying Capacity - Short-circuit Ratings.

UNIT III SUPPLY DISTRIBUTION SYSTEMS AND CABLES**9**

Supply Distribution Systems - Distribution Cable Types, Design and Applications - Paper Insulated Distribution Cables - PVC Insulated Cables - Polymeric Insulated Distribution Cables for 6-30 kV - Manufacture of Distribution Cables - Joints and Terminations for Distribution Cables - Testing of Distribution Cables.

UNIT IV TRANSMISSION SYSTEMS AND CABLES**9**

Basic Cable Types for A.C. Transmission - Self-contained Fluid-filled Cables - Gas Pressure Cables - High Pressure Fluid-filled Pipe Cables - Polymeric Insulated Cables for Transmission Voltages - Techniques for Increasing Current Carrying Capacity -Transmission Cable Accessories and Jointing for Pressure-assisted and Polymer Cables.

UNIT V CABLE INSTALLATION, TESTING, MAINTENANCE**9**

Installation of Transmission Cables -Splicing, Terminating, and Accessories - Sheath Bonding and Grounding-Testing of Transmission Cable Systems - Underground System Fault locating - Field





Assessment of Power Cable Systems- Condition monitoring tests – PD measurements.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the fundamental of underground cable system.
- Apply knowledge on the architecture of UG cable and physical and electrical characteristics of the UG cable.
- Identify the different types of cable used in distribution system.
- Analyze on underground cables used in transmission system
- Examine the theory/methodology of cable fault detection and rectification, testing and maintenance.

TEXTBOOKS

1. William Thue, "Electrical Power Cable Engineering", CRC Press Taylor & Francis Group., 6000 Broken Sound Parkway NW, Suite 300 Boca Raton, FL 33487-2742, Third Edition, 2022.
2. G. F. Moore, "Electric Cables Handbook", Blackwell Science Ltd, 9600 Garsington Road, Oxford OX4 2DQ, UK., Third Edition, 2017.

REFERENCES

1. Leonard L. Grigs by, "Electrical Power Cable Engineering" – CRC Press, Marcel Dekker, Third Edition 2021.
2. Christian Flytkjaer Jensen, "Online Location of Faults on AC Cables in Underground Transmission Systems" (Springer Theses), 2018.

E-RESOURCES

1. <https://nptel.ac.in/courses/117/105/117105140/> - (Power System)
2. <https://archievenptel.ac.in/courses/108/102/108102047/> - (Generation, Transmission and Distribution)



Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23EEP502

POWER QUALITY

LT P C

3 0 0 3

OBJECTIVES

- To impart knowledge on the concepts, sources, and standards of power quality.
- To familiarize with voltage sag, swell, transients, and their mitigation techniques.
- To acquire knowledge on harmonics and their effects on power systems.
- To enhance understanding of passive power compensators and power factor correction methods.
- To foster awareness of power quality monitoring techniques and custom power devices.

UNIT I INTRODUCTION TO POWER QUALITY

9

Terms and definitions & Sources-Overloading, under voltage, over voltage-Concepts of transients
Short duration variations such as interruption-Long duration variation such as sustained interruption
Sags and swells -Voltage sag- Voltage swell - Voltage imbalance - Voltage fluctuations-Power
frequency variations International standards of power quality- Computer Business Equipment
Manufacturers Associations (CBEMA) curve.

UNIT II VOLTAGE SAG AND SWELL

9

Estimating voltage sag performance-Thevenin's equivalent source-Analysis and calculation of
various fault condition -Estimation of the sag severity Mitigation of voltage sag, Static transfer
switches and fast transfer switches - Capacitor switching - Lightning - Ferro resonance-Mitigation of
voltage swell An introduction to computer analysis tools for transients, PSCAD and EMTP.

UNIT III HARMONICS

9

Harmonic sources from commercial and industrial loads - Locating harmonic sources -Power
system response characteristics - Harmonics Vs transients - Effect of harmonics - Harmonic
distortion Voltage and current distortions - Harmonic indices - Inter harmonics - Resonance
Harmonic distortion evaluation IEEE and IEC standards.

UNIT IV PASSIVE POWER COMPENSATORS

9

Principle of Operation of Passive Shunt and Series Compensators Analysis and Design of Passive
Shunt Compensators -Simulation and Performance of Passive Power Filters – Limitations of
Passive Filters Parallel Resonance of Passive Filters with the Supply System and Its Mitigation-
Fundamentals of load compensation Voltage regulation & power factor correction.

UNIT V POWER QUALITY MONITORING & CUSTOM POWER DEVICE

9

Monitoring considerations - Monitoring and diagnostic techniques for various power quality problems
Quality measurement equipment - Harmonic / spectrum analyzer - Flicker meters Disturbance analyzer Applications of expert systems for power quality monitoring -Principle& working of DSTATCOM in Voltage control mode, current control mode

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain various sources, causes and effects of power quality issues.
- Apply the concept of voltage sag and swell.
- Analyze the concepts about Voltage and current distortions, harmonics.
- Examine the passive filters and compensation techniques.
- Develop knowledge on power quality monitoring

TEXT BOOKS

1. Roger. C. Dugan, Mark. F. Mc Granaghan, Surya Santoso, H. Wayne Beaty, "Electrical Power Systems Quality", McGraw Hill, Third Edition , 2022.
2. Bhim Singh, Ambrish Chandra, Kamal Al-Haddad, "Power Quality Problems & Mitigation Techniques" Wiley, 2019.

REFERENCES

1. G.T.Heydt, "Electric Power Quality", West Lafayette, IN, Stars in a Circle Publications, Second Edition, 2021.
2. M.H.J Bollen, "Understanding Power Quality Problems:Voltage Sag and Interruptions", New York: IEEE Press, Second Edition, 2019.

E-RESOURCES

1. <https://archieve.nptel.ac.in/courses/108/106/108106025/>-(Power Quality in Power Distribution System).
2. <https://archieve.nptel.ac.in/courses/108/107/108107157/>-(Power Quality Improvement Techniques).

Mapping of COs-POs & PSOs

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

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



Chairman - BoS

23EEP503

FLEXIBLE AC TRANSMISSION SYSTEMS

LT P C

3 0 0 3

OBJECTIVES

- To impart knowledge on real and reactive power control and transmission line compensation techniques.
- To familiarize with the operation and applications of Static VAR Compensators (SVC).
- To acquire knowledge on Thyristor Controlled Series Capacitors (TCSC) and their applications in power systems.
- To enhance understanding of voltage source converter-based FACTS controllers and their applications.
- To foster awareness of advanced FACTS controllers for power flow and power quality improvement.

UNIT I INTRODUCTION

9

Real and reactive power control in electrical power transmission lines - Loads & system compensation Uncompensated transmission line Shunt and series compensation.

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS

9

Voltage control by SVC - Advantages of slope in dynamic characteristics - Influence of SVC on system voltage - Design of SVC voltage regulator - TCR-FC TCR modeling of SVC for power flow and fast transient stability - Applications: Enhancement of transient stability - Steady state power transfer Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR AND APPLICATIONS

9

Operation of the TCSC - Different modes of operation - Modeling of TCSC - Variability reactance model Modelling for power flow and stability studies - Applications: Improvement of the system stability limit Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS

9

Static Synchronous Compensator (STATCOM) - Principle of operation - V-I characteristics Applications: Steady state power transfer - Enhancement of transient stability - Prevention of voltage instability - SSSC Operation of SSSC and the control of power flow Modeling of SSSC in load flow and transient stability studies Dynamic voltage restorer (DVR).

UNIT V ADVANCED CONTROLLERS

9

 Interline DVR (IDVR) - Unified power flow controller (UPFC) - Interline power flow controller (IPFC)
 Unified power quality conditioner (UPQC).

TOTAL: 45 PERIODS
OUTCOMES

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

- Analyze hunt and series compensation.
- Design the static VAR compensate or regulator.
- Examine the thyristor controller series capacitor.
- Analyze the performance of steady state and transients of FACTS controllers.
- Apply the advanced FACTS controllers in power system.

TEXTBOOKS

1. R.Mohan Mathur, Rajiv K.Varma, "Thyristor-Based FACTS Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Third Edition, 2023.
2. Narain G.Hingorani, "Understanding FACTS - Concepts and Technology of Flexible AC Transmission Systems", Wiley India Private Limited, Third Edition, 2021.

REFERENCES

1. K.R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Limited, Third Edition, 2021.
2. Bjarne R.Anderson, "Flexible A.C. Transmission Systems", Springer, First Edition, 2020.

E-RESOURCES

1. <https://www.infocobuild.com/education/audio> - (FACTS Devices)
2. <https://nptel.ac.in/courses/108/107/108107114/>-(FACTSDevices)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS



23EEP504

HIGH VOLTAGE ENGINEERING

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge on over voltages and their effects in electrical power systems.
- To familiarize with dielectric breakdown mechanisms and insulating materials.
- To acquire knowledge on the generation of high voltages and high currents.
- To enhance understanding of high voltage and high current measurement techniques.
- To foster awareness of high voltage testing procedures and insulation coordination.

UNIT I OVER VOLTAGE IN ELECTRICAL POWER SYSTEMS

9

Causes of over voltages and its effects on power system – Lightning mechanism, energy in lightning – Switching surges and temporary over voltages – Corona and its effects – Bewley lattice diagram- Protection against over voltages.

UNIT II DIELECTRIC BREAKDOWN

9

Properties of Dielectric materials – Gaseous breakdown in uniform and non-uniform fields - Corona discharges - Vacuum breakdown Conduction and breakdown in pure and commercial liquids – Maintenance of oil Quality Breakdown mechanisms in solid and composite dielectrics – Applications of insulating materials in electrical equipment.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS

9

Generation of High DC voltage: Rectifiers, voltage multipliers, vandigriff generator Generation of high impulse voltage: single and multistage Marx circuits - Generation of nonstandard impulse voltage and very fast transients voltage (VFTO) Generation of high AC voltages: cascaded transformers, resonant transformer and tesla coil - Generation of switching surges-Generation of impulse currents Triggering and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS

9

High Resistance with series ammeter - Dividers, Resistance, Capacitance and Mixed dividers Peak Voltmeter, Generating Voltmeters - Capacitance Voltage Transformers, Electrostatic Voltmeters Sphere Gaps - High current shunts Digital techniques in high voltage measurement.

UNIT V HIGH VOLTAGE TESTING & INSULATION COORDINATION

9

High voltage testing of electrical power apparatus as per International and Indian standards - Power frequency, impulse voltage and DC testing of Insulators - Circuit breakers - Bushing, isolators and



transformers Insulation Coordination & testing of cable.

TOTAL : 45 PERIODS

OUTCOMES

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

- Analyze the various overvoltage's and its effects on power systems
- Describe breakdown phenomena in different medium under uniform and non- uniform fields.
- Design the high voltage and current
- Analyze the measuring High DC, AC, Impulse voltage and currents.
- Discuss suitable HV testing of Electrical power apparatus as per Standards.

TEXTBOOKS

1. S.Naidu and V. Kamaraju, "High Voltage Engineering", McGraw Hill Education Pvt.Ltd., New Delhi, Sixth Edition, 2020.
2. Ravindra roar and H. C. Wolfgang Mosch, "High voltage Insulation Engineering", New Age International Publishers, First Edition, 2022.

REFERENCES

1. W. Auguesteen and K.R Vadivelu, "Principles of High Voltage Engineering", Notion Publishers, First Edition, 2019.
2. C. L. Wadhwa, "High voltage Engineering", New Age International Publishers, Fourth Edition, 2019.

E-RESOURCES

1. [https://nptel.ac.in/courses/108/104/108104048/-](https://nptel.ac.in/courses/108/104/108104048/) (High Voltage Engineering)
2. [https://nptel.ac.in/courses/108/104/108104013/-](https://nptel.ac.in/courses/108/104/108104013/) (High Voltage DC Transmission)

Mapping of COs-POs & PSOs

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

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

Shree
Chairman - BoS



23EEP505

UTILIZATION OF ELECTRICAL ENERGY

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge on electric traction systems and modern railway electrification.
- To familiarize with illumination engineering principles and lighting system design.
- To acquire knowledge on electric heating and welding techniques.
- To enhance understanding of refrigeration, air conditioning, and energy-efficient motor systems.
- To foster awareness of domestic utilization of electrical energy and energy management practices.

UNIT I TRACTION

9

Merits of electric traction - Requirements of electric traction system - Systems of railway electrification Mechanics of train movement and energy consumption - Traction motors and control Track equipment and collection gear - Electric braking - Recent trends in electric traction - Introduction to EMU and metro railways.

UNIT II ILLUMINATION

9

Importance of lighting - Properties of good lighting scheme Important terms used in illumination engineering - Laws of illumination - Polar curves - Photometry - Types of lamps - Lighting calculations Design of illumination schemes for residential, commercial, street lighting, factory lighting and flood lighting Energy efficient lamps.

UNIT III HEATING AND WELDING

9

Introduction – Advantages of electric heating – Modes of heat transfer Resistance, Arc ,Induction, Dielectric, Infrared, Microwave and Solar heating - Brief introduction to electric welding Resistance, Arc and Radiation welding - Welding generator, welding transformer and the characteristics Introduction to TIG, MIG Welding.

UNIT IV REFRIGERATION AND AIR CONDITIONING

9

Refrigeration – Domestic refrigerator and water coolers - Air-Conditioning Various types of air-conditioning system and their applications - Smart air conditioning units Energy Efficient motors: Standard motor efficiency – Need for efficient motors – Motor life cycle - Direct Savings and payback analysis Efficiency evaluation factor.





UNIT V DOMESTIC UTILIZATION OF ELECTRICAL ENERGY

9

Domestic utilization of electrical energy: House wiring, Induction based appliances, Online and OFF line UPS, Batteries - Power quality aspects - Nonlinear and domestic loads – Earthing Domestic, Industrial and Substation Introduction to E-Vehicle (Qualitative treatment only).

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze the appropriate type of electric supply system as well as to evaluate the performance of a traction unit
- Examine the lighting system using LED Technologies
- Apply the knowledge on method of heating for any particular industrial application
- Design an electric connection for any domestic appliance like refrigerator and air conditioner
- Design a battery charging circuit for a specific house hold application

TEXTBOOKS

1. Wadhwa.C.L, "Generation, Distribution and Utilization of Electrical Energy", NewAge International Pvt. Ltd, Fourth Edition, 2021.
2. Gupta.J.B, "Utilization of Electric Power and Electric Traction", S.K.Kataria and Sons, Third Edition, 2016.

REFERENCES

1. R.K.Rajput, "Utilisation of Electric Power including electric drives and traction", Laxmi Publications, Third Edition, 2018.
2. Dr.Uppal S.L. and Prof.S.Rao, "Electrical Power Systems", Khanna Publishers, New Delhi, Sixteenth Edition, 2022.

E-RESOURCES

1. <https://nptel.ac.in/courses/108/105/108105060/>-(Illumination Engineering).
2. <https://nptel.ac.in/courses/112/105/112105129/>-(Refrigeration and Air conditioning).



Mapping of COs-POs & PSOs

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

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



Chairman - BoS



23EEP506

SMART GRID

LT P C

3 0 0 3

OBJECTIVES

- To impart knowledge on the evolution, concepts, and significance of smart grid systems.
- To familiarize with smart grid technologies and their applications in power systems.
- To acquire knowledge on smart meters and advanced metering infrastructure.
- To enhance understanding of power quality management and microgrid operations.
- To foster awareness of communication networks, cloud computing, and cybersecurity in smart grids.

UNIT I INTRODUCTION TO SMART GRID

9

Evolution of electric Grid - Concept definitions - Need for smart grid Difference between Conventional grid and smart grid - Opportunities & Barriers of Smart Grid - Functions and benefits Present development and international policies in smart grid.

UNIT II SMART GRID TECHNOLOGIES

9

Technology Drivers - Smart energy resources Smart Sensors, Smart storage, SMES - Smart substations—Home & building automation - Substation automation - Feeder automation Transmission systems: EMS - FACTS and HVDC - Wide area monitoring - Protection and control Distribution systems: DMS - Volt/VAR control - Fault Detection - Isolation and Service restoration- Outage management High-Efficiency distribution transformers - Phase shifting transformers Plug in Hybrid Electric Vehicles(PHEV).

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE

9

Introduction to smart meters - Advanced metering infrastructure (AMI) drivers and benefits - AMI protocols standards and initiatives - AMI needs in the smart grid - Phasor measurement Unit (PMU) Intelligent electronic devices (IED) & their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID

9

Power quality & EMC in smart grid Power quality issues of grid connected renewable energy sources – Power quality conditioners for smart grid - Web based power quality monitoring Power quality audit – Concept of micro grid - Need & applications of micro grid - Formation of micro grid - Protection & control of micro grid.



UNIT V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

Local area network (LAN) - House area network (HAN) - Wide area network (WAN) Broad band over power line (BPL) - IP based protocols - Basics of web service and cloud computing to make smart grids smarter Cyber security for smart grid.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the evolution, opportunities, and barriers of the electric grid to justify smart grid adoption policies.
- Develop integration strategies for smart sensors, automation systems, and advanced transmission controllers (FACTS/HVDC) in distribution systems.
- Analyze advanced metering infrastructure (AMI) data, PMU placements, and IED configurations for optimal grid monitoring.
- Examine power quality and EMC issues, Power quality audit and application in smart grids.
- Analyze secure, cloud-based network architectures using IP protocols to prevent smart grid cyber threats.

TEXTBOOKS

1. Stuart Borlase, "Smart Grid: Infrastructure, Technology and Solutions", CRC Press, Second Edition, 2020.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley, Second Edition, 2021.

REFERENCES

1. K S Manoj, "Smart Grid: Concepts to Design", Notion Press; First Edition, 2019.
2. Jhal S, "Smart Grid Fundamentals & Applications", New Age International Publishers; First Edition, 2019.

E-RESOURCES

1. [https://nptel.ac.in/courses/108/107/108107113/-](https://nptel.ac.in/courses/108/107/108107113/) (Introduction to smart grid)
2. [https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee42/-](https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee42/) (smart grid applications)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
1	3	3	2	3	3	-	-	1	-	-	-	3	3
2	3	3	2	3	3	-	-	1	-	-	-	3	3
3	3	3	2	3	3	-	-	1	-	-	-	3	3
4	3	3	2	3	3	-	-	1	-	-	-	3	3
5	3	3	2	3	3	-	-	1	-	-	-	3	3
Avg	3	3	2	3	3	-	-	1	-	-	-	3	3

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


Chairman - BoS

**PROFESSIONAL ELECTIVE – II**

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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





23EEP507

SMPS AND UPS

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge on the operating principles and analysis of DC–DC converters.
- To familiarize with switching mode power converters and PWM control techniques.
- To acquire knowledge on resonant converters and soft switching techniques.
- To enhance understanding of DC–AC converters, modulation methods, and multilevel inverters.
- To foster awareness of power conditioners, UPS systems, and filter design for power electronic applications.

UNIT I DC - DC CONVERTERS

9

Principles of step down and step up converters Analysis and state space modeling of Buck, Boost, Buck- Boost and Cuk converters.

UNIT II SWITCHING MODE POWER CONVERTERS

9

Analysis and state space modeling of fly back, Forward, Luo, Half bridge and full bridge converters Control circuits and PWM techniques.

UNIT III RESONANT CONVERTERS

9

Introduction - Classification - Basic concepts - Resonant switch - Load Resonant converters ZVS, Clamped voltage topologies - DC link inverters with Zero Voltage Switching - Series and parallel Resonant inverters Voltage control.

UNIT IV DC - AC CONVERTERS

9

Single phase and three phase inverters - Control using various (sine PWM, SVPWM and advanced modulation) techniques - Various harmonic elimination techniques - Multilevel inverters – Concepts Types: Diode clamped - Flying capacitor - Cascaded types Applications.

UNIT V POWER CONDITIONERS, UPS & FILTERS

9

Introduction - Power line disturbances - Power conditioners - UPS: offline UPS, Online UPS, Applications Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters - Design of inductor and transformer for PE applications, Selection of capacitors.



TOTAL: 45 PERIODS

OUTCOMES

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

- Explain various converters.
- Apply control circuits for converters.
- Examine different types of converters.
- Analyze various methodologies in filters.
- Identify a battery charging circuit for a specific household application.

TEXT BOOKS

1. M.H.Rashid, "Power Electronics Handbook", Butterworth-Heinemann, Fifth Edition, 2023.
2. Fang Lin Luo and Fang Lin Luo, "Advanced DC/DC Converters", CRC Press, Third Edition, 2021.

REFERENCES

1. Krein Philip T, "Elements of Power Electronics", Oxford University press, Third Edition, 2022.
2. Agarwal, "Power Electronics: Converters, Applications, and Design", Prentice Hall of India, Fourth Edition, 2020.

E-RESOURCES

1. <https://nptel.ac.in/courses/108/108/108108036/> - (Switched Mode Power Conversion)
2. <https://nptel.ac.in/courses/108/108/108108035/> - (PWM for Power Converters)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS




Chairman - BoS



23EEP510**PROTECTION AND SWITCHGEAR****L T P C****23EEP511****MODERN POWER CONVERTERS****L T P C****3 0 0 3****OBJECTIVES**

- To impart knowledge on switched-mode power supplies and their applications.
- To provide knowledge on the design and analysis of AC to DC converters.
- To familiarize with the concepts of cascaded multilevel inverters.
- To enhance understanding of the design and analysis of AC to AC converters.
- To inculcate the concepts of soft switching converter techniques.

UNIT I SWITCHED MODE POWER SUPPLIES**9**

DC Power supplies and Classification; Switched mode dc power supplies - with and without isolation, single and multiple outputs; Closed loop control and regulation; Design examples on converter and closed loop performance.

UNIT II AC-DC CONVERTERS**9**

Single and three phase topologies - Switching techniques - High input power factor, reduced input current harmonic distortion, Improved efficiency, with and without input-output isolation, performance indices design examples. Effect of source impedance and overlap, reactive power and power balance in converter circuits.

UNIT III DC-AC CONVERTERS**9**

Multi-level Inversion - concept, classification of multilevel inverters, Principle of operation, main features and analysis of Diode clamped, Flying capacitor and cascaded multilevel inverters; Modulation schemes. Problems.

UNIT IV AC-AC CONVERTERS WITH AND WITHOUT DC LINK**9**

Matrix converters. Basic topology of matrix converter- Modulation techniques - Scalar modulation, indirect modulation; Matrix converter as only AC-DC converter; AC-AC converter with DC link - topologies and operation - with and without resonance link - converter with dc link converter; Performance comparison with matrix converter with DC link converters.

UNIT V SOFT SWITCHING POWER CONVERTER**9**

Soft switching techniques. ZVS, ZCS, quasi resonance operation; Performance comparison hard switched and soft switched converters. AC-DC converter, DC-DC converter, DC-AC converter.; Resonant DC power supplies.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the converter and assess closed-loop performance.
- Develop an understanding of power converter performance using AC-DC converters.
- Describe about diode-clamped inverters.
- Analyze modulation techniques.
- Apply the importance of hard-switched and soft-switched converters.

TEXT BOOKS

1. Rashid M.H., "Power Electronics Circuits, Devices and Applications", Prentice Hall India, Fourth Edition, 2023.
2. P.C. Sen., "Modern Power Electronics", S. Chand Publications, Second Edition, 2020.

REFERENCES

1. Mohan N., Undeland and Robbins, "Power Electronics-Converters, Applications and Design", John Wiley and sons, Inc., New York, Second Edition, 2019.
2. Agarwal, "Power Electronics: Converters, Applications, and Design", Prentice Hall India, Third Edition, 2019.

E- RESOURCES

1. <https://nptel.ac.in/courses/108/105/108105066/> - (Power converter)
2. <https://nptel.ac.in/courses/108/107/108107128/> - (Advanced power electronics)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

**23EEP512****POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS****L T P C****3 0 0 3****OBJECTIVES**

- To impart knowledge on the design of AC to DC, DC to DC, and AC to AC power converters for renewable energy systems.
- To provide knowledge on maximum power point tracking algorithms for renewable energy applications.
- To familiarize with stand-alone and grid-connected renewable energy systems.
- To enhance understanding of the operating modes of wind electrical generators.
- To inculcate the concepts of power electronic interfaces and challenges in renewable energy systems.

UNIT I INTRODUCTION**9**

Overview of renewable energy sources: solar, wind, hydro, biomass - Introduction to power electronics: importance and applications - Basic power electronic devices: diodes, transistors, IGBTs, and thyristors - Converter topologies: DC-DC, AC-DC, DC-AC, and AC-AC converters - Control strategies for power electronic converters.

UNIT II POWER ELECTRONICS FOR SOLAR PHOTOVOLTAIC SYSTEM**9**

PV cells, modules, and arrays - Power electronic interfaces for PV systems: DC-DC converters, Maximum Power Point Tracking (MPPT) - Inverters for grid-connected and standalone PV systems - Design and analysis of PV systems with power electronics.

UNIT III POWER ELECTRONICS FOR WIND ENERGY CONVERSION SYSTEM**9**

Basics of wind energy conversion: wind turbines and generators - Power electronic converters for wind energy systems: rectifiers, inverters - Control strategies for variable-speed and fixed-speed wind turbines - Grid integration of wind energy: challenges and solutions.

UNIT IV GRID INTEGRATION OF RENEWABLE ENERGY SYSTEM**9**

Grid codes and standards for renewable energy integration - Power quality issues in renewable energy systems - Grid-tied inverters: synchronization, reactive power control, and protection - Islanding detection methods and anti-islanding protection - Impact of high penetration of renewables on grid stability.



**UNIT V EMERGING TECHNOLOGIES AND ADVANCED TOPICS****9**

Energy storage systems: batteries, supercapacitors, and flywheels - Power electronics for hybrid renewable energy systems - Smart grids and the role of power electronics in distributed generation - Electric vehicles and charging infrastructure: power electronic challenges - Future trends.

TOTAL: 45 PERIODS**OUTCOMES**

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

- Explain different power converters, namely AC to DC, DC to DC, and AC to AC converters for renewable energy sources.
- Identify various types of renewable energy sources.
- Apply knowledge about maximum power point tracking algorithms.
- Analyze various operating modes of wind electrical generators and solar energy systems.
- Examine different aspects of power electronics and their applications.

TEXT BOOKS

1. Sudipta Chakraborty, Marcelo G. Simes, and William E. Kramer. "Power Electronics for Renewable and Distributed Energy Systems: A Sourcebook of Topologies, Control and Integration". Springer Science & Business, Second Edition, 2019.
2. Andrzej M.Trzynadlowski, "Introduction to Modern Power Electronics", Wiley India Pvt. Ltd, Third Edition, 2021.

REFERENCES

1. Ali Keyhani, "Design of Smart Power Grid Renewable Energy Systems", Wiley-IEEE Press, Third Edition, 2019.
2. Remus Teodorescu, Marco Liserre, Pedro Rodriguez, "Grid Converters for Photovoltaic and Wind Power Systems", John Wiley and Sons, Ltd., Fourth Edition, 2024.

E- RESOURCES

1. <https://nptel.ac.in/courses/121/106/121106014/> - (Renewable Energy)
2. <https://www.pdfdrive.com/>-(Power electronics for renewable energy systems transportation and industrial applications)



Mapping of COs-POs & PSOs

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

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


Chairman - BoS

PROFESSIONAL ELECTIVE – III

Course Code	Name of the Subject	Category	Periods /Week			Credit	Maximum Marks		
			L	T	P		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



23EEP513

DISCRETE TIME SYSTEM AND SIGNAL PROCESSING

LT P C

3 0 0 3

OBJECTIVES

- To impart knowledge on signals, systems, and their mathematical representations.
- To provide knowledge on discrete-time signals and systems.
- To familiarize with transformation techniques and their computation.
- To enhance understanding of digital filter design and implementation.
- To inculcate the concepts of digital signal processors and quantization effects.

UNIT I INTRODUCTION

9

Classification of systems - Continuous - Discrete - Linear - Causal - Stability - Dynamic - Recursive - Time variance classification of signals - Continuous and discrete - Energy and power - Mathematical representation of signals - Spectral density - Sampling techniques - Quantization - Quantization error - Nyquist rate - Aliasing effect.

UNIT II DISCRETE TIME SYSTEM ANALYSIS

9

Z-transform and its properties - Inverse Z-transforms - Difference equation - Solution by Z transform - Application to discrete systems - Stability analysis - Frequency response - Convolution.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION

9

Discrete Fourier Transform – Properties - Magnitude and phase representation - Computation of DFT using FFT algorithm - DIT & DIF using radix 2 FFT - Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS

9

FIR & IIR filter realization - Parallel & cascade forms - FIR design: Windowing Techniques - Need and choice of windows - Linear phase characteristics - Analog filter design - Butterworth and Chebyshev approximations; IIR Filters - Digital design using impulse invariant and bilinear transformation Warping - Pre warping.

UNIT V DIGITAL SIGNAL PROCESSORS

9

Introduction - Architecture - Features - Addressing Formats - Functional modes - Introduction to Commercial DSP Processors.

TOTAL: 45 PERIODS



OUTCOMES

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

- Explain the importance of Fourier transforms digital filters and DS Processors.
- Apply knowledge on Signals and systems & their mathematical representation.
- Analyze the discrete time systems.
- Analyze the transformation techniques & their computation.
- Describe programmability digital signal processor & quantization effects.

TEXT BOOKS

1. J.G. Proakis and D.G. Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson Education, New Delhi, PHI. Fifth Edition, 2018.
2. S. K. Mitra, "Digital Signal Processing - A Computer Based Approach", McGraw Hill Edu, Fourth Edition, 2021.

REFERENCES

1. Poorna Chandra S, Sasikala. B , "Digital Signal Processing", Vijay Nicole/TMH, Third Edition, 2017.
2. Robert Schilling & Sandra L.Harris, "Introduction to Digital Signal Processing using Matlab", Cengage Learning, Third Edition, 2021.

E-RESOURCES

1. <https://nptel.ac.in/courses/117102060/NPTEL> - (Introduction of signal processing)
2. <https://nptel.ac.in/courses/108/105/108105055/> - (Discrete time system and signal)

Mapping of COs-POs & PSOs

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

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


 Chairman - BoS

**OBJECTIVES**

- To impart knowledge on embedded system architecture, processor selection, and memory organization.
- To familiarize with embedded networking concepts and communication protocols.
- To acquire knowledge on interrupt handling mechanisms and device driver concepts.
- To enhance understanding of RTOS concepts and task management techniques.
- To foster application development skills for real-time embedded systems.

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS**9**

Introduction to Embedded Systems–Structural units in Embedded processor, selection of processor & memory devices- DMA Memory management methods- Timer and Counting devices, Real Time Clock, In-circuit emulator, Target Hardware Debugging.

UNIT II EMBEDDED NETWORKING**9**

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols RS232 standard – RS485 – CAN Bus-Serial Peripheral Interface (SPI) – Inter-Integrated Circuits(I2C).

UNIT III INTERRUPTS THE SERVICE MECHANISM AND DEVICE DRIVER**9**

Programmed-I/O busy-wait approach without interrupt service mechanism-ISR concept-interrupt sources – multiple interrupts – context and periods for context switching, interrupt latency and deadline–Introduction to Device Drivers.

UNIT IV RTOS-BASED EMBEDDED SYSTEM DESIGN**9**

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication- shared memory, message passing - Interprocess Communication- Introduction to process synchronization using semaphores.

UNIT V EMBEDDED SYSTEM APPLICATION DEVELOPMENT**9**

Embedded Product Development Life Cycle - Case Study: Automatic chocolate vending machine, smart card, Precision Agriculture and Autonomous car.



OUTCOMES

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

- Explain the hardware functional and software strategies required to develop various embedded systems.
- Apply the basic differences between various Bus communication standards.
- Examine the incorporation of the interface as Interrupt services.
- Apply the various scheduling algorithms through a Real time operating system.
- Analyze the various embedded concepts for developing automation applications.

TEXT BOOKS

1. Rajkamal, "Embedded system - Architecture, Programming, Design", McGraw-Hill Edu, Fourth Edition, 2020.
2. Peckol, "Embedded system Design", John Wiley & Sons, 2021.

REFERENCES

1. Shibu. K. V, "Introduction to Embedded Systems", Tata Mcgraw Hill, Second Edition, 2019.
2. L.Das, "Embedded Systems", Pearson Education, Third Edition, 2022.

E-RESOURCES

1. <https://nptel.ac.in/courses/106/105/106105193/> - (Introduction to Embedded System)
2. <https://nptel.ac.in/courses/106105159/> - (Embedded System Design)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	2	2	-	-	-	-	-	2	2	2
2	3	2	3	2	2	-	-	-	-	-	2	2	2
3	3	3	2	3	2	-	-	-	-	-	2	2	2
4	3	2	2	2	2	-	-	-	-	-	2	3	2
5	3	2	1	2	2	-	-	-	-	-	2	3	2
AVG	3	2.2	2	2.2	2	-	-	-	-	-	2	2.4	2

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


Chairman - BoS



23EEP515

EMBEDDED C- PROGRAMMING

LT P C

3 0 0 3

OBJECTIVES

- To provide knowledge on the fundamentals of embedded programming and system development.
- To acquire knowledge on the GNU C programming toolchain for embedded applications.
- To impart knowledge on Embedded C programming concepts and coding techniques.
- To familiarize with programming concepts and applications of the 8051 microcontroller.
- To enhance understanding of interfacing techniques for the 8051 microcontroller and peripheral devices.

UNIT I BASIC C PROGRAMMING

9

Typical C Program Development Environment - Introduction to C Programming - Structured Program Development in C - Data Types and Operators - C Program Control - C Functions - Introduction to Arrays.

UNIT II EMBEDDED C

9

Adding Structure to „C“ Code: Object-oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism - Creating loop timeouts - Creating hardware timeouts.

UNIT III 8051 PROGRAMMING IN C

9

Data types and time delay in 8051, I/O programming in 8051, Logic operations in 8051, Data conversion program in 8051 Accessing code ROM space in 8051, Data serialization using 8051.

UNIT IV 8051 SERIAL PORT AND INTERRUPT PROGRAMMING IN C

9

Basics of serial communication, 8051 interface to RS232- serial port programming in 8051. 8051 interrupts and programming, Programming for timer configuration.

UNIT V 8051 INTERFACING

9

8051: ADC interfacing , DAC interfacing, Sensor interfacing, LCD interfacing, Stepper motor interfacing.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain embedded C programming and its salient features for embedded systems.
- Analyze the software and hardware architecture for distributed computing in embedded systems
- Analyze a solution for problems by using the concept learned in programming using the embedded controllers
- Develop simple applications with 8051 by using its various features and interfacing with various external hardware.
- Examine upgradation on recent trends in embedded programming skills.

TEXTBOOKS

1. Paul Deitel and Harvey Deitel, "C How to Program", Pearson Education Limited, First Edition 2022.
2. Gowrishankar S and Veena A, "Introduction to Python Programming", CRC Press, Taylor & Francis Group, 2019.

REFERENCES

1. Noel Kalicharan, "Learn to Program with C", Apress Inc., Second Edition, 2023.
2. Muhammad Ali Mazidi, Janice G. Mazidi and Rolin D. McKinlay, „The 8051 Microcontroller and Embedded Systems" Prentice Hall, Second Edition, 2014.

E-RESOURCES

1. <https://nptel.ac.in/courses/106105193>(Embedded programming)
2. <https://nptel.ac.in/courses/106105159/> (Embedded System Design)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS



23EEP516

EMBEDDED CONTROL FOR ELECTRIC DRIVES**LT P C****3 0 0 3****OBJECTIVES**

- To impart knowledge on the fundamental control concepts of electrical drives.
- To provide knowledge on the role of embedded systems in electrical drive control.
- To familiarize with embedded system-based control strategies for electrical drives.
- To acquire knowledge on optimization and machine learning techniques used in electrical drives.
- To enhance understanding of high-performance computing techniques for electrical drive applications.

UNIT I INTRODUCTION ELECTRICAL DRIVES**9**

Electric drive and its classifications, Four-quadrant drive, Dependence of load torque on various factors, Dynamics of motor-load combination-Solid State Controlled Drives-Machine learning and optimization techniques for electrical drives- IoT for Electrical drives applications.

UNIT II EMBEDDED PROCESSOR**9**

Embedded Processor architecture - RTOS - Hardware/software co-design Programming and optimization with SoC processors - control algorithms implementation for power converter.

UNIT III INDUCTION MOTOR CONTROL**9**

Types - Speed control methods - PWM techniques- VSI fed three - phase induction motor- Fuzzy logic Based speed control for three phase induction motor - FPGA based three phase induction motor control.

UNIT IV BLDC MOTOR CONTROL**9**

Overview of BLDC Motor - Speed control methods - PWM techniques - ARM processor based BDLC motor control - ANN for BLDC Motor control and operation.

UNIT V SRM MOTOR CONTROL**9**

Overview of SRM Motor - Speed control methods - PWM techniques - FPGA based SRM motor control - DNN for SRM Motor control and operation.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze the significance of embedded control for electrical drives
- Explain the various control strategy for electrical drives.
- Developing knowledge on Machine learning and optimization techniques for motor control.
- Develop embedded system solution for real time application such as Electric vehicles and UAVs.
- Apply the recent trends in embedded system for motor control strategy.

TEXTBOOKS

1. R. Krishnan, "Electric Motor Drives – Modeling, Analysis and Control", Prentice-Hall of India Pvt. Ltd., New Delhi, First Edition, 2022.
2. Steve Kilts, "Advanced FPGA Design: Architecture, Implementation, and Optimization", Wiley, First Edition, 2019.

REFERENCES

1. Ron Sass and Andrew G. Schmidt, "Embedded System design with platform FPGAs: Principles and Practices", Elsevier, 2021.
2. Steve Kilts, "Advanced FPGA Design: Architecture, Implementation, and Optimization" Wiley, 2020.

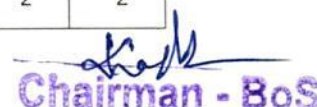
E- RESOURCES

1. <https://nptel.ac.in/courses/108/105/108105062>(Industrial automation and control)
2. <https://nptel.ac.in/courses/108/106/108106182>(Electric Vehicle)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

**23EEP517****MICROCONTROLLER BASED SYSTEM DESIGN****LT P C****3 0 0 3****OBJECTIVES**

- To impart knowledge on the architecture and features of PIC microcontrollers.
- To provide knowledge on interrupts and timer applications in PIC microcontrollers.
- To familiarize with peripheral interfacing and communication techniques for data transfer.
- To enhance understanding of the functional blocks and operation of ARM processors.
- To acquire knowledge on the architecture and applications of ARM processors.

UNIT I INTRODUCTION TO PIC MICROCONTROLLER**9**

Introduction to PIC Microcontroller - PIC 16C6x and PIC16C7x Architecture - IC16cxx - Pipelining - Program Memory considerations - Register File Structure - Instruction Set - Addressing modes - Simple Operations.

UNIT II INTERRUPTS AND TIMER**9**

PIC micro controller Interrupts - External Interrupts - Interrupt Programming - Loop time subroutine Timers -Timer Programming - Front panel I/O - Soft Keys - State machines and key switches - Display of Constant and Variability strings.

UNIT III PERIPHERALS AND INTERFACING**9**

I2C Bus for Peripherals Chip Access - Bus operation-Bus subroutines - Serial EEPROM -Analog to Digital Converter - UART- Baud rate selection - Data handling circuit - Initialization - LCD and keyboard Interfacing -ADC - DAC -Sensor Interfacing.

UNIT IV INTRODUCTION TO ARM PROCESSOR**9**

Architecture - ARM programmer"s model - ARM Development tools - Memory Hierarchy - ARM Assembly Language Programming - Simple Examples - Architectural Support for Operating systems.

UNIT V ARM ORGANIZATION**9**

3 Stage Pipeline ARM Organization - 5Stage Pipeline ARM Organization - ARM Instruction Execution - ARM Implementation - ARM Instruction Set - ARM coprocessor interface - Architectural support for High Level Languages - Embedded ARM Applications.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the architecture, memory organization, instruction set, and addressing modes of PIC microcontrollers.
- Apply interrupt handling, timer programming, and input/output interfacing techniques using PIC microcontrollers.
- Analyze the operation of peripheral interfaces, communication protocols, and sensor interfacing in PIC-based embedded systems.
- Examine the architecture, programming model, memory hierarchy, and assembly language programming of ARM processors.
- Analyze ARM processor organization, instruction execution, pipelining, and embedded system applications.

TEXT BOOKS

1. M. Bates, "PIC Microcontrollers", Newnes, Third Edition, 2021.
2. Andrew N.Sloss, Dominic Symes, Chris Wright, "ARM Developer's Guide", Elsevier, First Edition, 2020

REFERENCES

1. W.A. Smith, "ARM Microcontroller Interfacing: Hardware and Software", Elketo, First Edition, 2019.
2. Kenneth Ayala, "The 8051 Microcontroller & Embedded Systems Using Assembly and C", Cengage Learning, First Edition, 2018.

E-RESOURCES

1. <https://nptel.ac.in/courses/117/104/117104072/> - (PIC Microcontroller)
2. <https://nptel.ac.in/courses/117/106/117106111/> - (ARM Processor)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS



23EEP518

EMBEDDED SYSTEM FOR AUTOMOTIVE APPLICATIONS

LT P C

3 0 0 3

OBJECTIVES

- To impart knowledge on the fundamentals and architecture of electronic engine control systems.
- To provide knowledge on the functions and applications of sensors used in automotive systems.
- To familiarize with programmable controllers for vehicle management systems.
- To enhance understanding of automation logic and communication techniques in modern vehicles.
- To inculcate the concepts of infotainment system architecture and development.

UNIT I INTRODUCTION TO AUTOMOTIVE SYSTEMS

9

Overview of Automotive systems, fuel economy, air-fuel ratio, emission limits and vehicle performance; Electronic control Unit- open-source ECU.

UNIT II SENSORS AND ACTUATORS FOR AUTOMOTIVES

9

Review of automotive sensors- sensors interface to the ECU, Smart sensor and actuators for automotive applications.

UNIT III VEHICLE MANAGEMENT SYSTEMS

9

Energy Management system - Adaptive cruise control - anti-locking braking system - Safety and Collision Avoidance.

UNIT IV ONBOARD DIAGNOSTICS AND COMMUNICATION

9

OBD , Vehicle communication protocols - Bluetooth, CAN, LIN, FLEXRAY and MOST.

UNIT V RECENT TRENDS

9

Navigation - Autonomous car- Role of IoT in Automotive systems.

TOTAL: 45 PERIODS



**OUTCOMES**

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

- Develop insight into the significance of the role of embedded system for automotive applications.
- Examine the need, selection of sensors and actuators and interfacing with ECU
- Develop the Embedded concepts for vehicle management and control systems.
- Analyze the need of Electrical vehicle and able to apply the embedded system technology for various aspects of EVs
- Apply the knowledge up gradation on recent trends in embedded systems design and its application in automotive systems.

TEXTBOOKS

1. William B. Ribbens, "Understanding Automotive Electronics", Elsevier, Eighth Edition, 2019.
2. L.Vlasic, M.Parent, F.Harahima, "Intelligent Vehicle Technologies", SAE International, First Edition, 2020.

REFERENCES

1. Robert Bosch, "Automotive Electricals Electronics System and Components", Fifth Edition, 2021.
2. Automotive Hand Book, Robert Bosch, Bently Publishers, Tenth Edition, 2018.

E-RESOURCES

1. <https://nptel.ac.in/courses/106/105/106105193>-(Embedded system design with arm)
2. <https://nptel.ac.in/courses/106/103/106103182>-(Embedded system design)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	3	2	2	1	-	-	-	-	-	-	2	1
2	2	3	3	2	2	-	-	-	-	-	-	2	2
3	3	3	3	3	3	-	-	-	-	-	-	2	1
4	3	3	3	3	3	-	-	-	-	-	-	1	3
5	3	3	1	2	1	-	-	-	-	-	-	2	2
AVG	2.4	3	2.4	2.4	2	-	-	-	-	-	-	1.8	1.8

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

Chairman - BoS



**PROFESSIONAL ELECTIVE – IV**

Course Code	Name of the Subject	Category	Periods /Week			Credit	Maximum Marks		
			L	T	P		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



23EEP601

ELECTRIC VEHICLE ARCHITECTURE

LT P C

3 0 0 3

OBJECTIVES

- To impart knowledge on the architecture, evolution, and sizing of electric and hybrid electric vehicles.
- To provide knowledge on vehicle mechanics and propulsion system design.
- To familiarize with powertrain components, transmission systems, and braking mechanisms in electric vehicles.
- To acquire knowledge on supervisory and modal control strategies for hybrid electric vehicles.
- To enhance understanding of the construction, charging mechanisms, and applications of plug-in hybrid electric vehicles

UNIT I VEHICLE ARCHITECTURE AND SIZING

9

Electric Vehicle History, and Evolution of Electric Vehicles: Series, Parallel and Series parallel Architecture, Micro and Mild architectures. Mountain Bike – Motorcycle - Electric Cars and Heavy Duty EVs. - Details and Specifications.

UNIT II VEHICLE MECHANICS

9

Vehicle mechanics- Roadway fundamentals, Laws of motion, Vehicle Kinetics, Dynamics of vehicle motion, propulsion power, velocity and acceleration, Tire – Road mechanics, Propulsion System Design.

UNIT III POWER COMPONENTS AND BRAKES

9

Power train Component sizing - Gears, Clutches, Differential, Transmission and Vehicle Brakes. EV power train sizing, HEV Powertrain sizing, Example.

UNIT IV HYBRID VEHICLE CONTROL STRATEGY

9

Vehicle supervisory control - Mode selection strategy - Modal Control strategies.

UNIT V PLUG-IN HYBRID ELECTRIC VEHICLE

9

Introduction – History - Comparison with electrical and hybrid electrical vehicle - Construction and working of PHEV - Block diagram and components - Charging mechanisms - Advantages of PHEVs.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the History and Evolution of EVs, Hybrid and Plug-In Hybrid EVs
- Examine the various EV components.
- Analyze the details and Specifications for the various EVs developed.
- Examine the hybrid vehicle control strategy.
- Describe the concepts related in the Plug-In Hybrid Electric Vehicles

TEXT BOOK

1. Mehrdad Ehsani, Yimin Gao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.
2. Seth Leitman, Bob Brant, "Build Your Own Electric Vehicle", McGraw Hill, Third Edition, 2013.

REFERENCES

1. Ali Emadi, "Advanced Electric Drive Vehicles", CRC Press, First Edition, 2017.
2. C.C.Chan and K.T.Chau, "Modern Electric Vehicle Technology", OXFORD University Press, First Edition, 2001.

E-RESOURCES

1. <https://nptel.ac.in/courses/108103009> - (Hybrid and Electric Vehicles)
2. <http://nptel.ac.in/courses/108103009/> - (Electric Vehicle)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

**23EEP602****ELECTRIC VEHICLE DESIGN, MECHANICS AND CONTROL****L T P C****3 0 0 3****OBJECTIVES**

- To impart knowledge on the operation, performance, and emission control of internal combustion engines.
- To provide knowledge on electric vehicles, hybrid electric vehicles, and vehicle mechanics.
- To familiarize with battery technologies, battery modelling, and charging methods for electric vehicles.
- To acquire knowledge on control system fundamentals and stability analysis.
- To enhance understanding of control techniques for AC machines used in electric vehicle applications.

UNIT I INTERNAL COMBUSTION ENGINES**9**

IC Engines - BMEP and BSFC - Vehicle Fuel Economy, Emission Control Systems, Treatment of Diesel Exhaust Emissions.

UNIT II ELECTRIC VEHICLES AND VEHICLE MECHANICS**9**

Electric Vehicles (EV) - Hybrid Electric Vehicles (HEV) - Engine ratings - Comparisons of EV with internal combustion Engine vehicles - Fundamentals of vehicle mechanics.

UNIT III BATTERY MODELING, TYPES AND CHARGING**9**

Batteries in Electric and Hybrid Vehicles - Battery Basics - Battery Parameters. Types - Lead Acid Battery - Nickel-Cadmium Battery - Nickel-Metal-Hydride (NiMH) Battery - Li-Ion Battery - Li-Polymer Battery - Zinc-Air Battery - Sodium-Sulphur Battery - Sodium-Metal-Chloride, Research and Development for Advanced Batteries - Battery Modelling - Electric Circuit Models - Battery Pack Management - Battery Charging.

UNIT IV CONTROL PRELIMINARIES**9**

Control Design Preliminaries - Introduction - Transfer Functions - Bode plot analysis for First order and second order systems - Stability - Transient Performance- Power transfer function for boost converter - Gain margin and Phase margin study - Open loop mode.

UNIT V CONTROL OF AC MACHINES**9**

Introduction - Reference frame theory, basics - Modeling of induction and synchronous machine in various frames - Vector control - Direct torque control.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain IC engine performance metrics, fuel economy, and emission control systems.
- Discuss about EVs, HEVs, and vehicle mechanics, comparing them with IC engine vehicles.
- Describe battery types, modeling, management, and advanced charging systems for EVs.
- Examine control design basics, including transfer functions, stability, and boost converter analysis.
- Analyze control techniques of AC machine, including reference frame theory, vector, and direct torque control.

TEXT BOOK

1. Ali Emadi, Mehrdad Ehsani, John M. Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marcel Dekker, First Edition, 2003.
2. C.C. Chan and K.T. Chau, 'Modern Electric Vehicle Technology', OXFORD University Press, First Edition, 2001, First Edition.

REFERENCES

1. Iqbal Husain, "Electric and Hybrid Vehicles, Design Fundamentals", CRC Press, Third Edition, 2021.
2. Teuvo Suntio, Tuomas Messo, Joonas Puukko, "Power Electronic Converters, Dynamics and Control in Conventional and Renewable Energy Applications", Wiley – VCH, First Edition, 2014.

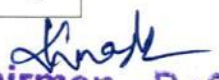
E-RESOURCES

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

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23EEP603

DESIGN OF ELECTRIC VEHICLE CHARGING SYSTEM

LT P C

3 0 0 3

OBJECTIVES

- To impart knowledge on electric vehicle charging stations, charging technologies, and international standards.
- To provide knowledge on power electronic converters used in EV charging systems.
- To familiarize with renewable energy integration and energy storage systems for EV charging.
- To acquire knowledge on wireless power transfer technologies and charging standards for electric vehicles.
- To enhance understanding of power factor correction techniques in EV charging systems.

UNIT I CHARGING STATIONS AND STANDARDS

9

Introduction - Charging technologies - Conductive charging, EV charging infrastructure, International standards and regulations - Inductive charging, need for inductive charging of EV - Modes and operating principle, Static and dynamic charging, Bidirectional power flow, International standards and regulations.

UNIT II POWER ELECTRONICS FOR EV CHARGING

9

Layouts of EV Battery Charging Systems - AC charging - DC charging systems - Power Electronic Converters for EV Battery Charging - AC-DC converter with boost PFC circuit, with bridge and without bridge circuit - Bidirectional DC-DC Converters - Non-isolated DC-DC bidirectional converter topologies - Half-bridge bidirectional converter.

UNIT III EV CHARGING USING RENEWABLE AND STORAGE SYSTEMS

9

Introduction- - EV charger topologies , EV charging/discharging strategies - Integration of EV charging-home solar PV system - Operation modes of EVC-HSP system - Control strategy of EVC- HSP system - Fast-charging infrastructure with solar PV and energy storage.

UNIT IV WIRELESS POWER TRANSFER

9

Introduction - Inductive, Magnetic Resonance, Capacitive types - Wireless Chargers for Electric Vehicles - Types of Electric Vehicles - Battery Technology in EVs - Charging Modes in EVs - Benefits of WPT - WPT Operation Modes - Standards for EV Wireless Chargers, SAE J2954, IEC 61980. ISO19363

UNIT V POWER FACTOR CORRECTION IN CHARGING SYSTEM

9

Need for power factor correction - Boost Converter for Power Factor Correction - Sizing the Boost Inductor - Average Currents in the Rectifier and calculation of power losses.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the various charging techniques and to know charging standards and regulations.
- Identify the working of DC-DC converters used for charging systems and principles
- Examine the advantages of renewable system based charging systems
- Examine the principles of wireless power transfer.
- Analyze the standards for charging system using power factor correction.

TEXT BOOK

1. Nil Patel, Akash Kumar Bhoi, Sanjeevikumar Padmanaban, Jens Bo Holm-Nielsen, "Electric Vehicles Modern Technologies and Trends", Springer Publisher, First Edition, 2021.
2. Rajiv Singh, Sanjeevikumar Padmanaban, Sanjeet Dwivedi, Marta Molinas and Frede Blaabjerg, "Cable Based and Wireless Charging Systems for Electric Vehicles, Technology and control, management and grid integration", IET 2021, First Edition, 2016.

REFERENCES

1. Miao Wang Ran Zhang Xuemin (Sherman) Shen, "Mobile Electric Vehicles Online Charging and Discharging", Springer 2016, First Edition.
2. Alicia Triviño-Cabrera, José M. González-González, José A. Aguado, "Wireless Power Transferor Electric Vehicles: Foundations and Design Approach", Springer Publisher, First Edition, 2020.

E-RESOURCES

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

Mapping of COs-POs & PSOs

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

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


Chairman - BoS



23EEP604

**DESIGN OF MOTOR AND POWER CONVERTERS FOR
ELECTRIC VEHICLES**

LT P C

3 0 0 3

OBJECTIVES

- To provide knowledge on electric vehicle dynamics and vehicle performance.
- To inculcate the concepts of electric motors and speed control methods.
- To impart knowledge on control system simulation and mathematical modelling techniques.
- To enhance understanding of modelling techniques for DC-DC converters.
- To familiarize with the transfer function analysis of DC-DC converter power stages.

UNIT I ELECTRIC VEHICLE DYNAMICS

9

Standard drive cycles-Dynamics of Electric Vehicles-Tractive force-Maximum speed, torque, power, energy requirements of EVs.

UNIT II MOTORS FOR ELECTRIC VEHICLE

9

Introduction – Speed And Torque control of above and below rated speed-Speed control of EV in the constant power region of electric motors. DC Motors, Induction Motor, Permanent Magnet Synchronous Motors (PMSM), Brushless DC Motors, Switched Reluctance Motors (SRMs). Synchronous Reluctance Machines-Choice of electric machines for EVs.

UNIT III BASICS OF SIMULATION IN CONTROL SYSTEMS

9

Transfer Function-How to build transfer function, identify Poles, zeros, draw time response plots, bode plot (Bode Plots for Multiplication Factors, Constant, Single and Double Integration Functions, Single and Double Differentiation Functions, Single Pole and Single Zero Functions, RHP Pole and RHP Zero Functions), state space modelling-transfer function from state space Model.

UNIT IV MODELING OF DC-DC CONVERTERS

9

Overview of PWM Converter Modelling -Power Stage Modelling - PWM Block Modelling - Voltage Feedback Circuit and Small-Signal Model of PWM Converter - Averaging Power Stage Dynamics - Average Models for buck/boost Converter - Small-Signal Model of Converter Power Stage - Frequency Response of Converter

UNIT V POWER STAGE TRANSFER FUNCTIONS OF DC – DC CONVERTERS

9

Power Stage Transfer Functions of buck-boost Converter in CCM Operation, Input-to-Output



Transfer Function, Duty Ratio-to-Output Transfer Function, Load Current-to-Output Transfer Function.

TOTAL: 45 Periods

OUTCOMES

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

- Identify the appropriate electric machine for electric vehicle application.
- Explain the working of motors used in Electric Vehicle.
- Analyze the transfer function with factors such as constant, integral, differential, first order factor and second order factor (both numerators & denominators).
- Examine the buck, boost and buck-boost converter.
- Derive the power stage transfer functions for DC-DC converters.

TEXT BOOK

1. Dean Frederick, Joe Cho, "Feedback Control problems using MATLAB and the Control system tool box", Cengage learning, First Edition, 2000.
2. Ali Emadi, Taylor & Francis, "Handbook of Automotive Power Electronics and Motor Drives", First Edition, 2000.

REFERENCES

1. Teuvo Suntio, Tuomas Messo, Joonas Puukko, "Power Electronic Converters", First Edition, 2017.
2. Randall Shaffer, "Fundamentals of Power Electronics with MATLAB", Lakshmi publications, Second Edition, 2013.

E-RESOURCES

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

Mapping of COs-POs & PSOs

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

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

Chairman - BoS



23EEP605

ELECTRIC VEHICLES

LT P C

3 0 0 3

OBJECTIVES

- To inculcate an overview of electric vehicle components, vehicle mechanics and propulsion system design.
- To acquire knowledge the fundamentals, types, characteristics and design aspects of batteries used in electric vehicles.
- To familiarize the working principles and applications of DC, AC, BLDC and switched reluctance motors in electric vehicles.
- To enhance electric vehicle drive train configurations, major components and motor sizing considerations.
- To provide knowledge about the hybrid electric vehicle types, configurations and drive train component design.

UNIT I ELECTRIC VEHICLES

9

Introduction - Components - Vehicle mechanics - Roadway fundamentals - Vehicle kinetics
Dynamics of vehicle motion Propulsion System Design

UNIT II BATTERY

9

Basics - Types - Parameters Capacity, Discharge rate, State of charge, state of discharge, Depth of discharge - Technical characteristics - Battery pack design Properties of batteries

UNIT III DC & AC ELECTRICAL MACHINES

9

Motor and engine rating - Requirements - DC machines - Three phase AC machines- Induction machines - Permanent magnet machines - BLDC Motor Switched reluctance machines

UNIT IV ELECTRIC VEHICLE DRIVE TRAIN

9

Transmission configuration - Components - Gears - Differential - Clutch - Brakes Regenerative braking - Motor sizing

UNIT V HYBRID ELECTRIC VEHICLES

9

Types - Series - Parallel and series - Parallel configuration - Design - Drive train Sizing of components.

TOTAL: 45 PERIODS



OUTCOMES

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

- Analyze the dynamics of vehicle motion and design propulsion systems for electric vehicles.
- Identify the battery performance parameters and design efficient battery packs for EV applications.
- Explain the electrical machines for different vehicle applications based on their characteristics.
- Apply EV concepts to develop and enhance EV drive trains, including transmission, braking systems, and regenerative braking.
- Examine the hybrid vehicle configurations and size components for effective performance.

TEXT BOOKS

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, Second Edition, 2017.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, First Edition, 2015.

REFERENCES

1. Iqbal Hussain, "Electric & Hybrid Vehicles - Design Fundamentals", CRC press, Second Edition, 2011.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, Second Edition, 2020.

E-RESOURCES

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

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23EEP606

TESTING OF ELECTRIC VEHICLES

LT P C

3 0 0 3

OBJECTIVES

- To impart knowledge on electric vehicle standardization and international standards.
- To provide knowledge on testing procedures for electric motors and controllers used in electric and hybrid electric vehicles.
- To familiarize with the principles of functional safety, reliability, and electromagnetic compatibility in electric vehicles.
- To inculcate the concepts of electromagnetic compatibility issues and mitigation techniques in electric vehicles.
- To enhance understanding of electromagnetic interference mechanisms in motor drive and DC-DC converter systems.

UNIT I EV STANDARDIZATION

9

Introduction - Current status of standardization of electric vehicles, electric Vehicles and Standardization - Standardization Bodies Active in the Field - Standardization activities in countries like Japan - The International Electro Technical Commission - Standardization of Vehicle Components.

UNIT II TESTING OF ELECTRIC MOTORS AND CONTROLLERS FOR ELECTRIC AND HYBRID ELECTRIC VEHICLES

9

Test Procedure Using M-G Set, electric motor, controller, application of Test Procedure, Analysis of Test Items for the Type Test - Motor Test and Controller Test (Controller Only). - Test Procedure Using Eddy Current Type Engine Dynamometer, Test Strategy, Test Procedure, Discussion on Test Procedure. Test Procedure Using AC Dynamometer.

UNIT III FUNDAMENTALS OF FUNCTIONAL SAFETY AND EMC

9

Functional safety life cycle - Fault tree analysis - Hazard and risk assessment — software development - Process models - Development assessments - Configuration management — Reliability-Reliability block diagrams and redundancy - Functional safety and EMC - Functional safety and quality - Standards - Functional safety of autonomous vehicles.

UNIT IV EMC IN ELECTRIC VEHICLES

9

Introduction - EMC Problems of EVs, EMC Problems of Motor Drive, EMC Problems of DC-DC Converter System, EMC Problems of Wireless Charging System, EMC Problem of Vehicle Controller, EMC Problems of Battery Management System, Vehicle EMC Requirements

UNIT V EMI IN MOTOR DRIVE AND DC-DC CONVERTER SYSTEM

9

Overview -EMI Mechanism of Motor Drive System, Conducted Emission Test of Motor Drive System, IGBT EMI Source, EMI Coupling Path, EMI Modelling of Motor Drive System. EMI in DC-DC Converter, EMI Source, The Conducted Emission High-Frequency, Equivalent Circuit of DC-DC Converter System, EMI Coupling Path

TOTAL: 45 PERIODS

OUTCOMES

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

- Identify the status and other details of standardization of EVs.
- Explain the testing protocols for EVs and HEV components.
- Analyze the safety cycle and need for functions safety for EVs.
- Explain the problems related with EMC for EV components.
- Analyze the EMI in motor drive and DC-DC converter system.

TEXT BOOKS

1. Mehrdad Ehsani, Yimin Gao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004.
2. Seth Leitman, Bob Brant, "Build Your Own Electric Vehicle", McGraw Hill, Third Edition 2013.

REFERENCES

1. Li Zhai, "Electromagnetic Compatibility of Electric Vehicle", Springer, First Edition, 2021.
2. Kai Borgeest, "EMC and Functional Safety of Automotive Electronics", IET, First Edition, 2018.

E-RESOURCES

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

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

PROFESSIONAL ELECTIVE – V

Course Code	Name of the Subject	Category	Periods /Week			Credit	Maximum Marks		
			L	T	P		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

**23EEP607****PROCESS MODELING AND SIMULATION****L T P C****3 0 0 3****OBJECTIVES**

- To impart knowledge on the principles and classification of mathematical modelling techniques.
- To provide knowledge on the modelling of distributed parameter processes and numerical solution methods.
- To familiarize with process modelling concepts and degree of freedom analysis.
- To inculcate the concepts of modelling industrial processes using mathematical approaches.
- To enhance understanding of simulation techniques and software tools for mathematical modelling.

UNIT I GENERAL PRINCIPLES OF MODELING**9**

Introduction to mathematical modeling - Advantages and limitations of models and applications of process models of stand-alone unit operations and unit processes - Classification of models: Linear vs Nonlinear, Lumped parameter vs. Distributed parameter; Static vs. Dynamic, Continuous vs. Discrete - Numerical Methods: Iterative convergence methods, Numerical integration of ODE- IVP and ODEBVP.

UNIT II MODELLING OF DISTRIBUTED PROCESSES**9**

Steady state models giving rise to differential algebraic equation (DAE) systems - Rate based Approaches for staged processes - Modeling of differential contactors - Distributed parameter models of packed beds - Packed bed reactors - Modeling of reactive separation processes - Review of solution strategies for Differential Algebraic Equations (DAEs) - Partial Differential Equations (PDEs) and available numerical software libraries.

UNIT III INTRODUCTION TO PROCESS MODELING**9**

Concept of degree of freedom analysis: System and its subsystem, System interaction, Degree of free domain a system e.g. Heat exchanger, Equilibrium still, Reversal of information flow - Design variable selection algorithm - Information flow through subsystems - Structural effects of design variable selection - Persistent Recycle.

UNIT IV MODELLING OF INDUSTRIAL PROCESSES**9**

Simple examples of process models - Models giving rise to nonlinear algebraic equation (NAE) system, - Steady state models of flash vessels, equilibrium staged processes distillation columns,





absorbers, strippers, CSTR, heat exchangers, etc., - Review of solution procedures and available numerical software libraries

UNIT V SIMULATION OF MATHEMATICAL MODELLING

9

Simulation and their approaches - Modular, Sequential, Simultaneous and Equation solving approach - Simulation softwares and their applications - Review of solution techniques and available numerical software libraries - Case Studies.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the different methods of developing models for industrial processes.
- Design mathematical models by applying relevant mathematics.
- Analyze mathematical models using relevant software.
- Apply perform analysis and subsequent conclusion for the developed mathematical models.
- Analyze the results obtained from the mathematical model in terms of original real world problem

TEXT BOOKS

1. Denn M.M., "Process Modeling", Longman Higher Education, First Edition, 1986,
2. Aris R., "Mathematical Modeling, A Chemical Engineering Perspective (Process System Engineering)", Academic Press, Volume 1, 1999.

REFERENCES

1. Luyben W.L., "Process Modeling, Simulation, and Control for Chemical Engineering", McGraw Hill Education, Second Edition, 2013.
2. D.F. Rudd and C.C. Watson, "Strategy of Process Engineering", Wiley international, First Edition, 1968.

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/103/107/103107096/> - (Process Modeling and Simulation)
2. <https://nptel.ac.in/courses/103101111> - (Advanced Numerical Analysis)



Mapping of COs-POs & PSOs

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

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



Chairman - BoS



23EEP608

SOFT COMPUTING

LT P C

3 0 0 3

OBJECTIVES

- To familiarize with foundations covering ANN, fuzzy logic and evolutionary approaches.
- To impart knowledge of various neural network models and their learning mechanisms.
- To inculcate an understanding of fuzzy logic concepts, fuzzy sets and inference methods.
- To develop knowledge of the fundamentals and working of genetic algorithms.
- To enhance the hybrid soft computing systems combining neural, fuzzy and GA techniques.

UNIT I INTRODUCTION TO SOFT COMPUTING

9

Introduction - Artificial Intelligence - Artificial Neural Networks - Fuzzy Systems - Genetic Algorithm and Evolutionary Programming - Swarm Intelligent Systems - Classification of ANNs - McCulloch and Pitts Neuron Model - Learning Rules: Hebbian and Delta - Perceptron Network - Adaline Network - Madaline Network.

UNIT II ARTIFICIAL NEURAL NETWORKS

9

Back propagation Neural Networks - Kohonen Neural Network - Learning Vector Quantization - Hamming Neural Network - Hopfield Neural Network - Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks - Support Vector Machines - Spike Neuron Models.

UNIT III FUZZY SYSTEMS

9

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations - Membership Functions - Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT IV GENETIC ALGORITHMS

9

Basic Concepts - Working Principles - Encoding - Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion - Mutation Operator - Bit-wise Operators - Convergence of Genetic Algorithm.

UNIT V HYBRID SYSTEMS

9

Hybrid Systems - Neural Networks, Fuzzy Logic and Genetic - GA Based Weight Determination - LR Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP - Inference by Fuzzy BP - Fuzzy Art Map: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller.



OUTCOMES

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

- Apply suitable soft computing techniques for various applications.
- Design the neural network architectures for AI based applications
- Analyze the fundamentals of fuzzy logic operators and fuzzy inference mechanisms
- Analyze the functionality of genetic algorithms in solving optimization problems
- Examine hybrid soft techniques that integrate neural networks and fuzzy logic

TEXT BOOKS

1. N.P.Padhy and S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, Second Edition, 2015.
2. S.N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., Third Edition, 2018.

REFERENCES

1. S. Rajasekaran, G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications", PHI Learning Pvt. Ltd, Second Edition, 2017.
2. Roj Kaushik and Sunita Tiwari, "Soft Computing-Fundamentals Techniques and Applications", McGraw Hill, First Edition, 2018.

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/106/105/106105173/> - (Introduction to soft computing)
2. <https://nptel.ac.in/courses/117105084> - (Neural networks and applications)

Mapping of COs-POs & PSOs

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

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



Chairman - BoS



23EEP609

OPTIMAL CONTROL

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge on the fundamentals of calculus of variations and optimal control systems.
- To provide knowledge on linear quadratic optimal control techniques for dynamic systems.
- To familiarize with discrete-time optimal control systems and their design approaches.
- To inculcate the concepts of Pontryagin Minimum Principle and dynamic programming methods.
- To enhance understanding of constrained optimal control strategies for engineering applications.

UNIT I CALCULUS OF VARIATIONS AND OPTIMAL CONTROL

9

Introduction - Performance Index - Constraints - Formal statement of optimal control system - Calculus of variations - Function, Functional, Increment, Differential and variation and optimum of function and functional - The basic variation problem Extrema of functions and functional with conditions - Variational approach to optimal control system

UNIT II LINEAR QUADRATIC OPTIMAL CONTROL SYSTEM

9

Problem formulation - Finite time Linear Quadratic regulator - Infinite time LQR system: Time Varying case - Time-invariant case - Stability issues of Time-invariant regulator - Linear Quadratic Tracking system: Finite time case and Infinite time case

UNIT III DISCRETE TIME OPTIMAL CONTROL SYSTEMS

9

Variational calculus for discrete time systems - Discrete time optimal control systems: Fixed final state and open-loop optimal control and Free-final state and open-loop optimal control - Discrete time linear state regulator system - Steady state regulator system

UNIT IV PONTYAGIN MINIMUM PRINCIPLE

9

Pontryagin Minimum Principle - Dynamic Programming: Principle of optimality, optimal control using Dynamic Programming - Optimal Control of Continuous time and Discrete-time systems - Hamilton-Jacobi-Bellman Equation - LQR system using H-J-B equation

UNIT V CONSTRAINED OPTIMAL CONTROL SYSTEMS

9

Time optimal control systems - Fuel Optimal Control Systems - Energy Optimal Control Systems -



Optimal Control Systems with State Constraints

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze different type of optimal control problems such as time-optimal, fuel optimal, energy optimal control problems.
- Apply Linear Quadratic Regulator for Time-invariant and Time-varying Linear system
- Examine steady state regulator system.
- Analyze optimal controller using Dynamic Programming Approach and H-J-B equation.
- Examine optimal controller in the presence of state constraints and time optimal controller.

TEXT BOOKS

- Donald E. Kirk, "Optimal Control Theory - An Introduction", Dover Publications, Inc. Mineola, New York, Tenth Edition, 2012.
- D. Subbaram Naidu, "Optimal Control Systems", CRC Press, New York, First Edition, 2003.

REFERENCES

- Frank L. Lewis, Draguna Vrabie, Vassilis L. Syrmos, "Optimal Control", Wiley Publication, Third Edition, 2012,
- Yan Wang, Cheng-Lin Liu, Zhi-Cheng Ji, " Quantitative Analysis and Optimal Control of Energy Efficiency in Discrete Manufacturing System", Springer ,First Edition , 2020.

E-RESOURCES

- <https://archive.nptel.ac.in/courses/108/105/108105019/> - (Optimal Control)
- <https://in.mathworks.com/discovery/optimal-control.html#lqrlqg>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	1	-	1	-	-	-	-	-	1	2	2
2	-	2	2	2	1	2	-	-	-	-	1	2	2
3	2	2	2	1	1	1	-	-	-	-	1	2	2
4	2	1	2	1	1	1	-	-	-	-	1	2	2
5	-	1	2	-	1	1	-	-	-	-	1	2	2
AVG	2	2	1.8	2	1	1.3	-	-	-	-	1	2	2

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


Chairman - BoS



23EEP610

ADAPTIVE CONTROL

L T P C

3 0 0 3

OBJECTIVES

- To provide knowledge on the principles and applications of adaptive control systems.
- To acquire knowledge on gain scheduling techniques and adaptive controller design.
- To enhance understanding of deterministic self-tuning regulator design methods.
- To familiarize with stochastic and predictive self-tuning regulator techniques.
- To inculcate the concepts of model reference adaptive systems and their MATLAB-based implementation.

UNIT I INTRODUCTION

9

Introduction - Adaptive Schemes - The adaptive Control Problem - Applications - Parameter estimation:-LS, RLS: and ERLS

UNIT II GAIN SCHEDULING

9

Introduction - The principle - Design of gain scheduling controllers - Nonlinear transformations - application of gain scheduling - Auto-tuning techniques: Methods based on Relay feedback - Design of gain scheduling adaptive control using MATLAB

UNIT III DETERMINISTIC SELF-TUNING REGULATORS

9

Introduction - Pole Placement design - Indirect Self-tuning regulators - Direct self-tuning regulators - Disturbances with known characteristics.

UNIT IV STOCHASTIC AND PREDICTIVE SELF-TUNING REGULATORS

9

Introduction - Design of minimum variance controller - Design of moving average controller - stochastic self-tuning regulators

UNIT V MODEL – REFERENCE ADAPTIVE SYSTEM

9

Introduction - MIT rule - Determination of adaptation gain - Lyapunov theory - Design of MRAS using Lyapunov theory - Relations between MRAS and STR - Design and verification of MRAC by MATLAB simulation

TOTAL: 45 PERIODS



OUTCOMES

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

- Apply the estimation algorithm to estimate the parameters of the process.
- Analyze the adaptive control concepts to control a process.
- Explain the adaptive schemes for complex instrumentation problem using gain scheduling.
- Develop the adaptive control for multidisciplinary problem
- Design the adaptive controllers and analysis of the process.

TEXT BOOKS

1. K.J. Astrom and B. J. Wittenmark, "Adaptive Control", Pearson Education Inc. Second Edition, 2013.
2. Petros A,Loannu and Jing Sun, "Robust Adaptive Control", Dover Publications, First Edition, 2012.

REFERENCES

1. T.Soderstorm and Petre Stoica, "System Identification", Prentice Hall International(UK) Ltd., First Edition, 1989,
2. Lennart Ljung, "System Identification: Theory for the User", Prentice Hall, Second Edition, 1999.

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/108/102/108102113/> - (Non Linear and Adaptive Control)
2. <https://archive.nptel.ac.in/courses/112/101/112101312/> - (Non Linear Adaptive Control)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	2	-	-	-	-	-	1	1	2	2
2	3	2	2	2	-	-	-	-	-	1	1	2	2
3	3	3	3	3	-	-	-	-	-	3	1	2	2
4	3	3	3	3	-	-	-	-	-	3	1	2	2
5	3	2	2	2	-	-	-	-	-	1	1	2	2
AVG	3	2.4	2.4	2.4	-	-	-	-	-	1.8	1	2	2

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


Chairman - BoS

23EEP611

COMPUTER CONTROL OF PROCESS

LT P C

3 0 0 3

OBJECTIVES

- To develop knowledge on discrete state-variable techniques and stability analysis of digital control systems.
- To provide knowledge on system identification methods using parametric and non-parametric models.
- To familiarize with the design of digital controllers for discrete-time systems.
- To inculcate the concepts of multi-loop regulatory control and controller design for MIMO systems.
- To enhance understanding of multivariable regulatory control strategies and their MATLAB-based implementation.

UNIT I DISCRETE STATE- VARIABLE TECHNIQUE

9

State equation of discrete data system with sample and hold - State transition equation - Methods of computing the state transition matrix - Decomposition of discrete data transfer functions - State diagrams of discrete data systems - System with zero-order hold - Controllability and observability of linear time invariant discrete data system - Stability tests of discrete-data system

UNIT II SYSTEM IDENTIFICATION

9

Identification of Non-Parametric Input-Output Models: Transient analysis - Frequency analysis - Correlation analysis - Spectral analysis - Identification of Parametric Input-Output Models: Least Squares Method - Recursive Least Square Method - Design a model for any industrial process using parametric & non-parametric system

UNIT III DIGITAL CONTROLLER DESIGN

9

Review of z-transform - Modified of z-transform - Pulse transfer function - Digital PID controller - Dead-beat controller and Dahlin's controller - Kalman's algorithm - Pole Placement Controller

UNIT IV MULTI-LOOP REGULATORY CONTROL

9

Multi-loop Control - Introduction - Process Interaction - Pairing of Inputs and Outputs -The Relative Gain Array (RGA) - Properties and Application of RGA - Multi-loop PID Controller - Biggest Log Modulus Tuning Method - De-coupler - Calculate the RGA to determine the recommended pairing between controlled and manipulated variables for any system - Design a Multi-loop controller for MIMO system.

UNIT V MULTIVARIABLE REGULATORY CONTROL

9

Introduction to Multivariable control - Multivariable PID Controller - Multivariable Dynamic Matrix Controller - Case Studies: - Distillation Column, CSTR and Four-tank system - Design a Multivariable controller for MIMO system - Design of DMC for distillation Column, CSTR and Four-tank system in MATLAB.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply the mathematical models for discrete time systems using state variable techniques and analyze the stability of the systems.
- Analyze the models from input-output data by least square and recursive least square method.
- Design different digital controllers to satisfy the required criterion.
- Analyze multi-loop controller and multivariable controller for multi-variable systems.
- Design multivariable dynamic matrix controller for industrial processes.

TEXT BOOKS

1. Stephanopoulos, G., "Chemical Process Control -An Introduction to Theory and Practice", Pearson Education, First Edition, 2015.
2. Sigurd Skogestad, Ian Postlethwaite, "Multivariable Feedback Control: Analysis and Design", John Wiley and Sons, Second Edition , 2005

REFERENCES

1. Thomas E. Marlin, Process Control – Designing Processes and Control systems for Dynamic Performance, Mc-Graw-Hill , Second Edition, 2000.
2. Gopal, M., "Digital Control and State Variable Methods", Tata Mc Graw Hill, Fourth Edition, 2017.

E-RESOURCES

1. <https://nptel.ac.in/courses/103104050> - (Plant wide control of chemical processes)
2. <https://nptel.ac.in/courses/103103037> - (Process Control and Instrumentation)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23EEP612

MACHINE MONITORING SYSTEM

LT P C

3 0 0 3

OBJECTIVES

- To provide knowledge on the fundamentals of machine condition monitoring and fault prognosis techniques.
- To inculcate the concepts of machinery maintenance strategies and reliability assessment methods.
- To familiarize with vibration analysis techniques for machinery fault diagnosis.
- To develop knowledge on signal processing methods used in machinery health monitoring.
- To enhance understanding of machine learning techniques for intelligent condition monitoring applications.

UNIT I INTRODUCTION TO MACHINE CONDITION MONITORING

9

Machinery condition monitoring - Present status - Fault prognosis - Future needs

UNIT II MACHINERY MAINTENANCE

9

Maintenance strategies - Reactive, Preventive, and Predictive - Benefits of planned maintenance - Bath tub curve - Failure Modes Effects and Criticality Analysis (FMECA)

UNIT III INTRODUCTION TO MACHINERY VIBRATION AND MONITORING

9

Characteristics of Vibration systems - Mode shapes & operational deflection shapes - Experimental modal analysis - Principles of vibration monitoring - Machinery faults diagnosed by vibration analysis

UNIT IV SIGNAL PROCESSING IN MACHINERY MONITORING

9

FFT analysis - Time domain analysis - Time-frequency analysis - Signal filtering - Cepstrum analysis - Health condition of compressor & engine

UNIT V MACHINE LEARNING FOR CONDITION MONITORING

9

Machine Learning: Feature extraction and feature selection methods - Feature reduction - Classification techniques - Case studies of condition monitoring in Nuclear plant components, Distillation column

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the fundamentals of machine condition monitoring, fault prognosis, and their industrial significance.
- Apply appropriate maintenance strategies and FMECA techniques to improve machinery reliability.
- Analyze vibration characteristics and monitoring techniques for machinery fault diagnosis.
- Examine signal processing methods for machinery health monitoring and fault identification.
- Apply machine learning techniques for feature extraction, classification, and condition monitoring of industrial systems.

TEXT BOOKS

1. Cornelius Scheffer and Paresh Girdhar, "Practical Machinery Vibration Analysis and Predictive Maintenance", Elsevier, First Edition, 2004,.
2. A.R. Mohanty, "Machinery Condition Monitoring: Principles and Practices", CRC Press, Taylor & Francis, First Edition, 2017.

REFERENCES

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", CRC, Press Second Edition, 2014,
2. Collacot, "Mechanical Fault Diagnosis and Condition Monitoring", Chapman 5x- Hall, First Edition, 2011.

E-RESOURCES

1. <https://nptel.ac.in/courses/112105232> - (Machinery Fault Diagnosis and Signal processing)
2. <https://in.mathworks.com/help/predmaint/ug/condition-monitoring-and-prognostics-using-vibration-signals.html>

Mapping of COs-POs & PSOs

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

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

Chairman - BoS



PROFESSIONAL ELECTIVE - VI

Course Code	Name of the Subject	Category	Periods /Week			Credit	Maximum Marks		
			L	T	P		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



23EEP613

DESIGN OF ELECTRICAL APPARATUS

LT P C

3 0 0 3

OBJECTIVES

- To develop an understanding of the principles, constraints, and magnetic circuit concepts involved in electrical machine design.
- To foster the ability to determine the main dimensions and design parameters of DC machines.
- To gain knowledge of transformer design, including core, winding, and thermal considerations.
- To acquire skills in designing stator and rotor components of three-phase induction motors.
- To inculcate an understanding of the design methodology of synchronous machines and their critical performance parameters.

UNIT I INTRODUCTION

9

Definition for design - Considerations and limitations in design - Concept of magnetic circuit Comparison of magnetic and electric circuits - Total loadings - Specific loadings - MMF calculation for air gap and teeth - Real and apparent flux density in rotating machines .

UNIT II DC MACHINES

9

Output equation - Main dimensions - Separation of D and L - Choice of specific loadings - Choice of number of poles - Core length - Armature diameter - Pole proportions - Design of air gap - Armature design - Design of commutator and brushes - Computer program : Design of armature main dimensions.

UNIT III TRANSFORMERS

9

Output equation of single phase and three phase transformers - Volt per turn and transformer constants - Optimum design - Design of core, windings and yoke for core and shell type transformers - Temperature rise of transformers - Design of tanks and cooling tubes.

UNIT IV THREE PHASE INDUCTION MOTOR

9

Output equation - Main dimensions - Separation of D and L - Choice of specific loadings - Design of stator Length of air gap - Design of rotor bars and end rings of squirrel cage rotor - Design of wound rotor - Computer program Design of slip ring rotor.

UNIT V SYNCHRONOUS MACHINES

9

Output equation - Runaway speed - Main dimensions - Separation of D and L - Choice of specific loadings Short circuit ratio - Estimation of air gap length - Design of stator and rotor of cylindrical pole and salient pole machines - Design of damper winding - Design of field winding.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the concepts of magnetic circuits, specific loadings, and design constraints in electrical machines.
- Evaluate the main dimensions and design parameters of DC machines for given performance specifications.
- Design single-phase and three-phase transformers by selecting appropriate core, winding, and cooling arrangements.
- Analyze the stator and rotor design of three-phase induction motors, including air-gap and rotor configurations.
- Apply design principles to synchronous machines to estimate air-gap length and stator-rotor dimensions using analytical and computational methods.

TEXT BOOKS

1. Sawhney, A.K., "A Course in Electrical Machine Design", Dhanpat Rai & Sons, New Delhi, Second Edition, 2019.
2. Sen, S.K., "Principles of Electrical Machine Designs with Computer Programmes", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, Second Edition, 2020.

REFERENCES

1. A. Shanmugasundaram, G. Gangadharan, R. Palani, "Electrical Machine Design Data Book", New Age International Pvt. Ltd., Second Edition, 2019.
2. A. Nagoor kani, "Electrical Machine Design", RBA publications, Third Edition, 2022

E-RESOURCES

1. <https://nptel.ac.in/courses/108102372> - (Computer Aided Design of Electrical Machines)
2. https://onlinecourses.nptel.ac.in/noc23_ee140/preview - (Design of Electrical motors)

Mapping of COs-POs & PSOs

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

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



Chairman - BoS



23EEP614

ENERGY STORAGE SYSTEMS

LT P C

3 0 0 3

OBJECTIVES

- To impart knowledge on the necessity, classifications, and applications of energy storage.
- To provide knowledge on thermal energy storage systems and their modeling techniques.
- To familiarize with electrical energy storage systems, battery technologies.
- To develop knowledge on fuel cell technologies and electrochemical energy storage.
- To inculcate the concepts of alternate energy storage technologies and their practical applications.

UNIT I INTRODUCTION

9

Necessity of energy storage - Types of energy storage -Comparison of energy storage technologies- Applications.

UNIT II THERMAL STORAGE SYSTEM

9

Output Thermal storage – Types - Modeling of thermal storage units- Simple water and rock bed storage system - pressurized water storage system - Modelling of phase change storage system - Simple units, packed bed storage units - Modelling using porous medium approach, Use of TRNSYS.

UNIT III ELECTRICAL ENERGY STORAGE

9

Classification Fundamental concept of batteries - Measuring of battery performance, charging and discharging, power density energy density, and safety issues. Types of batteries - Lead Acid, Nickel Cadmium, Zinc Manganese dioxide, Li-ion batteries - Mathematical Modelling for Lead Acid Batteries - Flow Batteries.

UNIT IV FUEL CELL

9

Fuel Cell - History of Fuel cell - Principles of Electrochemical storage -Types cells - Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell - Detailed analysis - Hydrogen oxygen advantages and disadvantages.

UNIT V ALTERNATE ENERGY STORAGE TECHNOLOGIES

9

Flywheel -Super capacitors - Principles & Methods Applications. Compressed air Energy storage - Concept of Hybrid Storage Applications - Pumped Hydro Storage – Applications.

TOTAL: 45 PERIODS



OUTCOMES

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

- Explain the necessity, classifications, and applications of energy storage technologies.
- Apply thermal energy storage concepts and modeling techniques for storage system design.
- Analyze the characteristics, performance, and modeling of electrical energy storage systems and batteries.
- Examine the operating principles and performance of fuel cell technologies for energy storage applications.
- Analyze the principles and applications of alternate energy storage technologies, including flywheels, supercapacitors, compressed air, hybrid storage, and pumped hydro systems.

TEXT BOOKS

1. Ibrahim Dincer and Mark A. Rosen, "Thermal Energy Storage Systems and Applications", John Wiley & Sons, Third Edition, 2021.
2. P. Jayarama Reddy, "Principles of Energy Storage Systems", BS Publication, Reprint, 2023.

REFERENCES

1. Przemyslaw Komarnicki, Pio Lombardi, Zbigniew Styczynski, "Electric Energy Storage Systems", Second Edition, 2020.
2. Ru-shi Liu, Lei Zhang and Xueliang sun, "Electrochemical technologies for energy storage and conversion", Wiley publications, 2020.

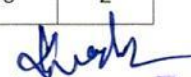
E-RESOURCES

1. <https://nptel.ac.in/courses/113105102> - (Electrochemical Energy Storage)
2. <https://nptel.ac.in/courses/112105221> - (Energy conservation and waste heat recovery)

Mapping of COs-POs & PSOs

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

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


 Chairman - BoS

23EEP615

GRID INTEGRATING TECHNIQUES AND CHALLENGES

LT P C

3 0 0 3

OBJECTIVES

- To provide knowledge on the present power scenario and the need for grid integration.
- To develop knowledge on the modeling and operation of microgrid systems.
- To familiarize with the modeling of power converters for grid interconnection.
- To inculcate the concepts of wind energy conversion systems integrated with the power grid.
- To enhance understanding of grid interconnection techniques and their practical applications.

UNIT I PRESENT POWER SCENARIO IN INDIA

9

Introduction -Thermal Power Plant : Components of Thermal Power Plant, Major Thermal Power Plants in India - Gas-Based Power Generation - Nuclear Power Plants - Hydropower Generation - Pumped Storage Plants - Solar Power-Wind Energy - Power plants India.

UNIT II POWER GRIDS

9

Introduction -. Construction of a Power Grid System - Basic concepts of Power Grids - Load Models ,Transformers in Electric Power Grids - Modelling of a Microgrid System.

UNIT III MODELING OF CONVERTERS IN POWER GRID DISTRIBUTED GENERATION SYSTEMS

9

Introduction – Single Phase DC/AC Inverters with Two Switches - Three-Phase DC/AC Inverters - Pulse Width Modulation Methods -. The Identity Method - Analysis of DC/AC Three-Phase Inverters. Micro grid of Renewable Energy Systems - DC/DC Converters in Green Energy - Pulse Width Modulation - Sizing of an Inverter for Microgrid Operation - Sizing of a Rectifier for Microgrid Operation - The Sizing of DC/DC Converters for Micro grid.

UNIT IV WIND ENERGY SYSTEM GRID INTEGRATION

9

Introduction - Significance of Electrical Power quality in Wind Power System - Integration Issues in Grid - Connected Wind Energy - Effect of Power Quality Issues - Importance of Custom Power Devices - Power Quality point of View.

UNIT V GRID INTER CONNECTION

9

Grid Code requirements - Grid integration of WECS - Grid Integration of PV systems

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the power sector scenario in India.
- Analyze a micro grid system.
- Apply the model of a converter for power grid distributed system.
- Analyze the grid integration in wind energy system.
- Examine the grid inter connection.

TEXT BOOKS

1. Yang Han, "Modeling and Control of Power Electronic Converters for Microgrid Applications", Springer, First Edition, 2022
2. Brian D'Andrade "The Power Grid", Academic Press, First Edition, 2020.

REFERENCES

1. M. Kathires, A. Mahaboob Subahani, and G.R. Kanaga chidambaresan , "Integration of Renewable Energy Sources with Smart Grid ", Scrivener & Wiley, First edition , 2021.
2. Ali M. Eltamaly, Almoataz Y. Abdelaziz, Ahmed G. Abo-Khalil , "Control and Operation of Grid-Connected Wind Energy Systems", Springer, First Edition, 2021.

E-RESOURCES

1. <https://nptel.ac.in/courses/108107113> - (Smart Grid: Basics to Advanced Technologies)
2. https://onlinecourses.nptel.ac.in/noc21_ee68/preview - (Introduction to Smart Grid)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

**OBJECTIVES**

- To provide knowledge on the concepts and configurations of hybrid energy systems.
- To develop knowledge on the operating principles of electrical generators.
- To familiarize with the design of power converters for solar photovoltaic systems.
- To inculcate the concepts of power converter topologies employed in hybrid energy systems.
- To enhance understanding of the performance and operational characteristics of hybrid energy systems.

UNIT I INTRODUCTION TO HYBRID ENERGY SYSTEMS**9**

Hybrid Energy Systems - Need for Hybrid Energy Systems - Solar-Wind-Fuel Cell - Diesel, Wind - Biomass-Diesel, Micro- Hydel - PV, Ocean and geyser energy - Classification of Hybrid Energy systems - Importance of Hybrid Energy systems - Advantages and Disadvantages - Environmental aspects of renewable energy - Impacts of renewable energy generation on the environment - Present Indian and international energy scenario of conventional and RE sources - Ocean energy, Hydel Energy - Wind Energy, Biomass energy.

UNIT II ELECTRICAL MACHINES FOR WIND ENERGY CONVERSION SYSTEMS**9**

Review of reference theory fundamentals - Construction, Principle of operation and analysis: Squirrel Cage Induction Generator (SCIG) - Doubly Fed Induction Generator (DFIG) -Permanent Magnet Synchronous Generator (PMSG).

UNIT III POWER CONVERTERS AND ANALYSIS OF SOLAR PV SYSTEMS**9**

Power Converters for SPV Systems - Line commutated converters (inversion-mode) - Boost and buck - Selection of inverter, battery sizing, array sizing - Analysis of SPV Systems - Block diagram of the solar PV systems -Types of Solar PV systems: Stand-alone PV systems.

UNIT IV ANALYSIS OF POWER CONVERTERS FOR HYBRID ENERGY SYSTEMS**9**

Introduction to Power Converters - Stand-alone Converters AC-DC-AC converters uncontrolled rectifiers, PWM Inverters - Bi-Directional Converters - Grid-Interactive Inverters - Matrix converter- Merits and Limitations.

UNIT V CASE STUDIES FOR HYBRID RENEWABLE ENERGY SYSTEMS**9**

Hybrid Systems - Range and type of Hybrid systems - Performance Analysis - Cost Analysis - Case



studies of Diesel -PV, Wind-PV-Fuel-cell, Micro-hydel-PV, Biomass-Diesel-Fuel-cell systems.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze the impacts of hybrid energy technologies on the environment and demonstrate them to harness electrical power.
- Identify a suitable Electrical machine for Wind Energy Conversion Systems and simulate wind energy conversion system.
- Design the power converters such as AC-DC, DC-DC, and AC-AC converters for SPV systems.
- Analyze the power converters such as AC-DC, DC-DC, and AC-AC converters for Hybrid energy systems.
- Examine the hybrid renewable energy systems.

TEXT BOOKS

- Bahman Zohuri, "Hybrid Energy Systems", Springer, First Edition, 2020.
- Md. Rabiul Islam, Md. Rakibuzzaman Shah, Mohd Hasan Ali, "Emerging Power Converters for Renewable Energy and Electric Vehicles", CRC Press, First Edition, 2021.

REFERENCES

- Emst Joshua, Wind Energy Technology, PHI, India, 2020, Third Edition.
- Rashid.M. H, "Power electronics Hand book", Academic press, Fourth Edition, 2020.

E-RESOURCES

- <https://nptel.ac.in/courses/108107113> - (Smart Grid: Basics to Advanced Technologies)
- https://onlinecourses.nptel.ac.in/noc21_ee68/preview -(Introduction to Smart Grid)

Mapping of COs-POs & PSOs

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

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

Chairman - BoS

23EEP617

POWER SYSTEM TRANSIENTS

LT P C

3003

OBJECTIVES

- To impart knowledge on the generation and control of switching transients using circuit theory concepts.
- To provide knowledge on the mechanisms of lightning strokes and the generation of lightning surges.
- To familiarize with the propagation, reflection, and refraction of travelling waves in power systems.
- To enhance understanding of voltage transients caused by faults, circuit breaker operations, and load rejection in integrated power systems.
- To inculcate the concepts of hybrid energy systems and their operating principles.

UNIT I INTRODUCTION AND SURVEY

9

Sources of different types of transients RL circuit transient with sine wave excitation - Double frequency transients basic transforms of the RLC circuit transients - Study of transients in system planning - Importance of grounding.

UNIT II SWITCHING TRANSIENTS

9

Basic concept of switching transients - Resistance switching and equivalent circuit for interrupting the resistor current - Load switching and equivalent circuit - Waveforms for transient voltage across the load and the switch - Normal and abnormal switching transients. Current suppression - Current chopping - Effective equivalent circuit capacitance switching with a restrike, with multiple restrikes - Ferro resonance.

UNIT III LIGHTNING TRANSIENTS

9

Theories of cloud formation - Mechanism of lightning discharges and characteristics of lightning strokes - Model for lightning stroke - Factors contributing to good line design protection using ground wires - Tower footing resistance - Interaction between lightning and power system.

UNIT IV TRAVELING WAVES ON TRANSMISSION LINE COMPUTATION OF TRANSIENTS

9

Computation of transients - Transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept - Step response - Bewley's lattice diagram - Standing waves and natural frequencies reflection and refraction of travelling waves. Computation

of overvoltages using EMTP.

UNIT V TRANSIENTS IN INTEGRATED POWER SYSTEM

9

The short line and kilometric fault - Distribution of voltages in a power system - Line dropping and load rejection - Voltage transients on closing and reclosing lines - Overvoltage induced by faults - Switching surges on integrated system - Qualitative application of EMTP for transient computation.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the principles of transients and its concepts.
- Understand the different types of switching transients and the way to draw the necessary equivalent circuit.
- Explain the concepts behind lighting and the way to protect the same.
- Examine the transient behavior in transmission line.
- Analyze the behavior of the Circuit during switching and to learn the simulation tool.

TEXT BOOKS

1. C.S. Indulkar, D.P.Kothari. K. Ramalingam, "Power System Transients - A statistical approach", PHI Learning Private Limited, Second Edition, 2020.
2. Pritindra Chowdhari, "Electromagnetic transients in Power System", John Wiley and Sons Inc., Second Edition, 2019.

REFERENCES

1. M.S.Naidu and V.Yamaraju," High Voltage Engineering ", Tata McGraw Hill, Fifth Edition, 2020.
2. Y. Hase, "Handbook of Power System Engineering" Wiley India, Third edition , 2022.

E-RESOURCES

1. <https://nptel.ac.in/courses/108105104> - (Power System Engineering).
2. <https://nptel.ac.in/courses/108105067> - (Power System Analysis).



SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade,

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



Mapping of COs-POs & PSOs

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

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


Chairman - BoS



**OBJECTIVES**

- To provide knowledge on the architecture, components, and applications of Programmable Logic Controllers (PLC).
- To inculcate the concepts of logical functions, timers, and counters used in PLC programming.
- To familiarize with PLC instructions and various modes of operation.
- To develop knowledge on the architecture and interfacing techniques of Distributed Control Systems (DCS).
- To enhance understanding of industrial applications of Programmable Logic Controllers and Distributed Control Systems.

UNIT I INTRODUCTION TO PROGRAMMABLE LOGIC CONTROLLER (PLC)**9**

Introduction - PLC Evolution – PLC Vs Computers – Block Diagram of PLC – Parts of a PLC - Principles of Operation - Modifying the Operation - PLC Hardware Components: I/O modules, Power Supply, CPU – PLC size and Applications.

UNIT II LOGIC FUNDAMENTALS, TIMER AND COUNTER**9**

Logic functions – Boolean instructions and functions – Hardwired logic Vs Programmed Logic - Developing circuits from Boolean instructions – PLC timer: Classification and instructions – PLC counter: Classification, instructions and applications.

UNIT III PLC PROGRAMMING**9**

PLC - Memory map - Program scan – Relay type instructions – Instruction addressing - Branch instructions - Internal relay instructions - EXAMINE IF CLOSED and EXAMINE IF OPEN instructions - Modes of operation – Basic relay ladder logic and its control flow chart.

UNIT IV DISTRIBUTED CONTROL SYSTEM**9**

Distributed control system: Evolution – Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities – HMI Interface – Low and high level operator interfaces – Operator displays – Low and high level engineering interfaces – Introduction to SCADA.

UNIT V APPLICATIONS OF PLC AND DCS**9**

PLC applications: Automatic Control of Ware House Door – Automatic Lubricating Oil Supplier –



Conveyor Belt motor Control – Automatic Car Washing Machine – DCS applications: Pulp and paper environment, Petroleum and refining environment.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to

- Explain the major components of Programmable Logic Controller and its applications.
- Summarize the logical functions, timers and counters of PLC.
- Discuss the various instructions and modes of operation related to PLC.
- Realize the architecture and various interfacing techniques of Distributed Control Systems.
- Examine the different applications of PLC and Distributed Control Systems (DCS).

TEXT BOOKS

1. John W Webb and Ronald A Reis, "Programmable logic controllers: Principles and Applications", Prentice Hall India, Second Edition , 2019.
2. Hans Berger , "Automating with Simatic S7-1200", Publics Publishing, Second Edition, 2020.

REFERENCES

1. Kelvin T Erikson , "Programmable Logic Controllers", Dogwood Valley Press, Second Edition, 2020.
2. R.S.Manoj , "Industrial Automation with SCADA : Concepts, Communications and Security", Notion Press, Second Edition, 2019.

E RESOURCES

1. <https://nptel.ac.in/courses/108105088> - (Industrial Automation and control).
2. <https://nptel.ac.in/courses/108105063> - (Industrial Automation and control).

Mapping of COs-POs & PSOs

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

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

Chairman - BoS

OPEN ELECTIVES - I

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
CIVIL	23CEO607 / Environmental and Social Impact Assessment	OE	3	0	0	3	40	60	100
CSE	23CSO610 / Introduction to Drone Technologies	OE	3	0	0	3	40	60	100
ECE	23ECO602 / Fundamentals of Electronic Devices and Circuits	OE	3	0	0	3	40	60	100
EEE	23EEO603 / Electric Vehicle Technology	OE	3	0	0	3	40	60	100
	23EEO604 / Renewable Energy Systems	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO601 / Introduction to Industrial Engineering	OE	3	0	0	3	40	60	100
	23MEO605 / CNC Machining Technology	OE	3	0	0	3	40	60	100
MEDICAL ELECTRONICS	23MDO611 / Hospital Management	OE	3	0	0	3	40	60	100
ROBOTICS AND AUTOMATION	23RAO609 / Fundamentals of Robotics	OE	3	0	0	3	40	60	100
CSE(Cyber Security)	23CSO612 / Cyber Forensics and Ethical Hacking	OE	3	0	0	3	40	60	100
PHARMACEUTICAL TECHNOLOGY	23PMO608 / Pharmaceutical Nanotechnology	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO606 / Graph Theory	OE	3	0	0	3	40	60	100

**OPEN ELECTIVE – I****23CEO607****ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT****LT P C****3 0 0 3****OBJECTIVES**

- To explore the Rio principles of environmental impact assessment.
- To enhance the screening and scoping in EIA.
- To develop the environmental monitoring plan and EIA report preparation.
- To inculcate the baseline monitoring of socio economic environment.
- To instruct the EIA case studies pertaining to infrastructure projects.

UNIT I INTRODUCTION**9**

Impacts of Development on Environment – Rio Principles of Sustainable Development- Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle –EIA Notification and Legal Framework.

UNIT II ENVIRONMENTAL ASSESSMENT**9**

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise, flora and fauna - Matrices – Networks Checklist Methods - Mathematical models for Impact prediction.

UNIT III ENVIRONMENTAL MANAGEMENT PLAN**9**

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Public Hearing- Environmental Clearance.

UNIT IV SOCIO ECONOMIC ASSESSMENT**9**

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis.

UNIT V CASE STUDIES**9**

EIA case studies pertaining to Infrastructure Projects – Roads and Bridges – Mass Rapid Transport Systems- Airports - Dams and Irrigation projects - Power plants.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine the impacts of development on environment.
- Analyze the scoping and screening of developmental projects for environmental and social assessments.
- Construct the environmental management plans and EIA reports.
- Apply the economic valuation of environmental impacts and cost benefit analysis.
- Identify the EIA case studies pertaining to Infrastructure Projects.

TEXT BOOKS

1. Canter, R.L, "Environmental impact Assessment ", Second Edition, McGraw Hill Inc, New Delhi, 1995.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu, "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank, 1997.
3. Peter Morris, Riki Therivel "Methods of Environmental Impact Assessment", Routledge Publishers, First Edition, 2009.

REFERENCES

1. Becker H. A., Frank Vanclay, "The International handbook of social impact assessment" Conceptual and Methodological Advances, Edward Elgar Publishing, 2003.
2. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme, 2002.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I and II", Blackwell Science New York, 1998.

E-RESOURCES

1. <https://nptel.ac.in/courses/124107160> (Environmental Impact Assessment)
2. https://onlinecourses.nptel.ac.in/noc25_ch24/preview (Environmental Quality Monitoring & Analysis)



Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	–	2	3	–	–	–	–	-	-
2	3	3	2	2	–	2	3	–	–	–	–	-	-
3	3	3	3	2	2	2	3	–	–	–	2	-	-
4	3	3	2	2	–	2	3	–	–	–	3	-	-
5	3	3	3	2	2	3	3	–	–	–	2	-	-
AVG	3.0	3.0	2.4	2.0	2.0	2.2	3.0	–	–	–	2.3	-	-

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


Chairman - BoS



23CSO610

INTRODUCTION TO DRONE TECHNOLOGIES

LT P C

3 0 0 3

OBJECTIVES

- To impart fundamental knowledge of drone technology, including its concepts, terminology, historical evolution, and emerging applications.
- To develop students understanding of UAV architecture, drone components, fabrication techniques, and programming methodologies.
- To train students in drone flight operations, navigation systems, sensors, data acquisition, and UAV management tools.
- To enable students to explore commercial applications of drones in sectors such as agriculture, logistics, inspection, surveillance, and aerial imaging.
- To familiarize students with drone safety regulations, licensing requirements, and emerging technologies including autonomous and swarm-based UAV systems.

UNIT I INTRODUCTION TO DRONE TECHNOLOGY

9

Drone Concept-Vocabulary Terminology-History of drone-Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses-Drone business through entrepreneurship-Opportunities/applications for entrepreneurship and Employability.

UNIT II DRONE DESIGN, FABRICATION AND PROGRAMMING

9

Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program – Install program on computer-Running Programs-Multi rotor stabilization-Flight modes-Wi-Fi connection.

UNIT III DRONE FLYING AND OPERATION

9

Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity- Removable storage devices-Linked mobile devices and applications.

UNIT IV DRONE COMMERCIAL APPLICATIONS

9

Choosing a drone based on the application-Drones in the insurance sector-Drones in delivering mail, parcels and other cargo-Drones in agriculture-Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing.

UNIT V FUTURE DRONES AND SAFETY

9

The safety risks-Guidelines to fly safely –Specific aviation regulation and standardization-Drone License-Miniaturization of drones-Increasing autonomy of drones-The use of drones in swarms.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the fundamental concepts, terminology, classifications, history, and applications of drone technology.
- Design a multirotor drone by selecting appropriate hardware appropriate components and tools.
- Apply flight control principles, navigation methods, onboard sensors, and UAV management tools for drone flight operations.
- Analyze the drone technologies for commercial applications such as aerial imaging, agriculture, logistics, infrastructure inspection, and surveillance
- Analyze drone safety regulations, licensing requirements, and emerging technologies including autonomous drones and swarm intelligence for future UAV applications.

TEXTBOOKS

1. Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", John Wiley & Sons, First Edition, 2021
2. Terry Kilby and Belinda Kilby, "Make: Getting Started with Drones, Maker Media, Inc.", Sheroff Publishers and Distributors Pvt Ltd, First Edition, 2015

REFERENCES

1. John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, First Edition, 2016
2. Zavrnsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, First Edition, 2018.

E-RESOURCES

1. <http://www.digimat.in/nptel/courses/video/101108661/L50.html> (Fundamentals of Drone Technologies)
2. <http://www.digimat.in/nptel/courses/video/101108661/L38.html> (Drone Technology Commercial Application)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	1	3	-	-	-	-	-	3	-	-
2	3	3	3	2	3	-	-	-	-	-	3	-	-
3	3	3	2	2	3	-	-	-	-	-	3	-	-
4	2	3	2	2	3	-	-	1	-	-	2	-	-
5	2	3	3	2	3	-	-	2	-	-	2	-	-
AVG	2.6	2.8	2.4	1.8	3	-	-	1.5	-	-	2.6	-	-

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


Chairman - BoS

**OBJECTIVES**

- To introduce fundamental knowledge of semiconductors and devices and its applications.
- To discuss the operation and characteristics of Bipolar Junction Transistor.
- To expose the various types of oscillators and FET.
- To inculcate the operation of power semiconductor devices
- To impart knowledge on optoelectric devices and wave shaping circuits.

UNIT I SEMICONDUCTOR AND DIODES

9

Semiconductor - Definition, classification, intrinsic and extrinsic N type & p type – drift current & diffusion current diodes – PN junction diode – forward and reverse bias characteristics – specification – zener diode construction & working Principle -characteristics - zener break down - avalanche break down.

Rectifier – introduction-classification of rectifiers-half wave rectifier-full wave Rectifier (center tapped, bridge) - (no mathematical equations) – comparison – Applications - filters-C, LC and PI filters.

UNIT II BIPOLAR JUNCTION TRANSISTOR

9

Transistor – NPN and PNP transistor – operation-transistor as an amplifier- transistor as a switch – CB,CE,CC configurations – characteristics - comparison between three configurations in terms of input impedance, output impedance, current gain, voltage gain – negative feedback Concept, effect of negative feedback – types of negative feedback connections.

UNIT III TRANSISTOR OSCILLATORS AND FET

9

Transistor oscillators – Classifications – Condition for oscillations (Barkhausen criterion) – General form of Hartley Oscillator – Colpitts Oscillator – RC Phase shift oscillator.

Field Effect Transistor – construction – working principle of FET – difference Between FET and BJT – classification of FET – characteristics of FET – Applications.

UNIT IV SCR, DIAC, TRIAC

9

SCR – introduction – working – VI-characteristics -comparison between SCR and transistor – SCR as a switch, controlled rectifier. **TRIAC** working principle, Characteristics –**DIAC** –characteristics – DIAC as bi- directional switch. Applications of SCR, TRIAC and DIAC.



UNIT V OPTOELECTRONIC DEVICES AND WAVE SHAPING CIRCUITS

9

Classification of optoelectronic devices – symbols, Characteristics, working of LDR, LED, 7 segment LED and LCD– opto coupler - Photo transistor. Clipper, Clamper Circuits and waveforms only – Astable, Monostable Multivibrators and Schmitt trigger using transistors.

TOTAL : 45 PERIODS

OUTCOMES

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

- Understand the concept of semiconductor, diodes and its applications.
- Discuss the various biasing circuits using BJT.
- Explain the oscillator circuits and Field Effect Transistor.
- Analyze the operation of power semiconductor devices and its applications.
- Explain the operation of optoelectronic devices and wave shaping circuits.

TEXT BOOKS

1. Robert L. Boylestad, Louis Nashelsky "Electronic Devices and Circuits Theory", Prentice Hall Publications, Tenth Edition, 2009.
2. S.Salivahanan, N.Suresh kumar, , "Electronic Devices and Circuits", McGraw Hill, Fifth Edition, 2022.

REFERENCE

1. G.S.N. Raju, "Electronic Devices and Circuits", I.K. International Publications, New Delhi, First Edition, 2006.
2. A.P Godse, U.A Bakshi, "Electronic Devices and Circuits", Technical Publications, 2010.

E-RESOURCES

1. <https://nptel.ac.in/courses/108108122> - (Fundamentals of Semiconductor Devices).
2. https://onlinecourses.nptel.ac.in/noc21_ee86 - (Microelectronics: Devices To Circuits).

Mapping of COs - POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	1	-	2	-	-	-	1	-	2	-	-
2	3	3	2	2	3	-	-	-	1	-	2	-	-
3	3	3	3	2	3	-	-	-	1	-	2	-	-
4	3	2	3	2	3	-	-	-	1	-	2	-	-
5	2	2	2	2	3	-	-	-	1	-	2	-	-
AVG	2.4	2.4	2.2	2	2.8	-	-	-	1	-	2	-	-

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

Chairman - BoS



23EE0603

ELECTRIC VEHICLE TECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge on the basic concepts and working of electric vehicles.
- To familiarize with battery types, parameters, and battery pack design for electric vehicles.
- To instruct on DC and AC electrical machines used in electric vehicle applications.
- To develop understanding of electric vehicle drive train components and regenerative braking.
- To foster awareness of hybrid electric vehicle types, configurations, and component sizing.

UNIT I ELECTRIC VEHICLES

9

Introduction - Components - Vehicle mechanics - Roadway fundamentals - Vehicle kinetics
Dynamics of vehicle motion Propulsion System Design

UNIT II BATTERY

9

Basics - Types - Parameters Capacity, Discharge rate, State of charge, state of discharge, Depth of
discharge - Technical characteristics - Battery pack design Properties of batteries

UNIT III DC & AC ELECTRICAL MACHINES

9

Motor and engine rating - Requirements - DC machines - Three phase AC machines- Induction
machines - Permanent magnet machines - BLDC Motor Switched reluctance machines

UNIT IV ELECTRIC VEHICLE DRIVE TRAIN

9

Transmission configuration - Components - Gears - Differential - Clutch - Brakes Regenerative
braking - Motor sizing

UNIT V HYBRID ELECTRIC VEHICLES

9

Types - Series - Parallel and series - Parallel configuration - Design - Drive train Sizing of
components.

TOTAL: 45 PERIODS



OUTCOMES

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

- Analyze the basic concepts and working of electric vehicles.
- Apply the battery types, parameters in battery pack design.
- Explain the DC and AC electrical machines used in electric vehicles.
- Identify the electric vehicle drive train components and regenerative braking.
- Examine the hybrid electric vehicle types, configurations, and component sizing.

TEXT BOOKS

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley & Sons, Second Edition, 2017.
2. S. Onori, L. Serrao and G. Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, First Edition, 2015.

REFERENCES

1. Iqbal Hussain, "Electric & Hybrid Vehicles - Design Fundamentals", CRC press, Second Edition, 2011.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, Second Edition, 2020.

E-RESOURCES

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

Mapping of COs-POs & PSOs

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

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


Chairman - BoS



23EE0604

RENEWABLE ENERGY SYSTEMS

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge on renewable energy sources and their role in sustainable energy development.
- To familiarize with the working and applications of wind energy systems.
- To develop understanding of solar photovoltaic and solar thermal energy systems.
- To instruct on biomass, geothermal, and hydroelectric energy systems.
- To get knowledge on other renewable energy sources and energy storage systems.

UNIT I RENEWABLE ENERGY SOURCES

9

Environmental consequences of fossil fuel use - Importance of Renewable Sources (RE) of energy - Sustainable design and development - Types of RE sources - Limitations of RE sources - Present Indian and international energy scenario of conventional and RE sources.

UNIT II WIND ENERGY

9

Power in the wind - Types of wind power plants(wpps) - Components of wpps - Working of wpps - Siting of wpps - Grid integration issues of wpps.

UNIT III SOLAR PV AND THERMAL SYSTEMS

9

Solar radiation - Radiation measurement - Solar thermal power plant - Central receiver power plants - Solar ponds - Thermal energy storage system with pcm - Solar photovoltaic systems - Basic principle of spv conversion - Types of pv systems -Maximum power point tracking - Best free solar pv system simulation.

UNIT IV BIOMASS ENERGY

9

Introduction - Bio mass resources - Energy from bio mass - Conversion processes - Biomass cogeneration - Environmental benefits - Geothermal energy - Basics - Direct use - Geothermal electricity - Mini/micro hydro power - Classification of hydropower schemes - Classification of water turbine - Turbine theory - Essential components of hydroelectric system.

UNIT V OTHER ENERGY SOURCES

9

Tidal energy - Energy from the tides - Barrage and non barrage tidal power systems - Wave energy - Energy from waves - Wave power devices - Ocean thermal energy conversion (OTEC) - Hydrogen production and storage - Fuel cell - Principle of working - Various types - Construction and applications - Energy storage system - Hybrid energy systems.

TOTAL : 45 PERIODS



OUTCOMES

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

- Explain the importance and types of renewable energy sources.
- Analyze the working and components of wind energy systems.
- Discuss how solar photovoltaic and solar thermal systems work.
- Determine biomass, geothermal, and hydroelectric energy systems.
- Examine tidal, wave, ocean thermal, fuel cell, and hybrid energy systems.

TEXT BOOKS

1. Scott Grinnell, "Renewable Energy & Sustainable Design", Cengage Learning, USA, Second Edition, 2016.
2. Richard A. Dunlap, "Sustainable Energy", Cengage Learning India Private Limited, Second Edition, 2015.

REFERENCES

1. ShobhNath Singh, "Non-conventional Energy resources", Pearson Education India, Second Edition, 2015.
2. Bradley A. Striebig, Adebayo A.Ogundipe and Maria Papadakis, "Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, First Edition, 2016.

E-RESOURCES

1. <https://nptel.ac.in/courses/108/108/108108078/> - (Renewable Energy Systems)
2. <https://nptel.ac.in/courses/108/105/108105058/> - (Non-Conventional Energy resources)

Mapping of COs-POs & PSOs

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

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


 Chairman - BoS

23MEO601

INTRODUCTION TO INDUSTRIAL ENGINEERING

L T P C

3 0 0 3

OBJECTIVES

- To enable students to grasp the fundamental concepts, scope, and role of Industrial Engineering in manufacturing and service systems.
- To expose students to plant location, facility layout, and production planning concepts relevant to real-world industries.
- To develop analytical ability to apply work study, method study, and ergonomics principles in industrial environments.
- To equip students with foundational knowledge of statistical quality control and its application in process improvement.
- To prepare the concept of Production and Operations Management in creating and enhancing a firm's competitive advantages.

UNIT I INTRODUCTION

9

Concepts of Industrial Engineering – History and development of Industrial Engineering – Roles of Industrial Engineer – Applications of Industrial Engineering – Production Management Vs Industrial Engineering – Production System – Input Output Model – Productivity – Factors affecting Productivity – Increasing Productivity of resources – Kinds of Productivity measures.

UNIT II PLANT LOCATION AND LAYOUT

9

Factors affecting Plant location – Objectives of Plant Layout – Principles of Plant Layout – Types of Plant Layout – Methods of Plant and Facility Layout – Storage Space requirements – Plant Layout procedure – Line Balancing methods.

UNIT III WORK SYSTEM DESIGN & ERGONOMICS

9

Need – Objectives – Method Study procedure – Principles of Motion Economy – Work Measurement procedures – Time Study – Work sampling – Ergonomics and its areas of application in the work system – Physical work load and energy expenditure, Anthropometry – measures – design procedure, Work postures – sitting, standing.

UNIT IV STATISTICAL QUALITY CONTROL

9

Definition and Concepts – Fundamentals – Control Charts for variables – Control Charts for attributes – Acceptance Sampling – O.C curve – Single sampling plan – Double sampling plan.

UNIT V PRODUCTION PLANNING AND CONTROL

9

Forecasting –Techniques – Types of production – Process planning – Economic Batch Quantity–
Loading – Scheduling and control of production.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply the concepts of productivity and productivity measurement approaches.
- Examine appropriate location models for various facility types and design various facility layouts.
- Analyze and conduct method study and time study to improve the efficiency of the system.
- Examine the quality of processes using control charts in manufacturing/service industries.
- Examine sufficient knowledge and skill for Planning strategies and Material Requirement Plan (MRP).

TEXTBOOKS

1. Martand Telsang, "Industrial Engineering and Production Management", S. Chand and Company, 2016.
2. Khanna O. P., and Sarup A., "Industrial Engineering and Management", Dhanpat Rai Publications, New Delhi, 2020,
3. George Kanwaty, "Introduction to Work Study ", ILO, Geneva, 2016,

REFERENCES

1. Ravi Shankar, 2019, "Industrial Engineering and Management", Galgotia Publications & Private Limited.
2. Norberd Lloyd Enrick., "Industrial Engineering Manual for Textile Industry", Wiley Eastern (P) Ltd., New Delhi, 2018,
3. Enrick N. L., "Time study manual for Textile industry", Wiley Eastern (P) Ltd.,2019,

E-RESOURCES

1. <https://nptel.ac.in/courses/112107292> (Principles of Industrial Engineering)
2. https://onlinecourses.nptel.ac.in/noc25_me181/preview- (Industrial Engineering and Operations Research)



Mapping of COs-POs & PSOs

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

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


Chairman - BoS





23MEO605

CNC MACHINING TECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES

- To introduce students to the fundamentals of computer graphics, CAD systems, geometric transformations, and viewing techniques used in computer-aided design.
- To provide knowledge on geometric modeling techniques, assembly modeling, graphics standards, and product data exchange standards used in CAD applications.
- To explain the construction, components, control systems, and operational features of CNC machines and advanced machining centres.
- To familiarize students with manual and computer-aided CNC part programming techniques using APT, CAM packages, and canned cycles.
- To develop an understanding of Computer-Aided Manufacturing (CAM), Computer Integrated Manufacturing (CIM), manufacturing planning and control, automation, lean production, and Just-in-Time (JIT) manufacturing concepts.

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS

9

Product cycle - Design process - sequential and concurrent engineering - Computer-aided design - CAD system architecture - Computer graphics - coordinate systems - 2D and 3D transformations homogeneous coordinates - Line drawing - Clipping - viewing transformation.

UNIT II GEOMETRIC MODELING

9

Geometric Modeling - types - Wireframe, surface and solid modeling - Boundary Representation, constructive solid geometry - Graphics standards - assembly modeling - use of software packages - Data exchange standards - IGES, STEP, CALS, etc. - communication standards.

UNIT III CNC MACHINES

9

NC, CNC & DNC - types of CNC - constructional features - drives and control systems - feedback devices - Interchangeable tooling system - preset & qualified tools - ISO specification - Machining center - Turning center - CNC EDM - CNC wire cut EDM.

UNIT IV CNC PROGRAMMING

9

Manual part programming - steps involved - sample program in lathe & milling. - Computer-aided part programming - APT - CAM package - canned cycles - Programming.



UNIT V FUNDAMENTALS OF CAM

9

Brief introduction to CAM - Manufacturing Planning, Manufacturing control - Concurrent Engineering - CIM concepts - Computerized elements of CIM system - Types of production Basic Elements of an Automated system - Levels of Automation - Lean Production and Just-In-Time Production.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze the principles of computer graphics, CAD system architecture, coordinate systems, geometric transformations, and viewing techniques used in computer-aided design.
- Examine geometric modeling techniques, assembly modeling approaches, graphics standards, and data exchange standards for engineering design applications.
- Compare the constructional features, control systems, tooling arrangements, and operational characteristics of CNC machines and advanced machining centres.
- Classify CNC programming techniques, including manual part programming, computer-aided part programming, APT, CAM packages, and canned cycles for manufacturing applications.
- Differentiate the concepts of CAM, CIM, manufacturing planning and control, automation, lean production, and Just-in-Time (JIT) production in modern manufacturing systems.

TEXTBOOKS

1. Mikell P. Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing, Pearson Education", Fifth Edition, 2023.
2. Ibrahim Zeid, "Mastering CAD/CAM", McGraw-Hill Education, Third Edition, 2021.
3. P. N. Rao, "CAD/CAM: Principles and Applications", McGraw-Hill Education (India), Fourth Edition, 2022.

REFERENCES

1. M. P. Groover and Emory W. Zimmers Jr., "CAD/CAM: Computer-Aided Design and Manufacturing", Pearson Education, Second Edition (Reprint), 2020
2. M. P. Groover, "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", John Wiley & Sons, Eighth Edition, 2025
3. Ibrahim Zeid and R. Sivasubramanian, "CAD/CAM: Theory and Practice", McGraw Hill Education, Second Edition, 2020.

E-RESOURCES

1. <https://nptel.ac.in/courses/112102103> (Overview of CNC machines)
2. <http://www.digimat.in/nptel/courses/video/112104289/L20.html> (CNC Part Programming)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23MDO611

HOSPITAL MANAGEMENT

L T P C

3 0 0 3

OBJECTIVES

- To familiarize students with the fundamentals of hospital administration and management.
- To impart knowledge on human resource management practices in healthcare organizations.
- To explore marketing research processes and consumer behavior in healthcare services.
- To introduce hospital information systems and supportive healthcare services.
- To inculcate awareness of quality assurance, accreditation standards, and patient safety practices.

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION

9

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning - Current Issues in Hospital Management – Telemedicine - Bio-Medical Waste Management..

UNIT II HUMAN RESOURCE MANAGEMENT IN HOSPITAL

9

Principles of HRM — Functions of HRM — Profile of HRD Manager — Tools of HRD — Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer, Communication – nature, scope, barriers, styles and modes of communication.

UNIT III MARKETING RESEARCH PROCESS

9

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations — Consumer Markets & Consumer Buyer Behaviour - Model of consumer behaviour - The buyer decision process - Model of business buyer behavior — Major types of buying situations - WTO and its implications.

UNIT IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES

9

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems — Medical Transcription, Medical Records Department – Central Sterilization and Supply Department– Pharmacy– Food Services - Laundry Services.

UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL

9

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems. NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine the principles and functions of hospital administration in healthcare organizations.
- Analyze human resource management practices and their role in hospital operations.
- Apply marketing research techniques for healthcare service management.
- Utilize hospital information systems and supportive services for decision-making.
- Develop quality assurance and patient safety strategies in healthcare settings.

TEXT BOOKS

1. Gupta Joydeep Das, "Hospital Administration and Management: A Comprehensive Guide", Third Edition, 2023.
2. G.D.Kunders, "Hospitals – Facilities Planning and Management", TMH, New Delhi, Fifth Edition, Reprint 2018.

REFERENCES

1. Bruce J. Fried and Myron D. Fottler, "Human Resources in Healthcare Managing for Success", Fourth Edition, 2020.
2. James R. Langabeer, "Handbook on Health Care Operations Management", Jones & Bartlett Publishers, 2020.

E-RESOURCES

1. <https://www.youtube.com/watch?v=2J-F4Fi2VRQ> – (Introduction to Human Resource Management in Healthcare Settings)
2. <https://www.youtube.com/watch?v=dXHJemWm1xl&pp=ygUVI2hvc3BpdGFsX2luZm9ybWF0aW9u> – (Hospital Information Management Software (HIMS))

Mapping of COs, POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	3	1	-	-	2	1	-	-	1	1	-	-
2	1	2	2	1	-	1	2	1	1	2	1	-	-
3	1	2	3	1	1	1	1	-	1	2	1	-	-
4	1	2	2	2	3	1	1	-	1	1	2	-	-
5	1	3	2	2	2	3	2	1	1	2	2	-	-
AVG.	1	2.4	2	1.5	2	1.6	1.4	1.0	1.0	1.6	1.4	-	-

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



Chairman - BoS

23RAO609

FUNDAMENTALS OF ROBOTICS

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basics of robots, including anatomy, types, specifications, and applications.
- To impart knowledge on robot kinematics, including forward/inverse kinematics and transformation matrices for manipulators.
- To familiarize with robot drive systems and end effectors, including types, features, applications, and design considerations.
- To discuss sensors in robotics, including force, tactile, proximity, and their applications and safety aspects.
- To enhance understanding of robot programming and its applications in industrial and specialized fields.

UNIT I BASICS OF ROBOT

9

Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications.

UNIT II ROBOT KINEMATICS

9

Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices, translation and rotation matrices.

UNIT III ROBOT DRIVE SYSTEMS AND END EFFECTORS

9

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic grippers, vacuum grippers, internal grippers and external grippers, selection and design considerations of a gripper

UNIT IV SENSORS IN ROBOTICS

9

Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance

mechanism

UNIT V PROGRAMMING AND APPLICATIONS OF ROBOT

9

Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effectors Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TOTAL: 45 PERIODS

OUTCOMES

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

- Identify robot types, anatomy, specifications, and applications.
- Illustrate forward and inverse kinematics of manipulators using transformation matrices.
- Analyze and select appropriate drive systems and end effectors for robotic applications.
- Apply sensor technologies and safety systems to robotic cells for reliable detection, hazard prevention, and compliant operation.
- Apply robot programming techniques and analyze their applications in industrial and specialized fields.

TEXTBOOKS

1. Ganesh.S.Hedge, "A textbook of Industrial Robotics", Lakshmi Publications, Second Edition, 2015.
2. Mikell.P.Groover, "Industrial Robotics–Technology, Programming and applications", McGraw Hill, Second Edition , 2017.

REFERENCES

1. Fu K.S. Gonalz R.C. and ice C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill book co., Second Edition, 2007.
2. John. J.Craig, "Introduction to Robotics: Mechanics and Control", Fourth Edition, 2022.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_me37/preview- (Fundamentals of Robotics)
2. <https://archive.nptel.ac.in/courses/112/108/11210828> (Basics of Robotics)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	-	3	3	-	1	-	2	-	1	-	-
2	3	2	-	3	3	-	-	-	2	-	2	-	-
3	3	2	-	3	3	-	-	2	2	2	2	-	-
4	3	2	-	3	3	2	-	2	2	2	2	-	-
5	3	2	-	2	3	2	-	2	2	3	3	-	-
AVG	3.0	2	-	2.8	3.0	2.0	1.0	2.0	2.0	2.3	2.0	-	-

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


Chairman - BoS



23CS0612

CYBER FORENSICS AND ETHICAL HACKING

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge about the cyber crime and forensics.
- To acquire knowledge about forensic tools used for evidence acquisition and analysis.
- To familiarize with skills to collect, analyse, and present digital evidence following accepted forensic procedures and legal requirements.
- To impart the fundamental concepts, principles, and scope of ethical hacking in cyber security.
- To acquire the ethical hacking principles and security best practices to identify, analyze, and mitigate vulnerabilities in web applications

UNIT I INTRODUCTION TO CYBER CRIME AND FORENSICS

9

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Role of ECD and ICT in Cybercrime - Classification of Cyber Crime. The Present and future of Cybercrime - Cyber Forensics -Steps in Forensic Investigation - Forensic Examination Process - Types of CF techniques - Forensic duplication and investigation - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

UNIT II FORENSICS TOOLS

9

Processing Crime and Incident Scenes – Digital Evidence - Sources of Evidence -Working with File Systems. - Registry - Artifacts - Current Computer Forensics Tools: Software/ Hardware Tools - Forensic Suite - Acquisition and Seizure of Evidence from Computers and Mobile Devices - Chain of Custody- Forensic Tools

UNIT III VALIDATING FORENSICS DATA

9

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics - Analysis of Digital Evidence - Admissibility of Evidence - Cyber Laws in India.

UNIT IV ETHICAL HACKING

9

Introduction to Ethical Hacking – Foot printing and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing – Email Tracking .

UNIT V ETHICAL HACKING IN WEB

9

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

.TOTAL: 45 PERIODS

OUTCOMES

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

- Understand the basics of cyber crime and computer forensics
- Apply the forensic tools for acquiring, preserving, and analyzing digital evidence
- Analyze and validate digital evidence by applying standard forensic procedure
- Apply ethical hacking methodologies to perform reconnaissance, scanning, enumeration, and vulnerability
- Analyze the security vulnerabilities in web applications, wireless networks, and mobile platform.

TEXT BOOKS

1. Bill Nelson, Amelia Phillips, Christopher Stuart, "Guide to Computer Forensics and Investigations", Cengage Learning, India, Sixth Edition, 2019.
2. CEH official "Certified Ethical Hacking Review Guide", Wiley India Edition, Version 11, 2021.
3. Deje, S. Murugan, "Cyber Forensics", Oxford University Press, India, 2018

REFERENCES

1. John R.Vacca, "Computer Forensics", Cengage Learning, 2005.
2. Marjie T.Britz, "Computer Forensics and Cyber Crime: An Introduction", Third Edition, Prentice Hall, 2013.
3. AnkitFadia " Ethical Hacking", Second Edition, Macmillan India Ltd, 2006.
4. Kenneth C.Brancik "Insider Computer Fraud" Auerbach Publications, Taylor & Francis Group - 2008.

E-RESOURCES

1. https://onlinecourses.swayam2.ac.in/e-learning/preview/cec21_ge10
2. <https://nptel.ac.in/courses/106105217>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	-	-	1	1	1	-	-	-	1	-	-
2	3	2	1	2	3	1	2	1	1	-	2	-	-
3	3	3	1	3	3	2	3	1	2	-	2	-	-
4	3	3	2	2	3	2	2	1	1	-	2	-	-
5	3	3	3	2	3	2	3	1	2	1	3	-	-
AVG	3	2.6	1.8	2.3	2.6	1.6	2.2	1	1.5	1	2	-	-

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

Chairman - BoS

23PMO608

PHARMACEUTICAL NANOTECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES

- To introduce the evolution, principles, and applications of nanotechnology in drug delivery.
- To familiarize students with the principles of biopharmaceutics and pharmacokinetics.
- To provide knowledge of the principles, preparation, characterization, evaluation, and pharmaceutical applications of closed bilayered drug delivery systems.
- To develop a comprehensive understanding of programmed drug delivery systems, drug targeting strategies,
- To enhance understanding of the interactions of nanomaterials with biological systems, nanotoxicity.

UNIT I FUNDAMENTALS OF NANOTECHNOLOGY IN DRUG DELIVERY

9

Nanotechnology in Drug Delivery- Past, Present and Future- Conventional delivery of pharmaceuticals and its limitations, Significance of nano-size in Pharmacy, biotechnology and medicine, Physicochemical Principles of nano-sized Drug Delivery Systems, Biopharmaceutical, Physiological, and Clinical Considerations for Nanotechnology in Drug Delivery.

UNIT II PHARMACOKINETICS AND BIO DISTRIBUTION

9

Introduction- Definitions, concepts of Absorption, Distribution, Metabolism and excretion, concentration time profile, Bioavailability, bio pharmaceuticals and pharmacokinetics in drug research. Biotransformation of drugs- Drug metabolizing enzymes, chemical pathways of Drug transformation, Phase-I and Phase-II reactions, Factors affecting drug transformation Prodrugs- Application of produg design.

UNIT III NANO CARRIERS FOR DRUG DELIVERY

9

Closed bilayered system- Introduction, structural aspects, preparation, characterization, evaluation and applications of liposomes, niosomes, erythrosomes. Polymeric Nanoparticles- Introduction, preparation, characterization, evaluation and pharmaceutical applications.

UNIT IV CONTROLLED AND TARGETED DRUG DELIVERY

9

Programmed Drug Delivery Systems- principles of sustained, controlled, pulsatile and triggered release of drug from nanoparticles. Concept of targeting- Targeting Approaches, Transport Across Biological Barriers, mechanisms of drug targeting, Ideal carrier system and approach Disease-Related Approaches by Nanotherapeutics- nanoparticles for Cancer, Skin Diseases, Bacterial,

Diseases, Parasites Diseases and Inflammatory Disease.

UNIT V NANO TOXICOLOGY AND REGULATORY ISSUES

9

Human health and safety- Interaction of nanomaterials with biological systems, Toxicology of nanoparticles- in-vitro and in-vivo, Complications with Nanotoxicity studies, environmental impact of nano-materials, Regulatory Toxicology.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply the physicochemical principles governing nano-sized drug delivery systems.
- Explain the role of biopharmaceutics and pharmacokinetics in drug discovery, development, and therapeutic optimization.
- Analyze the physicochemical properties and performance of liposomes, niosomes, erythroosomes, and polymeric nanoparticles for pharmaceutical applications.
- Explain the principles of programmed drug delivery systems, including sustained, controlled, pulsatile, and triggered drug release from nanoparticles.
- Apply appropriate approaches to assess the toxicological effects and safety of nanomaterials using in-vitro and in-vivo studies.

TEXT BOOKS

1. Padma Devarajan, Sanyog Jain, "Targeted Drug Delivery : Concepts and Design", Springer publisher, First Edition , 2015.
2. M. A. Mateescu P. Ispas-Szabo E. Assaad, "Controlled Drug Delivery", Woodhead Publishing , Second Edition, 2014

REFERENCES

1. Michael E. Aulton , "Pharmaceutics", Churchill Livingstone Publisher , Second Edition, 2013.
2. Philippe Houdy, Marcel Lahmani, "Nanoethics and Nanotoxicology", Springer-Verlag Publisher, Second edition, 2011.

E-RESOURCES

1. <https://onlinelibrary.wiley.com/doi/book/10.1002/9783527800681>
2. <https://www.scribd.com/document/742651789/Nano-Technology-1>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	3	2	2	-	-	-	-	2	-	-
2	2	2	2	3	2	1	2	-	-	-	2	-	-
3	2	2	2	2	2	2	3	-	-	-	2	-	-
4	2	3	3	3	3	2	1	-	-	1	2	-	-
5	3	3	3	3	3	2	2	1	-	-	3	-	-
AVG.	2.4	2.6	2.4	2.8	2.4	1.8	2	1	-	1	2.2	-	-

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


Chairman - BoS

23MAO606

GRAPH THEORY

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamental concepts of graph theory.
- To explain the properties of trees, spanning trees, and fundamental circuits.
- To explain the concepts of connectivity and planarity.
- To provide knowledge of graph coloring, covering and partitioning.
- To introduce the concepts of directed graphs and Euler digraphs.

UNIT I INTRODUCTION, PATHS AND CIRCUITS

9

Graphs introduction – Finite and Infinite graphs – Incidence and degree – Isolated vertex, Pendant vertex and Null graph – Isomorphism – Sub graphs – Walks, Paths and Circuits – Connected graphs, disconnected graphs and components – Euler graphs – Hamiltonian paths and circuits.

UNIT II TREES AND FUNDAMENTAL CIRCUITS

9

Trees – Properties of trees – Pendant vertices in a tree – Distance and centers in tree – Rooted and binary trees – Spanning trees – Fundamental circuits – Spanning trees in a weighted graph.

UNIT III CONNECTIVITY AND PLANARITY

9

Connectivity and separability – Network flows – 1-isomorphism – 2-isomorphism – Combinational and geometric graphs – Planer graphs – Kuratowski's two graphs – Different representation of a planer graph.

UNIT IV COLORING, COVERING AND PARTITIONING

9

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem

UNIT V DIRECTED GRAPH

9

Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler digraphs

OUTCOMES

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

- Understand the fundamental concepts of graphs, paths, circuits, Euler and Hamiltonian graphs.
- Apply tree properties and fundamental circuits to solve engineering problems.



- Analyze graph connectivity, network flows and planar graphs for modeling real-world systems.
- Apply graph coloring, matching, covering, and partitioning techniques to optimization and scheduling problems.
- Analyze directed graph and Euler digraphs in engineering applications.

TOTAL: 45 PERIODS**TEXT BOOKS**

- Narsingh Deo., " Graph theory with applications to engineering and computer Science ", Prentice-Hall of India Pvt.Ltd, Fifth Edition, 2016.
- L.R.Foulds , "Graph Theory Applications", Springer LTD, Seventh Edition, 2016.

REFERENCES

- Kenneth H Rosen, "Discrete Mathematics and its Applications", McGraw Hill Education (India) Private Ltd., Seventh Edition,, 2011.
- Ralph P Grimaldi and B.V Ramana., "Discrete and Combinatorial Mathematics", Pearson Education limited, Fifth Edition, 2014.

E-RESOURCES

- <https://nptel.ac.in/courses/111106102> (Graph theory)
- <https://nptel.ac.in/courses/128106001> (Graph theory)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	1	-	-
2	3	3	2	-	-	-	-	-	-	-	1	-	-
3	3	3	2	1	-	-	-	-	-	-	1	-	-
4	3	3	3	1	-	-	-	-	-	-	2	-	-
5	3	3	2	1	-	-	-	-	-	-	2	-	-
AVG	3	2.8	2.3	1	-	-	-	-	-	-	1.4	-	-

1-Low 2-Medium 3-High '-' – No Correlation**Chairman - BoS**

OPEN ELECTIVE- II

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
CIVIL	23CEO704 / Remote Sensing Concepts	OE	3	0	0	3	40	60	100
ECE	23ECO708 / Energy Technology	OE	3	0	0	3	40	60	100
EEE	23EE0709 / Sensors, Actuators and its Application	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO703 / Fundamentals of Mechatronics	OE	3	0	0	3	40	60	100
	23MEO704 / Nano Technology	OE	3	0	0	3	40	60	100
	23MEO712 / Smart Manufacturing	OE	3	0	0	3	40	60	100
MEDICAL ELECTRONICS	23MDO705 / Ultrasound Principles and its Medical Applications	OE	3	0	0	3	40	60	100
ROBOTICS AND AUTOMATION	23RAO707 / Mobile Robots	OE	3	0	0	3	40	60	100
CSE(Cyber Security)	23CSO711 / Introduction to Cyber Security	OE	3	0	0	3	40	60	100
PHARMACEUTICAL TECHNOLOGY	23PMO706 / Intellectual Property Rights for Pharma Industry	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO710 / Operations Research	OE	3	0	0	3	40	60	100



23CE0704

REMOTE SENSING CONCEPTS

L T P C

3 0 0 3

OBJECTIVES

- To inculcate the concepts of remote sensing processes.
- To impart knowledge on applications of standard atmospheric profile and earth material.
- To familiarize with the orbits and platforms.
- To Instruct the various remote sensing techniques
- To enhance the elements of data interpretation.

UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION

9

Definition – components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum – Radiation principles - Wave theory, Planck's law, Wien's Displacement Law, Stefan's Boltzmann law, Kirchoff's law – Radiation sources: active & passive - Radiation Quantities.

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL

9

Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows - Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.

UNIT III ORBITS AND PLATFORMS

9

Motions of planets and satellites – Newton's law of gravitation - Gravitational field and potential - Escape velocity - Kepler's law of planetary motion - Orbit elements and types – Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Lorange Orbit.

UNIT IV SENSING TECHNIQUES

9

Classification of remote sensors – Resolution concept: spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors –microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR , UAV – Orbital and sensor characteristics of live Indian earth observation satellites.



UNIT V DATA PRODUCTS AND INTERPRETATION

9

Photographic and digital products – Types, levels and open-source satellite data products – selection and procurement of data– Visual interpretation: basic elements and interpretation keys - Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine the concepts and laws related to remote sensing.
- Analyze the interaction of electromagnetic radiation with atmosphere and earth material.
- Develop the satellite orbits and different types of satellites.
- Classify the different types of remote sensors.
- Construct the concepts of interpretation of satellite imagery.

TEXT BOOKS

1. Thomas M. Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, "Remote Sensing and Image interpretation", John Wiley and Sons, Ninth Edition, 2019.
2. George Joseph and C Jeganathan, "Fundamentals of Remote Sensing", Universities Press (India) Private limited, Third Edition, 2020.
1. Janza, F.Z., Blue H.M. and Johnson, J.E. "Manual of Remote Sensing. Vol. I", American Society of Photogrametry, Virginia, Fifth Edition, 2021.

REFERENCES

1. Verbyla, David, "Satellite Remote Sensing of Natural Resources", CRC Press, Third Edition, 2019
2. Paul Curran P.J. "Principles of Remote Sensing. Longman", RLBS, Eighth Edition, 2022.
3. Charles Elachi and Jacob Van Zyl, "Introduction to Physics and Techniques of Remote Sensing", Wiley Publication, Second Edition, 2020.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_ce84/preview (Remote Sensing and GIS)
2. https://onlinecourses.nptel.ac.in/noc20_ce29/preview (Remote Sensing Essentials)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23ECO708

ENERGY TECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES

- To acquire knowledge of the basic concepts of energy, energy resources, and energy consumption.
- To familiarize the working principles of conventional power plants such as thermal, hydel, and nuclear power plants.
- To impart knowledge on the principles and applications of renewable energy sources like solar, wind, tidal, ocean, and geothermal energy.
- To enhance understanding of biomass energy conversion methods, fuel cells, and energy storage systems.
- To foster awareness of energy conservation techniques and energy auditing for improving industrial energy efficiency

UNIT I INTRODUCTION

9

Units of energy, conversion factors, general classification of energy, world energy resources and energy consumption, Indian energy resources and energy consumption, energy crisis, energy alternatives, Renewable and non-renewable energy sources and their availability. Prospects of Renewable energy sources

UNIT II CONVENTIONAL ENERGY

9

Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

UNIT III NON-CONVENTIONAL ENERGY

9

Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

UNIT IV BIOMASS ENERGY

9

Biomass energy resources, thermo-chemical and biochemical methods of biomass conversion, combustion, gasification, pyrolysis, biogas production, ethanol, fuel cell and its types, energy storage routes like thermal energy storage, chemical, mechanical storage and electrical storage.



UNIT V ENERGY CONSERVATION

9

Energy conservation in chemical process plants, energy audit, energy saving in heat exchangers, distillation columns, dryers, ovens and furnaces and boilers, steam economy in chemical plants, energy conservation.

TOTAL : 45 PERIODS

OUTCOMES

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

- Apply conversion factors in solving energy-related numerical problems.
- Analyze merits, demerits and combustion processes of conventional plants.
- Examine about solar, wind, tidal, wave and geothermal energy sources.
- Identify the technological basis for harnessing renewable energy sources.
- Analyze energy losses in heat exchangers, boilers and furnaces.

TEXT BOOKS

1. Rao, S. and Parulekar, B.B., Energy Technology, Khanna Publishers, 2005.
2. Nagpal, G.R., Power Plant Engineering, Khanna Publishers, 2008.

REFERENCES

1. El. Wakil, Power Plant Technology, Tata McGraw Hill, New York, 2002.
2. Sukhatme. S.P., Solar Energy - Thermal Collection and Storage, Tata McGraw hill, New Delhi, 1981.

E-RESOURCES

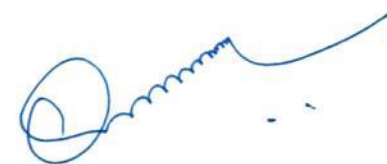
1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_ch27 - (Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems)
2. https://nptel.ac.in/courses/121106014?utm_source=chatgpt.com - (NOC-Conventional Sources)



Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	3	2	3	3	-	-	1	1	-	3	-	-
2	3	1	3	3	-	-	1	1	-	3	3	-	-
3	2	2	2	3	3	1	-	1	1	-	3	-	-
4	2	2	1	3	3	1	1	1	-	1	3	-	-
5	2	2	1	3	3	1	1	1	-	1	3	-	-
AVG	2.2	2	1.8	3	3	1	1	1	1	1.6	3	-	-

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



Chairman - BoS

23EE0709

SENSORS, ACTUATORS AND ITS APPLICATION

L T P C

3 0 0 3

OBJECTIVES

- To familiarize common types of sensor and actuators used in automotive vehicles.
- To enhance measuring equipment's for the measurement of pressure force, temperature and flow.
- To acquire new ideas in designing the sensors and actuators for automotive application
- To inculcate the operation of the sensors, actuators and electronic control.
- To develop temperature control actuators for vehicles.

UNIT I INTRODUCTION TO MEASUREMENTS AND SENSORS

9

Sensors: Functions- Classifications- Main technical requirement and trends Units and standards- Calibration methods- Classification of errors- Error analysis- Limiting error- Probable error- Propagation of error- Odds and uncertainty- principle of transduction-Classification. Static characteristics- mathematical model of transducers- Zero, First and Second order transducers- Dynamic characteristics of first and second order transducers for standard test inputs .

UNIT II VARIABLE RESISTANCE AND INDUTANCE SENSORS

9

Principle of operation – construction details – Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT.

UNIT III VARIABLE AND OTHER SPECIAL SENSORS

9

Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNIT IV AUTOMOTIVE ACTUATORS

9

Electromechanical actuators - Fluid-mechanical actuators - Electrical machines- Direct-current machines - Three-phase machines - Single-phase alternating-current Machines - Duty-type ratings for electrical machines. Working principles, construction and location of actuators viz. Solenoid, relay, stepper motor etc.

UNIT V AUTOMATIC TEMPERATURE CONTROL ACTUATORS

9

Different types of actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system.

TOTAL : 45 PERIODS

OUTCOMES

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

- Apply common types of sensor and actuators used in vehicles.
- Examine measuring equipment's for the measurement of pressure force, temperature and flow.
- Analyze the sensors and actuators for automotive application.
- Analyze the operation of the sensors, actuators and electronic control.
- Apply temperature control actuators for vehicles.

TEXT BOOKS

1. Ernest O. Doebelin Dhanesh N.Manik, "Doebelin's Measurement Systems", McGraw Hill Publishers, Seventh Edition, 2019.
2. Bosch, "Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive", Fifth Edition, 2007.

REFERENCES

1. William Ribbens, "Understanding Automotive Electronics -An Engineering Perspective," Elsevier Butterworth-Heinemann Publishers, Seventh Edition, 2012.
2. James D Halderman, "Automotive Electrical and Electronics", Prentice Hall, USA, 2013.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_ee32/preview - (Sensors and Actuators)
2. <https://archive.nptel.ac.in/noc/courses/noc19/SEM2/noc19-ee41/> - (Sensors and Actuators)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS



23MEO703

FUNDAMENTALS OF MECHATRONICS

L T P C

3 0 0 3

OBJECTIVES

- To train students in the basic concepts of mechatronics and explain the working principles of commonly used sensors and transducers.
- To teach the architecture, instruction set, and operation of the 8085 microprocessor for control applications.
- To explain and train students in interfacing techniques using 8255 PPI for applications such as ADC/DAC, temperature control, motor control, and traffic control.
- TO familiarize students with the fundamentals of Programmable Logic Controllers (PLC), including I/O processing, timers, and counters used in industrial automation.
- To train students on actuators and mechatronics system design, supported by real-time case studies.

UNIT I INTRODUCTION AND SENSORS

9

Introduction to Mechatronics – Systems – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and Dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance Sensors – Strain Gauges – Eddy Current Sensor – Hall Effect Sensor – Temperature Sensors – Light Sensors.

UNIT II 8085 MICROPROCESSOR

9

Introduction – Pin Configuration - Architecture of 8085 – Addressing Modes – Instruction set, Timing diagram of 8085.

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE

9

Introduction – Architecture of 8255, Keyboard Interfacing, LED display – Interfacing, ADC and DAC Interface, Temperature Control – Stepper Motor Control – Traffic Control Interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER

9

Introduction – Architecture – Input / Output Processing – Programming with Timers, Counters and Internal relays – Data Handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONICS SYSTEM DESIGN

9

Types of Stepper and Servo motors – Construction – Working Principle – Characteristics, Stages of Mechatronics Design Process – Comparison of Traditional and Mechatronics Design Concepts with





Examples – Case studies of Mechatronics Systems – Pick and Place Robot – Engine Management system – Automatic Car Park Barrier.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply basic mechatronics concepts and select suitable sensors and transducers for simple engineering applications.
- Develop basic control and interfacing programs using the 8085 microprocessor instruction set and addressing modes.
- Design real-time interfacing applications using 8255 PPI, ADC/DAC, and display devices.
- Apply PLC programming concepts with timers, counters, and I/O modules for industrial automation tasks.
- Analyze actuator performance and integrate mechatronics system designs through practical case studies such as pick-and-place robots and engine management systems.

TEXTBOOKS

1. Bolton W., "Mechatronics", Pearson Education, Seventh Edition, 2019.
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", Penram International Publishing Private Limited, Sixth Edition, 2013.
3. Dr. JayashreeDeka, Mayuri Sanjay Mhaske, Ajeet Bhagwat Bhane, Kiran C, "Mechatronics", Quill Tech Publications, First Edition, 2025

REFERENCES

1. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", Cengage Learning, 2019.
2. NitaigourPremchandMahalik, "Mechatronics Principles, Concepts and Applications", McGraw Hill Education, 2020.
3. Smaili.A and Mrad. F, "Mechatronics Integrated Technologies for Intelligent Machines", Oxford University Press, 2018.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_me27/preview - (Mechatronics)
2. https://onlinecourses.nptel.ac.in/noc25_me179/preview- (Design of Mechatronics Systems)



Mapping of COs-POs &PSOs

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

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


Chairman - BoS

23ME0704

NANO TECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES

- To provide an understanding of the types of nanostructures and their electronic properties
- To introduce the principles and operational aspects of high-energy ball milling and post-oxidation processes.
- To describe the role of surfactants in controlling the formation and stability of nanoparticles.
- To provide an understanding of thermal analysis methods for assessing the properties of nanomaterials.
- To focus on the emerging applications of nanomaterials in science and engineering.

UNIT I TYPES OF NANOMATERIALS

9

Zero dimensional, one-dimensional and two dimensional nanostructures, Graphene, Fullerene, Carbon nano tubes and, Quantum Dots, Nanoclusture, Zeolites minerals, Nanowires, Block Copolymers, Properties of nanomaterials - Surface properties, Electrical properties, Magnetic properties.

UNIT II PHYSICAL ROUTES

9

High energy ball mill - Chemical Vapour Deposition – Physical Vapour Deposition – Laser ablation - Pulsed laser deposition – Rapid solidification – Arc discharge method- photolysis – radiolysis - Fabrication of nanostructures and microfabrication using wet and dry etching-Lithography.

UNIT III CHEMICAL METHODS

9

Colloidal precipitation – Sol-Gel process– Chemical precipitation: Normal and Reverse reactions- Hydrothermal – Solvothermal – Sonochemical – DC and Pulsed electrodeposition and Electroless deposition – Combustion route.

UNIT IV NANOMATERIAL ANALYSIS

9

Photoluminescence Spectroscopy, Raman Spectroscopy, X-Ray Photoelectron Spectroscopy (XPS), Thermal analysis – Differential Scanning Calorimetry (DSC) – Thermogravimetric Analysis (TGA) – Differential Thermal Analysis (DTA) –Mechanical Testing- Nano Indentation -Vibrating Sample Magnetometer, Zeta Potential and Particle size measurement.

UNIT V APPLICATION OF NANOMATERIALS

9

Molecular Electronics and Nanoelectronics – Nanobots- Biological Applications – Quantum Devices



– Nanomechanics - Carbon Nanotube – Photonics- Nano structures as single electron transistor – principle and design.

OUTCOMES

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

- Analyze the structure, classification, and size-dependent properties of nanostructures.
- Apply wet and dry etching techniques for the fabrication of nanostructures and micro fabricated devices.
- Analyze chemical synthesis techniques to prepare nanomaterials and evaluate the influence of processing parameters on their properties.
- Explain the principles of nanomaterial characterization techniques.
- Apply the principles and applications of nanomaterials.

TEXT BOOKS

1. G. Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications", Imperial College Press, 2015.
2. T. Pradeep, "A Textbook of Nanoscience and Nanotechnology", Tata McGraw Hill Education, 2019.

REFERENCES

1. B.Bhushan, "Springer Handbook of Nanotechnology", Springer-Verlag Berlin Heidelberg, 2020.
2. G.A. Ozin and A.C. Arsenault, "Nanotechnology : A chemical approach to nanomaterials", Royal Society of Chemistry, 2015.

E-RESOURCES

1. <https://libguides.utdallas.edu/nanotechnology-nanoscience-nanomaterials-guide/sources/books>
2. <https://libguides.lib.msu.edu/nanotechnology/online>



Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	2	1	2	1	1	2	1	-	-	-
2	3	2	3	2	1	2	1	1	2	1	-	-	-
3	3	2	3	3	1	2	3	1	3	2	-	-	-
4	3	2	3	3	1	2	2	1	3	1	-	-	-
5	3	1	2	2	1	2	2	1	2	2	-	-	-
AVG	3	1.8	2.6	2.4	1	2	1.8	1	2.4	1.4	-	-	-

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


Chairman - BoS



23ME0712

SMART MANUFACTURING

L T P C

3 0 0 3

OBJECTIVES

- To familiarize with the concepts, architecture, and components of Smart Manufacturing systems.
- To provide knowledge of sensing, monitoring, and data acquisition technologies used in modern manufacturing environments.
- To enable application of Industrial IoT and Cyber-Physical Systems for smart manufacturing applications.
- To develop the ability to analyze manufacturing data for process monitoring and predictive maintenance.
- To equip with the knowledge of advanced Industry 4.0 technologies and their applications in smart factory implementation.

UNIT I INTRODUCTION TO SMART MANUFACTURING

9

Evolution of Manufacturing Systems, Conventional Manufacturing vs Smart Manufacturing, Industry 4.0 Concepts, Smart Factory Architecture, Digital Transformation in Manufacturing, Components of Smart Manufacturing, Intelligent Production Systems, Applications and Case Studies.

UNIT II SENSORS AND DATA ACQUISITION

9

Sensors in Manufacturing Automation, Electrical, Optical, Acoustic and Vision Sensors, Smart Sensors and Intelligent Sensors, Machine Vision Systems, Condition Monitoring, Data Acquisition Systems, Sensor Networks for Manufacturing, Shop Floor Data Collection.

UNIT III INDUSTRIAL IoT AND CYBER PHYSICAL SYSTEMS

9

Introduction to IoT and IIoT, IoT Architecture, Smart Connected Manufacturing, Cyber Physical Systems (CPS), Cloud Manufacturing, Fog and Edge Computing, Communication Protocols in Manufacturing, Cyber Security in Smart Factories.

UNIT IV DATA ANALYTICS AND DIGITAL MANUFACTURING

9

Manufacturing Data Analytics, Big Data in Manufacturing, Machine Learning Fundamentals, Predictive Maintenance, Quality Monitoring and Process Optimization, Digital Twin Concepts, Real-Time Monitoring Systems, Decision Support Systems.



UNIT V ADVANCED SMART MANUFACTURING TECHNOLOGIES

9

Additive Manufacturing and 3D Printing, Collaborative Robots (Cobots), Automated Guided Vehicles (AGVs), Flexible Manufacturing Systems, Autonomous Manufacturing, Sustainable Smart Manufacturing, Smart Supply Chain and Logistics, Future Trends in Industry 5.0.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply the concepts, architecture, and components of Smart Manufacturing systems to manufacturing scenarios.
- Analyze the role of smart and intelligent sensors in enhancing manufacturing efficiency, process monitoring, and decision-making.
- Apply the Industrial IoT and Cyber-Physical Systems to smart manufacturing applications.
- Analyze manufacturing data for process monitoring and predictive maintenance.
- Examine advanced smart manufacturing technologies for modern industrial applications.

TEXT BOOKS

1. Gilchrist, A., "Industry 4.0: The Industrial Internet of Things", Apress, First Edition, 2016.
2. Ustundag, A. and Cevikcan, E., "Industry 4.0: Managing the Digital Transformation", Springer, First Edition, 2018.
3. Jeschke, S., Brecher, C., Song, H. and Rawat, D.B., "Industrial Internet of Things: Cyber manufacturing Systems", Springer, First Edition, 2017.

REFERENCES

1. Song, H., Rawat, D.B., Jeschke, S. and Brecher, C., "Cyber-Physical Systems: Foundations, Principles and Applications", Academic Press, First Edition, 2016.
2. Buyya, R. and Dastjerdi, A.V., "Internet of Things: Principles and Paradigms", Morgan Kaufmann, First Edition, 2016.
3. Locher, D.A., "Smart Manufacturing: The Lean Six Sigma and Systems Engineering Approach", CRC Press, First Edition, 2017.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_cs95/preview (Industrial Internet of Things, Cyber Physical Systems and Data Analytics)
2. <https://onlinecourses.nptel.ac.in/127101872> (Industry 4.0: Managing the Digital Transformation)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	-	-	1	-	-	-	-	-	1	-	-
2	2	3	-	1	3	-	-	-	-	-	-	-	-
3	2	3	2	2	3	-	-	-	-	-	1	-	-
4	2	3	-	3	3	-	1	-	-	-	2	-	-
5	1	2	3	2	3	-	2	-	-	-	2	-	-
AVG	2.0	2.6	2.5	2.0	2.6	-	1.5	-	-	-	1.5	-	-

1 - Low, 2 - Medium, 3 - High, '-' - No correlation


Chairman - BoS

23MDO705

ULTRASOUND PRINCIPLES AND ITS MEDICAL APPLICATIONS

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamentals of ultrasound physics and instrumentation.
- To explore the interaction of ultrasound with biological tissues and image formation.
- To familiarize students with ultrasound scanning techniques.
- To impart knowledge on various ultrasound imaging modalities and Doppler principles.
- To provide knowledge on the clinical applications of diagnostic ultrasound.

UNIT I FUNDAMENTALS OF MEDICAL ULTRASOUND

9

Introduction to ultrasound in healthcare – Basic physics of sound waves – Frequency, wavelength, velocity, acoustic impedance – Piezoelectric effect and ultrasound generation – Ultrasound transducers and their working principle – Propagation of ultrasound in biological tissues – Reflection, refraction, scattering, attenuation and absorption – Safety aspects of diagnostic ultrasound.

UNIT II TISSUE INTERACTION AND IMAGE FORMATION

9

Interaction of ultrasound with biological tissues – Acoustic properties of tissues – Tissue characterization using ultrasound – Echo generation and detection – Principles of pulse-echo imaging – Factors affecting image quality – Resolution and penetration – Artifacts in ultrasound imaging – Basics of image interpretation.

UNIT III ULTRASOUND INSTRUMENTATION AND SCANNING TECHNIQUES

9

Ultrasound transducers and probes – Construction and types of probes – Functions of transmitter and receiver – Beam steering and focusing concepts – Scan conversion and image display – Signal processing basics – Image optimization controls – Scanning techniques, acoustic windows, transducer selection and patient positioning.

UNIT IV ULTRASOUND IMAGING MODALITIES

9

Modes of ultrasound display: A-mode, B-mode and M-mode – Real-time ultrasound imaging – Principles of Doppler ultrasound – Color Doppler imaging – 2D and 3D ultrasound imaging – Introduction to tissue elasticity imaging – Use of contrast agents in ultrasound – Performance parameters of ultrasound systems.

UNIT V CLINICAL APPLICATIONS OF ULTRASOUND

9

Ultrasound applications in abdomen, breast, thyroid, heart, kidney and eye – Obstetric and

gynecological ultrasound – Fetal imaging and monitoring – Musculoskeletal and vascular ultrasound
– Advantages and limitations of ultrasound imaging – Emerging trends in medical ultrasound.

TOTAL: 45 PERIODS

OUTCOMES

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

- Identify the basic principles of medical ultrasound and transducer operation.
- Analyze the interaction of ultrasound waves with biological tissues.
- Apply appropriate scanning techniques for ultrasound image acquisition.
- Examine different ultrasound imaging modalities and their applications.
- Utilize the role of ultrasound in clinical diagnosis and healthcare practice.

TEXT BOOKS

1. Frank Miele Jr., "Ultrasound Physics and Instrumentation", Miele Enterprises, Sixth Edition, 2021.
2. Thomas L. Szabo, "Diagnostic Ultrasound Imaging: Inside Out", Academic Press, Second Edition, 2018.

REFERENCES

1. Peter Hoskins, Kevin Martin, and Abigail Thrush (Eds.), "Diagnostic Ultrasound: Physics and Equipment", CRC Press, Third Edition, 2019.
2. Yufeng Zhou (Ed.), "Principles and Applications of Therapeutic Ultrasound in Healthcare", Routledge, 2021.

E-RESOURCES

1. https://www.youtube.com/watch?v=UdDmP_CDH5I - (Medical Engineering)
2. <https://www.youtube.com/watch?v=a8xcXDez5M> - (Ultra sonic Imaging Systems)

Mapping of COs, POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	1	-	-	1	1	-	-	1	1	-	-
2	2	3	1	2	-	1	1	-	-	1	1	-	-
3	2	2	3	1	3	1	1	-	-	1	1	-	-
4	2	2	2	2	3	1	1	-	-	1	1	-	-
5	2	3	2	2	2	2	1	-	1	1	2	-	-
AVG.	2.2	2.4	1.8	1.8	2.7	1.2	1.0	-	1	1	1.2	-	-

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

Chairman - BoS



23RA0707

MOBILE ROBOTS

L T P C

3 0 0 3

OBJECTIVES

- To introduce locomotion principles and control of mobile robots.
- To focus on kinematic modeling and constraints in mobile systems.
- To provide an understanding of robot maneuverability, holonomic constraints, and trajectory-following control strategies.
- To inculcate the principles of dynamic modeling for differential-drive and omni directional mobile robots using Lagrange methods.
- To develop the ability to classify sensors, characterize performance, and represent environmental uncertainty using statistical methods.

UNIT I INTRODUCTION TO MOBILE ROBOTS

9

Introduction – Locomotion of the Robots – Key Issues on Locomotion – Legged Mobile Robots – Configurations and Stability – Wheeled Mobile Robots – Design Space and Mobility Issues – Unmanned Aerial and Underwater Vehicles – Teleportation and Control

UNIT II MOBILE ROBOT KINEMATICS

9

Introduction; kinematic models and constraints: representing robot position, forward kinematic models, wheel kinematic constraints: fixed, caster and omni wheels, robot kinematic constraints, examples: robot kinematic models and constraints.

UNIT III MOBILE ROBOT MANEUVERABILITY

9

Degree of mobility, degree of steerability, robot maneuverability; mobile robot workspace: degrees of freedom, holonomic robots, path and trajectory considerations; motion control (kinematic control): open loop control (trajectory following), feedback control.

UNIT IV MOBILE ROBOT DYNAMICS

9

Introduction, general robot dynamic modeling - Newton-Euler and Lagrange, differential-drive Wheeled mobile robot, three-Wheel omni directional mobile robot, four mecanum-wheel omni directional robot.

UNIT V SENSORS FOR MOBILE ROBOTS

9

Sensor classification, characterizing sensor performance, wheel/motor sensors, heading sensors,



ground-based beacons, active ranging, motion/speed sensors, visionbased sensors; representing uncertainty: statistical representation.

TOTAL: 45 PERIODS

OUTCOMES

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

- Classify various locomotion mechanisms, including legged, wheeled, and aerial configurations, based on stability and design constraints.
- Construct forward kinematic models for mobile robots by accounting for fixed, caster, and omni-wheel constraints.
- Compare holonomic and non-holonomic maneuverability to implement effective trajectory-following and feedback motion control.
- Analyze the dynamic behavior of differential-drive and Mecanum-wheel robots using Newton-Euler and Lagrange formulations.
- Examine sensor performance and statistical uncertainty to determine the most effective sensing suite for robot localization.

TEXT BOOKS

1. Roland Siegwart, Illah R. Nourbakhsh, "Introduction to Autonomous Mobile Robots", MIT Press, Second Edition, 2011.
2. Spyros G. Tzafestas, "Introduction to Mobile Robot Control", Elsevier, Second Edition, 2014.

REFERENCES

1. Gregory Dudek, Michael Jenkin, "Computational Principles of Mobile Robotics", Cambridge University Press, Third Edition, 2023..
2. George A. Bekey, "Autonomous Robots", MIT Press, First Edition, 2005..

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/112/106/112106298/> -(Wheeled mobile Robots)
2. <https://www.mathworks.com/help/robotics/> - (Robotics System Toolbox)



SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade,

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	2	1	1	1	1	-	1	-	-
2	3	3	3	2	3	1	1	1	1	-	1	-	-
3	3	3	3	3	3	1	1	1	2	-	2	-	-
4	3	3	3	3	3	1	1	1	2	-	2	-	-
5	3	3	3	3	3	2	1	1	2	-	2	-	-
AVG	3	3	2.8	2.6	2.8	1.2	1	1	1.6	-	1.6	-	-

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


Chairman - BoS





23CSO711

INTRODUCTION TO CYBER SECURITY

L T P C

3 0 0 3

OBJECTIVES

- To impart fundamental knowledge of cyber security concepts, cyber threats and risk management frameworks.
- To provide knowledge about computer networking fundamentals, secure protocols, and defensive mechanisms.
- To impart understanding of cryptographic techniques, hashing, digital signatures, PKI, and data security practices.
- To develop students understanding on common cyber threats, malware, web-based attacks, and appropriate mitigation approaches
- To familiarize the students with regulatory compliance standards, security practices and cloud security.

UNIT I FUNDAMENTALS OF CYBER SECURITY

9

Introduction to Cyber Security - Information Security - CIA Triad - Cyber Space - Digital Identity - Threats and Vulnerabilities - Risk Management - Types of Hackers - Cyber Crimes - Security Policies.

UNIT II NETWORK SECURITY

9

Computer Networks - OSI Model - TCP/IP Model - IP Addressing - DNS and DHCP - Firewalls - IDS and IPS - VPN - Secure Communication Protocols - Network Attacks - Wireless Security.

UNIT III CRYPTOGRAPHY AND DATA SECURITY

9

Introduction to Cryptography - Encryption and Decryption - Symmetric Cryptography - Asymmetric Cryptography - AES - RSA - Hash Functions - Digital Signatures - Public Key Infrastructure (PKI) - Data Security.

UNIT IV CYBER THREATS AND MALWARE

9

Cyber Attacks - Malware - Viruses - Worms - Trojans - Ransomware - Phishing - Social Engineering - SQL Injection - Cross-Site Scripting (XSS) - DoS and DDoS Attacks.

UNIT V CYBER LAWS AND SECURITY PRACTICES

9

Cyber Ethics - Information Technology Act, 2000 - Cyber Laws - Digital Privacy - Password Security



- Multi-Factor Authentication - Incident Response - Disaster Recovery - Cloud Security - Artificial Intelligence in Cyber Security.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain fundamental cyber security concepts and apply basic risk management frameworks to identify security risks.
- Apply computer networking fundamentals, secure protocols, and defensive mechanisms to protect networked systems.
- Apply cryptographic techniques, hashing mechanisms, and data security methods to ensure information and ensure data security
- Analyze malware infections, system vulnerabilities, and web-based attacks and recommend appropriate mitigation measures.
- Analyze regulatory compliance requirements, Cyber Laws, and cloud security practices for securing digital environments.

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security: Principles and Practice", Pearson Education, 8th Edition, 2020.
2. AnandShinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021.

REFERENCES

1. Chwan-Hwa (John) Wu and J. David Irwin, "Introduction to Computer Networks and Cyber Security", CRC Press, 2016.
2. Nina Godbole and SunitBelapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India, 2011.

E-RESOURCES

1. https://onlinecourses.swayam2.ac.in/e-learning/preview/nou19_cs08
2. <https://nptel.ac.in/courses/106106248>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	2	-	2	1	2	-	-	-
CO2	3	3	3	2	3	-	-	-	2	2	-	-	-
CO3	3	3	3	2	2	-	-	-	1	1	-	-	-
CO4	3	3	3	3	3	1	-	-	2	2	-	-	-
CO5	3	2	2	2	2	3	2	3	2	3	2	-	-
AVG	3.0	2.6	2.4	2.3	2.5	2.0	2.0	2.5	1.6	2.0	2.0	-	-

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


Chairman - BoS

**23PMO706****INTELLECTUAL PROPERTY RIGHTS FOR PHARMA
INDUSTRY****L T P C****3 0 0 3****OBJECTIVES**

- To introduce the basic concepts of Intellectual Property Rights (IPR), their protection mechanisms, and their significance in the pharmaceutical industry.
- To familiarize students with patent laws, copyright regulations, international treaties, and their role in protecting intellectual property in the pharmaceutical sector.
- To provide knowledge of patent filing, prior art search, patent applications, and international patenting for pharmaceutical innovations.
- To develop an understanding of patent administration and legal aspects of patent protection in the pharmaceutical industry.
- To enhance understanding of patent ownership, publication ethics, copyright protection, and intellectual property management in research and academia.

UNIT I INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS**9**

Concept of Intellectual Property Right , The World Intellectual Property Organization, Intellectual property protection (IPP) and intellectual property rights (IPR), Economic importance, mechanisms for protection of intellectual property-patents, copyrights, trademark, Factors affecting choice of IP protection, Penalties for violation, Role of IPR in pharmaceutical industry, Global ramifications and financial implications.

UNIT II RULES AND REGULATIONS**9**

The Patents (Amendment) Act, 2002 and The Patents (Amendment) Act, 2005, Rationale of Patent & License, Application for Patents, Rights of Patentee, Compulsory Licenses, Surrender and Revocation of Patents, Infringement of Patents, Amendments, Registration of Lapsed Patents, Patent Agent , Overview of global patents and US, Indian Copyright Law and digital technologies- Berne convention, WIPO copyright treaty (WCT), WIPO performance and Phonogram Treaty (WPPT).

UNIT III PATENT FILING**9**

Precautions before patenting-disclosures / non-disclosures, publication-article / thesis , Prior art search-published patents, internet search patent sites, specialized services-search requests, costs, Patent application-forms and guidelines, fee structure, time frames, jurisdiction aspects, Types of patent applications- provisional, non-provisional, PCT and convention patent applications, International patenting-requirement procedures and costs.



UNIT IV FINANCIAL ASSISTANCE FOR PATENTING

9

Introduction to schemes by NRDC and TIFAC ,Publication of patents-gazette of India, status in Europe and US , Patent annuity; Patent attorneys-technical aspects, criteria for selection, addresses, fee, rights and responsibilities of a patentee, Patent infringement- meaning, scope, litigation, case studies and examples.

UNIT V RESEARCH, PATENTS, COPYRIGHT, AND TECHNOLOGY TRANSFER

9

Patenting by research students, lecturers and scientists University / organisational rules in India and abroad, Thesis research paper publication, credit sharing by workers, financial incentives, Useful information sources for patents related information-internet sites and periodicals Significance of copyright protection for researchers, Protection for computer data bases, multimedia works.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- Apply the principles of IPR to identify appropriate protection mechanisms based on the nature of pharmaceutical innovations and factors influencing IP protection.
- Analyze the patent systems of India and the United States, and evaluate the impact of amendments on patent protection and innovation.
- Describe the methods for conducting prior art searches using patent databases and online search resources.
- Explain the objectives of NRDC and TIFAC schemes and the patent publication process in India, Europe, and the United States.
- Implement patenting procedures and institutional policies in academic and research environments.

TEXT BOOKS

1. Bayya subba rao. V. Appaji, "Intellectual Property Rights in Pharmaceutical Industry" PharmaMed Press, Second Edition, 2025.
2. Prof. Rupinder Tewari Ms. Mamta Bhardwaj," Intellectual Property", Publication Bureau Panjab University , Forth Edition ,2019.

REFERENCES

1. Harshal Ashok Pawar," Intellectual Property Rights and Patents in Pharmacy" Everest Publishing House , First Edition , 2025
2. Anasuya Patil," textbook on Pharmaceutical Intellectual Property Rights", shashwat publication , First Edition, 2016.

E-RESOURCES

1. <https://www.lexology.com/library/detail.aspx?g=0588408f-f7e2-4c00-aa50-76fcb455b12c>
2. <https://www.lingayasvidyapeeth.edu.in/the-vital-role-of-intellectual-property-rights-ipr-in-pharmacy/>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	1	3	1	1	-	-	1	1	-	-
2	2	2	2	1	3	2	2	-	1	-	-	-	-
3	3	1	2	1	2	1	1	-	-	-	2	-	-
4	2	3	3	2	2	2	1	2	-	1	2	-	-
5	2	3	2	1	1	3	3	2	-	-	2	-	-
AVG	2.4	2.2	2.2	1.2	2.2	1.8	1.6	2	1	1	1.8	-	-

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


Chairman - BoS

23MA0710

OPERATIONS RESEARCH

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basic concepts of linear programming.
- To provide knowledge of duality and network models.
- To explain the concepts of integer programming.
- To explore the techniques of classical optimization theory.
- To develop an understanding of the Critical path method and the Program evaluation and review technique.

UNIT I LINEAR PROGRAMMING

9

Principal components of decision problem – Modeling phases – Linear Programming Formulation and graphic solution – Simplex method.

UNIT II DUALITY AND NETWORKS

9

Definition of dual problem – Primal – Dual relationships – Dual simplex methods – Post optimality analysis – Transportation and assignment model – Shortest route problem

UNIT III INTEGER PROGRAMMING

9

Cutting plan algorithm– Branch and bound methods, Multistage (Dynamic) programming.

UNIT IV CLASSICAL OPTIMISATION THEORY

9

Unconstrained external problems, Newton – Raphson method– Equality constraints– Jacobean methods – Lagrangian method–Kuhn–Tucker conditions–Simple problems.

UNIT V OBJECT SCHEDULING

9

Network diagram representation – Critical path method – Time charts and resource leveling– Programme evaluation review technique.

TOTAL: 45 PERIODS

OUTCOMES

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

- Solve Linear Programming Problems using graphical and simplex methods.
- Apply duality concepts and network optimization techniques to solve transportation, assignment, and shortest path problems.
- Solve Integer Programming and Dynamic Programming problems using appropriate

optimization techniques.

- Analyze unconstrained and constrained optimization problems using classical optimization methods.
- Apply project scheduling techniques such as CPM and PERT for planning, scheduling, and resource optimization.

TEXT BOOKS

- H.A. Taha, "Operation Research", Prentice Hall of India, Eighth Edition, 2002
- Paneer Selvam, „Operations Research", Prentice Hall of India, Second Edition, 2002

REFERENCES

- Vohra, "Quantitative Techniques in Management", Tata Mc Graw Hill, Second Edition, 2002
- Winston "Operation Research", Thomson Learning, Fourth Edition, 2003

E-RESOURCES

- <https://nptel.ac.in/courses/111/102/111102012/> (Operation Research)
- <https://freevideolectures.com/course/4737/nptel-project-management/21>(Operation Research)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	1	2	1	-	-	-	-	2	-	-
2	3	3	2	2	2	1	-	-	-	-	2	-	-
3	3	3	3	2	2	1	-	-	-	-	2	-	-
4	3	3	2	2	2	1	-	-	-	-	2	-	-
5	2	3	3	2	2	1	-	-	-	-	2	-	-
AVG	2.8	3	2.4	1.8	2	1	-	-	-	-	2	-	-

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


Chairman - BoS

OPEN ELECTIVE - III

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit C	Maximum Marks		
			L	T	P		CIA	ESE	TOT
CIVIL	23CEO717 / Geographical Information System	OE	3	0	0	3	40	60	100
CSE	23CSO715 / Fundamentals of Blockchain Technology	OE	3	0	0	3	40	60	100
ECE	23ECO718 / VLSI Design	OE	3	0	0	3	40	60	100
EEE	23EEO716 / Electrical, Electronic and Magnetic Materials	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO720 / Marine Vehicles	OE	3	0	0	3	40	60	100
MEDICAL ELECTRONICS	23MDO719 / Wearable Technology	OE	3	0	0	3	40	60	100
	23MDO723 / Medical Waste Management								
	23MDO724 / Lifestyle Diseases								
ROBOTICS AND AUTOMATION	23RAO721 / Robotics Process Automation	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO714 / Advanced Numerical Methods	OE	3	0	0	3	40	60	100
MANAGEMENT	23MGO722 / Cost management of Engineering Projects	OE	3	0	0	3	40	60	100

23CE0717

GEOGRAPHICAL INFORMATION SYSTEM

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamental concepts and components of GIS.
- To impart knowledge on spatial data models and database structures.
- To familiarize students with data acquisition, input, and management techniques.
- To instruct GIS analysis and modeling techniques.
- To enhance skills in spatial data interpretation and real-world applications.

UNIT I INTRODUCTION TO GIS

9

Definition and components of GIS – History and evolution of GIS – Basic concepts of spatial information – Elements of GIS – Hardware, software, data, people and methods – GIS vs conventional mapping – Coordinate systems and map projections – Types of maps – Overview of GIS applications in engineering and resource management.

UNIT II – SPATIAL DATA MODELS AND DATA STRUCTURES

9

Spatial data types – Raster and Vector data models – Comparison between raster and vector models – Spatial data structures – Topology concepts – Attribute data and database management systems – Relational database model – Data storage and retrieval – Metadata concepts – Data quality and accuracy.

UNIT III – DATA ACQUISITION AND INPUT TECHNIQUES

9

Sources of spatial data – Maps, aerial photographs and satellite imagery – GPS data collection – Surveying data integration – Digitization and scanning – Georeferencing – Data editing and transformation – Error sources and correction – Data integration techniques – Spatial data standards.

UNIT IV – GIS ANALYSIS AND MODELING

9

Spatial analysis concepts – Query operations – Buffering and overlay analysis – Network analysis – Terrain analysis and Digital Elevation Model (DEM) – Interpolation techniques – Spatial modeling – Multi-criteria decision analysis – GIS-based modeling applications in urban planning and environmental management.

UNIT V – GIS OUTPUT, VISUALIZATION AND APPLICATIONS

9

Cartographic visualization – Map layout and design – Thematic mapping – Data visualization

techniques – Web GIS concepts – Open-source GIS platforms – GIS applications in water resources, transportation, disaster management, urban planning and environmental monitoring – Introduction to GIS project workflow.

TOTAL: 45 PERIODS

OUTCOMES

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

- Construct the fundamental concepts and components of GIS.
- Analyze spatial data models and database structures.
- Apply data acquisition and preprocessing techniques in GIS.
- Examine the spatial analysis and GIS modeling.
- Analyze GIS outputs, effective spatial visualizations and GIS techniques.

TEXT BOOKS

1. Kang-tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Education, Ninth Edition, 2022.
2. Ian Heywood, Sarah Cornelius and Steve Carver, "An Introduction to Geographical Information Systems", Pearson Education, Fifth Edition, 2019.
3. Tor Bernhardsen, "Geographic Information Systems: An Introduction", Wiley India, Third Edition, 2018.

REFERENCES

1. Paul A. Longley, Michael F. Goodchild, David J. Maguire and David W. Rhind, "Geographical Information Systems and Science", Wiley, Fourth Edition, 2021.
2. Burrough, P.A. and McDonnell, R.A., "Principles of Geographical Information Systems", Oxford University Press, 2015.
3. Lo, C.P. and Yeung, A.K.W., "Concepts and Techniques of Geographic Information Systems", Prentice Hall, 2018.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_ce84/preview (GIS and Remote Sensing)
2. https://onlinecourses.nptel.ac.in/noc20_ce29/preview (GIS Applications)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS



23CSO715

FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY

LT P C

3 0 0 3

OBJECTIVES

- To impart fundamental knowledge of blockchain technology, distributed ledger concepts, and decentralized systems.
- To develop students' understanding of cryptographic techniques, consensus mechanisms, and blockchain architecture.
- To train students in designing and implementing smart contracts using Ethereum and Solidity.
- To familiarize students with blockchain platforms, decentralized applications (DApps), and enterprise blockchain frameworks.
- To expose students to blockchain applications, security challenges, emerging trends, and real-world case studies through practical implementation.

UNIT I INTRODUCTION TO BLOCKCHAIN TECHNOLOGY

9

Introduction to Blockchain – Evolution of Blockchain – Distributed Ledger Technology (DLT) – Characteristics of Blockchain – Blockchain Architecture – Types of Blockchain (Public, Private, Consortium, Hybrid) – Blockchain Components – Blocks, Transactions and Hashes – Merkle Tree – Blockchain Lifecycle – Benefits and Limitations – Blockchain Applications in Various Industries.

UNIT II CRYPTOGRAPHY AND CONSENSUS MECHANISMS

9

Cryptographic Hash Functions – Digital Signatures – Public Key Infrastructure – Elliptic Curve Cryptography – Wallets – Consensus Algorithms – Proof of Work (PoW) – Proof of Stake (PoS) – Delegated Proof of Stake (DPoS) – Proof of Authority (PoA) – Byzantine Fault Tolerance (PBFT) – Mining Process – Blockchain Security.

UNIT III ETHEREUM AND SMART CONTRACTS

9

Ethereum Architecture – Ethereum Virtual Machine (EVM) – Accounts – Gas – Ether – Smart Contracts – Solidity Programming – Variables – Functions – Modifiers – Events – Error Handling – Smart Contract Deployment – Remix IDE – MetaMask – Web3 Basics.

UNIT IV DECENTRALIZED APPLICATIONS AND ENTERPRISE BLOCKCHAIN

9

Decentralized Applications (DApps) – DApp Architecture – IPFS – Hyperledger Fabric – Hyperledger Composer – Corda – Quorum – Blockchain APIs – Blockchain as a Service (BaaS) – Identity Management – Supply Chain Management – Healthcare Applications.



UNIT V BLOCKCHAIN APPLICATIONS AND EMERGING TRENDS

9

Cryptocurrency – Bitcoin Architecture – NFTs – Decentralized Finance (DeFi) – Central Bank Digital Currency (CBDC) – Blockchain in IoT – Blockchain in Artificial Intelligence – Web3 – DAO – Blockchain Scalability – Layer-2 Solutions – Security Challenges – Regulatory Issues – Future Trends – Industry Case Studies.

TOTAL : 45 PERIODS

OUTCOMES

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

- Explain blockchain fundamentals, distributed ledger concepts, blockchain architecture, and applications.
- Analyze cryptographic techniques, digital signatures, wallets, and consensus mechanisms used in blockchain systems.
- Develop smart contracts using Solidity and deploy decentralized applications on Ethereum.
- Analyze enterprise blockchain platforms, decentralized applications, and blockchain integration for real-world business solutions.
- Apply blockchain technologies to develop secure, scalable, and decentralized solutions for modern computing applications

TEXT BOOKS

1. Imran Bashir, "Mastering Blockchain", Packt Publishing, Fourth Edition, 2023.
2. Arshdeep Bahga and Vijay Madiseti, "Blockchain Applications: A Hands-on Approach", VPT Publications, Second Edition, 2017.

REFERENCES

1. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly Media, First Edition, 2015.
2. Andreas M. Antonopoulos and Gavin Wood, "Mastering Ethereum: Building Smart Contracts and DApps", O'Reilly Media, First Edition, 2018.

E - RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_cs44/preview (Block chain and its application)
2. https://onlinecourses.nptel.ac.in/noc20_cs01/preview (Introduction to block chain technology and information)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	1	-	2	-	-	-	1	-	2	-	-
2	3	3	2	2	3	-	-	-	1	-	2	-	-
3	3	3	3	2	3	-	-	-	1	-	2	-	-
4	3	2	3	2	3	-	-	-	1	-	2	-	-
5	2	2	2	2	3	-	-	-	1	-	2	-	-
AVG	2.8	2.4	2.2	2	2.8	-	-	-	1	-	2	-	-

1-Low, 2-Medium, 3-High, "-" – No Correlation


Chairman - BoS

23ECO718

VLSI Design

L T P C

3 0 0 3

OBJECTIVES

- To explain the fundamentals of CMOS circuits and their characteristics.
- To realize MOS based circuits using different design styles
- To impart knowledge on adder, multiplier, and shifter circuits for realizing data path design.
- To understand memory architectures, peripheral circuits and SRAM/DRAM design concepts for high-speed VLSI memory systems.
- To gain knowledge of the testing processes of CMOS circuits.

UNIT I MOS TRANSISTOR

9

MOS operating modes, Pass transistors, Characteristics of CMOS inverter, Scaling principles and fundamental limits. Propagation Delays, CMOS inverter scaling, Elmore's constant.

UNIT II MOS CIRCUIT DESIGN STYLES

9

Static: Static CMOS, Pass transistor, Transmission gate, Pseudo NMOS design Styles, Dynamic: C2MOS, Dynamic, Domino, NORA, and Zipper design styles.

UNIT III DATA PATH DESIGN

9

Adder: CLA adder, MODL, Manchester carry chain, High-speed adders: carry skip, carry select and carry save, Multipliers and shifter: Array multiplier and barrel shifter.

UNIT IV MEMORY DESIGN AND PERIPHERAL CIRCUITS

9

Memory architectures- ROM, 6T SRAM, 1T and 3T DRAM. Memory Peripheral Circuits Address Decoder, Sense Amplifier, Voltage References, Timing and Control, Drivers, Case Study – 4Mbit SRAM.

UNIT V CMOS TESTING

9

CMOS Testing, Need for Testing, Test Principles, Design Strategies for Test, Chip Level and Board Level Test Techniques.

OUTCOMES

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

- Explain pass transistor operation, propagation delay and Elmore's constant.
- Analyze different MOS circuit design styles.
- Design adder, multiplier and shifter circuits using MOS logic.
- Examine the memory peripheral circuits in SRAM and DRAM design.
- Analyze the design strategies and concepts of testing.

TEXT BOOKS

1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI DESIGN", A system PerspectiveAddision Wesley , Second Edition, 2004.
2. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated circuits: A Design Perspective", Prentice Hall of India, Second Edition, 2003.

REFERENCES

1. A.Pucknell, Kamran Eshraghian, "BASIC VLSI DESIGN", Prentice Hall of India, Third Edition, 2007.
2. John P. Uyemura, "Introduction to VLSI Circuits and Systems", Wiley India Pvt. Ltd.

E - RESOURCES

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ee09 - (CMOS digital VLSI design)
2. https://nptel.ac.in/courses/117101004?utm_source=chatgpt.com - (ADVANSED VLSI DESIGN)

Mapping of COs-POs & PSOs

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

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

Chairman - BoS

23EE0716

ELECTRICAL, ELECTRONIC AND MAGNETIC MATERIALS

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge on dielectric materials and their electrical properties.
- To familiarize with magnetic materials and their characteristics for electrical applications.
- To acquire knowledge on semiconductor materials and superconductivity concepts.
- To enhance understanding of materials used in electrical engineering applications.
- To foster awareness of optical and optoelectronic materials and their applications.

UNIT I DIELECTRIC MATERIALS

9

Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT II MAGNETIC MATERIALS

9

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and Hysteresis

UNIT III SEMICONDUCTOR MATERIALS

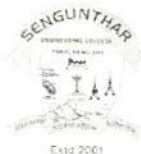
9

Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale Integration techniques. Concept of superconductivity; theories and examples for high temperature superconductivity; discussion on specific superconducting materials; comments on fabrication and engineering applications.

UNIT IV MATERIALS FOR ELECTRICAL APPLICATIONS

9

Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetallic fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.



UNIT V OPTICAL AND OPTOELECTRONIC MATERIALS

9

Principles of photoconductivity - effect of impurities - principles of luminescence-laser principles - He-Ne, injection lasers, LED materials - binary, ternary photoelectronic materials - LCD materials - photo detectors - applications of optoelectronic materials - optical fibres and materials - electro optic modulators - Kerr effect - Pockels effect.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to

- Explain the properties and behavior of dielectric materials.
- Apply the characteristics of magnetic materials in electrical applications.
- Analyze semiconductor materials and superconducting phenomena.
- Examine the selection of materials for electrical engineering applications.
- Analyze the principles and applications of optical and optoelectronic materials.

TEXT BOOKS

1. Pradeep Fulay, "Electronic, Magnetic and Optical materials", CRC Press, Taylor and Francis, Second Edition, 2017.
2. R K Rajput, "A course in Electrical Engineering Materials", Laxmi Publications, 2009.

REFERENCES

1. T K Basak, "A course in Electrical Engineering Materials", New Age Science Publications, 2009.
2. S. P. Seth, P. V. Gupta, "A course in Electrical Engineering Materials", Dhanpat Rai & Sons, 2011.

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/108/104/108104087/> - (Electromagnetic Theory).
2. https://onlinecourses.nptel.ac.in/noc24_ee125/preview - (A Basic Course on Electric and Magnetic Circuits).



Mapping of COs-POs & PSOs

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

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


Chairman - BoS



23ME0720

MARINE VEHICLES

L T P C

3 0 0 3

OBJECTIVES

- To introduce the classification, functions, and applications of various marine vehicles, including commercial vessels and submersibles.
- To provide knowledge on the design, construction, operational principles, and applications of manned and unmanned submersible systems.
- To explain the design concepts, components, control systems, stability, and industrial applications of Remotely Operated Vehicles (ROVs).
- To familiarize students with the design, navigation, sensing technologies, control strategies, and applications of Autonomous Underwater Vehicles (AUVs).
- To develop an understanding of the design considerations, pressure hulls, maneuvering, life-support systems, safety requirements, and certification procedures of manned submersibles.

UNIT I MARINE VEHICLES

9

Types – general – by function – commercial marine vehicles- submersibles types – applications

UNIT II SUBMERSIBLES

9

Manned and unmanned submersibles – towed vehicles – gliders – crawler – Design and construction

UNIT III REMOTELY OPERABLE VEHICLE (ROV)

9

Remotely Operable Vehicles (ROV) – The ROV business – Design theory and standards – control and simulation – design and stability – components of ROV - applications

UNIT IV AUTONOMOUS UNDERWATER VEHICLE (AUV)

9

AUV – Design and construction – components – sensors – Navigation -control strategies – applications

UNIT V MANNED SUBMERSIBLE

9

Introduction – Design and operational consideration – pressure hulls and exostructures – ballasting and trim – maneuvering and control – Life support and habitability – emergency devices and equipment's – certification and classification



OUTCOMES

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

- Analyze the classification, functions, and operational characteristics of different marine vehicles and submersibles for various underwater applications.
- Examine the design features, construction methods, and operational capabilities of manned and unmanned submersible systems.
- Compare the design principles, stability, control mechanisms, and functional components of Remotely Operated Vehicles (ROVs) for underwater operations.
- Classify Autonomous Underwater Vehicles (AUVs) based on their design, navigation systems, sensing technologies, control strategies, and marine applications.
- Differentiate the design considerations, life-support systems, maneuvering mechanisms, safety features, and certification requirements of manned submersibles for reliable underwater operations.

TEXT BOOKS

1. Jonathan M. Ross, "Human Factors for Naval Marine Vehicle Design and Operation", CRC Press, First Edition, 2020.
2. Tien Anh Tran, Kolla Bhanu Prakash, Subrata Chowdhury, and Ivan C.K. Tam, "Underwater Vehicle Control and Communication Systems Based on Machine Learning Techniques", CRC Press, First Edition, 2024.
3. Paul A. Russell, Reeds, "General Engineering Knowledge for Marine Engineers" , Bloomsbury Publishing (Reeds Marine Engineering and Technology Series), Seventh Edition, 2024.

REFERENCES

1. Ferial L. Hawry (Ed.), "The Ocean Engineering Handbook", CRC Press, First Edition, 2020.
2. Richard A. Geyer (Ed.), Submersibles and Their Use in Oceanography and Ocean Engineering, Elsevier, Revised Edition, 2019
3. Sabiha A. Wadoo and Pushkin Kachroo, "Autonomous Underwater Vehicles: Modeling, Control Design and Simulation", CRC Press, First Edition, 2019.

E-RESOURCES

1. <https://nptel.ac.in/courses/114105030> - (Components of Resistance - I)
2. <http://www.digimat.in/nptel/courses/video/114105030/L22.html> - (Regular Sea Waves - II)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23MDO719

WEARABLE TECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES

- To introduce the concepts and applications of wearable healthcare systems.
- To familiarize students with wearable devices and physiological parameter monitoring.
- To impart knowledge on communication technologies used in wearable systems.
- To explore wireless body area networks and healthcare monitoring applications.
- To inculcate understanding of data processing, validation, and analytics in wearable technologies.

UNIT I INTRODUCTION TO WEARABLES

9

Wearable Systems- Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Types of Wearable Systems, Components of Wearable Systems, Physiological Parameters Commonly Monitored in Wearable Applications, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles, Sport Application, Smart Fabrics: Intelligent Textiles.

UNIT II WEARABLE DEVICES FOR HEALTHCARE AND VITAL PARAMETERS

9

Vital Parameters Monitored and their Significances, Bio-potential Signal Recordings (ECG, EEG, EMG), Dry Electrodes Design and Fabrication methods, Cuff-less Blood Pressure Measurement, PPG, Galvanic Skin Response (GSR), Body Temperature Measurements, Activity Monitoring for Energy Expenditure, Respiratory parameters, Wearable sensors for Body Temperature: Intermittent and Continuous temperature monitoring, Detection principles – thermistor, infrared radiation, thermopile.

UNIT III COMMUNICATION TECHNOLOGIES

9

Principles of different sensors, Micro-Motors and Communication Channels - Accelerometers, Optical sensor, GPS- Various Input Methods, Power Requirements, Wearable Systems Packaging, Batteries and Charging, Wireless Communication Technologies and Protocols, Receiver Systems.

UNIT IV WIRELESS BODY AREA NETWORKS

9

Wireless Body Area Networks – Introduction, Personal Area Networks (PAN), Application in Vital Physiological Parameter monitoring, Design of Sensor & Sink Nodes, Architecture Communication & Routing Protocols, Security, Power and Energy Harvesting, Mobile Applications Based Devices.

UNIT V DATA PROCESSING AND VALIDATION

9

Classification Algorithms, Data Mining and Data Fusion, Signal Processing Algorithms in Wearable Applications, Issues of Wearable Physiological Monitoring Systems, Statistical Validation of Parameters, Certifications of Medical Devices and Patenting.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine the fundamentals and applications of wearable healthcare systems.
- Select suitable wearable sensors and devices for monitoring physiological signals.
- Apply communication technologies and protocols employed in wearable healthcare systems.
- Discuss wireless body area network solutions for healthcare monitoring applications.
- Analyze the quality of wearable technology data using suitable processing and validation methods.

TEXT BOOKS

1. Haider Raad, "Fundamentals of IoT and Wearable Technology Design", Wiley, First Edition, 2020.
2. Christine Farion, "The Ultimate Guide to Informed Wearable Technology: A Hands-on Approach for Creating Wearables from Prototype to Purpose Using Arduino Systems", Packt Publishing, First Edition, 2022.

REFERENCES

1. Subhas Chandra Mukhopadhyay, Wearable Electronics and Embedded Computing Systems, Springer, First Edition, 2021.
2. Miodrag Bolic, David Simons, and Insook Choi, Wearable Sensors: Theory, Design, and Applications, Academic Press, First Edition, 2023.

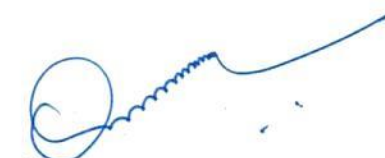
E-RESOURCES

1. https://www.youtube.com/watch?v=gp_X_DwoyC4 - (Introduction to Wireless systems).
2. <https://www.youtube.com/watch?v=dm9W5WQUq2A> - (Introduction Wearable device).

Mapping Of COs, POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	1	-	-	1	-	-	-	-	1	-	-
2	2	2	3	1	2	-	-	-	-	-	1	-	-
3	2	3	2	1	3	-	-	-	-	-	1	-	-
4	2	2	2	2	2	2	1	-	-	-	1	-	-
5	2	3	1	3	2	-	-	-	-	-	3	-	-
AVG.	2.2	2.4	1.8	1.75	2.25	1.5	1.0	-	-	-	1.4	-	-

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



Chairman - RoS

23MDO723

MEDICAL WASTE MANAGEMENT

L T P C

3 0 0 3

OBJECTIVES

- To familiarize students with biomedical waste management practices in healthcare facilities.
- To introduce biomedical waste handling, segregation, and transportation procedures.
- To impart knowledge on biomedical waste treatment and disposal technologies.
- To explore biomedical waste regulations, standards, and compliance requirements.
- To inculcate awareness of patient safety and environmental protection measures.

UNIT I HEALTHCARE HAZARD CONTROL AND UNDERSTANDING ACCIDENTS

9

Waste disposal management, Hospital waste management, Biosafety- regulatory framework for GMOs, bioethics and its socio economic impact, hazards associated with poor health care waste management..

UNIT II BIOMEDICAL WASTE HANDLING TECHNIQUES

9

Characterization of medical waste(management and handling) rules, 1998, amendments and guidelines, segregation, packaging, storage, transport of infectious waste. Techniques of biomedical waste management. Health and safety rules. Protocols, issues, and challenges in transportation of biomedical waste.

UNIT III DISPOSAL TECHNIQUES

9

Treatment method- Autoclave, Hydroclave, Microwave, Chemical Disinfection, Solidification and stabilization, Bioremediation, Thermal Conversion Technologies, accumulation and storage of hazardous waste, land disposal of hazardous waste, other treatment and disposal method. Common Hazardous Waste Treatment Facilities (TSDF).

UNIT IV RULES AND CATEGORIES OF WASTE

9

Biomedical waste management rule: Biomedical wastes categories and their segregation, collection, treatment, processing, and disposal options, Standards For Treatment and Disposal Of Bio-Medical wastes, Standards for autoclaving of bio-medical waste, standards of microwaving, standards for deep burial, standards for the efficacy of chemical disinfection, standards for dry heat sterilization, standards for liquid waste.

UNIT V PREVENTION AND PATIENT SAFETY

9

Healthcare Immunizations, Centers for Disease Control and Prevention, Disinfectants, Sterilants, and Antiseptics, OSHA Bloodborne Pathogens Standard, Tuberculosis, Healthcare Opportunistic Infections, Medical Waste. Patient Safety: An Organizational Function, Errors and Adverse Events, Safety Cultures.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine biomedical waste management practices in healthcare facilities.
- Apply biomedical waste handling and transportation procedures.
- Analyze biomedical waste treatment and disposal techniques.
- Utilize biomedical waste management regulations and standards in healthcare settings.
- Develop safety measures for patient protection and environmental sustainability.

TEXT BOOKS

1. NehaSuyal , Prasenjit Debbarma , Manali Singh , Anita Mishra, Roop S Bora , "Biomedical Waste Management: Bioremediation and Recycling", September 2024.
2. Dr. Shivakumar M.A,"Law Relating to Bio-medical Waste Management With Special Reference to Bangalore Urban City", BlueRose Publishers Pvt.Ltd, First Edition,January 2023.

REFERENCES

1. Himadri Panda, "Biomedical Waste: Management, Recycling And Applications", Discovery Publishing House PVT LTD, First Edition, April 2019.
2. NIIR Board of Consultants & Engineers, "Handbook on Recycling and Disposal of Hospital Waste Municipal Solid Waste, Biomedical Waste Plastic Waste", NIIR Project Consultancy Services, January 2018.

E-RESOURCES

1. <https://www.youtube.com/watch?v=32KyVb-Ggn8> – (Biomedical Waste Management System)
2. <https://www.youtube.com/watch?v=hYRp7SDWJXE> - (Mnemonic for Biomedical waste management)



Chairman - Bos

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
1	2	2	1	-	1	3	2	-	-	1	1	-	-
2	2	2	2	1	2	3	2	-	-	1	1	-	-
3	2	3	2	2	2	2	1	-	-	1	1	-	-
4	2	2	2	2	2	3	2	-	-	1	1	-	-
5	2	3	2	2	2	3	3	1	1	2	2	-	-
AVG.	2	2.4	1.8	1.75	1.8	2.8	2	1	1	1.2	1.2	-	-

Mapping of COs, POs & PSOs



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





23MDO724

LIFESTYLE DISEASES

LT P C

3 0 0 3

OBJECTIVES

- To introduce the concepts of lifestyle diseases and their associated risk factors.
- To inculcate awareness on cancer, its types and treatment. .
- To impart knowledge on cardiovascular diseases and their causes..
- To familiarize students with types of diabetes, obesity and their preventive measures.
- To explore respiratory diseases, their causes, prevention, and management strategies.

UNIT I INTRODUCTION

9

Lifestyle diseases – Definition ; Risk factors – Eating, smoking, drinking, stress, physical activity, illicit drug use ; Obesity, diabetes, cardiovascular diseases, respiratory diseases, cancer; Prevention – Diet and exercise.

UNIT II CANCER

9

Types – Lung cancer, Mouth cancer, Skin cancer, Cervical cancer, Carcinoma esophagus; Causes Tobacco usage, Diagnosis – Biomarkers, Treatment.

UNIT III CARDIOVASCULAR DISEASES

9

Coronary atherosclerosis – Coronary artery disease; Causes -Fat and lipids, Alcohol abuse — Diagnosis - Electrocardiograph, echocardiograph, Treatment, Exercise and Cardiac rehabilitation.

UNIT IV DIABETES AND OBESITY

9

Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Pediatrics and adolescent obesity – Weight control and BMI.

UNIT V RESPIRATORY DISEASES

9

Chronic lung disease, Asthma, COPD; Causes - Breathing pattern (Nasal vs mouth), Smoking – Diagnosis - Pulmonary function testing.

TOTAL: 45 PERIODS



OUTCOMES

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

- Analyze lifestyle diseases and their associated risk factors.
- Examine diagnostic and treatment approaches for cancer management.
- Utilize diagnostic tools used in cardiovascular disease assessment.
- Apply weight management and diabetes prevention strategies.
- Develop preventive measures and management plans for respiratory diseases.

TEXT BOOKS

1. MingfuLu, "Solving Lifestyle Disease with Lifestyle", Thorpe Bowker Australia, February 2018.
2. Labros S. Sidossis, Labros S. Sidossis, "Textbook of Lifestyle Medicine", February 2022.

REFERENCES

1. K V Ramani , Hemlatha Ramani , Gunjan Y Trivedi Vishwanathan P Lakshmi M and Anita Verma , "Preventing Insidious Lifestyle Diseases", January 2022.
2. Jeff Lumiri , Cliff Nyambichu, "Lifestyle Diseases: Lifestyle Disease Management" February 2018.

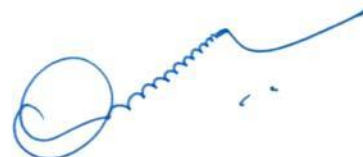
E-RESOURCES

1. <https://youtu.be/6l6gTPIZeOk?si=3GYHWv5itK1unltc> – (Diagnosis Prognosis)
2. <https://youtu.be/fhL5lAyjz0o?si=GFUtO-FSyShP9gXN> - (Prescribing Asthma and COPD)

Mapping of COs, POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	3	1	-	1	2	1	-	-	1	1	-	-
2	2	2	2	1	2	2	1	-	-	1	1	-	-
3	2	2	2	2	3	2	1	-	-	1	1	-	-
4	2	2	2	1	2	2	1	-	-	1	2	-	-
5	2	3	2	2	2	3	2	1	1	2	2	-	-
AVG.	2	2.4	1.8	1.5	2	2.2	1.2	1	1	1.2	1.4	-	-

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



Chairman - BoS



23RA0721

ROBOTICS PROCESS AUTOMATION**L T P C****3 0 0 3****OBJECTIVES**

- To introduce the fundamentals and evolution of Robotic Process Automation.
- To develop skills in workflow sequencing, data manipulation, and control flow for automated decision-making.
- To familiarize students with application integration, web scraping methods, and the use of recorders to automate UI actions.
- To develop expertise in exception handling, debugging techniques, and the organization of reusable automation projects.
- To inculcate knowledge of bot deployment using Orchestration Servers, license management, and the current landscape of RPA vendors.

UNIT I INTRODUCTION TO RPA**9**

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation – Benefits of RPA – Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools – Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II AUTOMATION PROCESS ACTIVITIES**9**

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT III APPLICATION INTEGRATION, RECORDING & SCRAPING**9**

Application integration strategies, selector usage - key workflow activities ,Recording mouse/keyboard actions -Web scraping from websites and exporting to CSV - Introductory process mining

UNIT IV EXCEPTION HANDLING AND CODE MANAGEMENT**9**

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine



UNIT V DEPLOYMENT AND MAINTENANCE

9

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors – Open Source RPA, Future of RPA

OUTCOMES

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

- Classify RPA platforms and components by differentiating between traditional automation and modern robotic process evolution.
- Build automated workflows using sequences, flowcharts, and data manipulation techniques for effective decision-making.
- Apply recording and web scraping techniques to integrate applications and export data into structured formats.
- Examine exception handling and debugging techniques to ensure robust code management and workflow reusability.
- Analyze deployment strategies using Orchestration Servers to manage bot licensing, publishing, and maintenance updates.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Mary C. Lacity, Leslie P. Willcocks, Robotic Process Automation and Cognitive Automation: The Next Phase, SB Publishing, 2018.
2. NandanMullakara, Robotic Process Automation with UiPath: A Complete Guide, BPB Publications, 2021.

REFERENCES

1. Alok Mani Tripathi, "A practical guide to understanding and implementing RPA with UiPath and other tools." Packt Publishing, Fourth Edition, 2019.
2. Pascal Borner, Ian Barkin, JochenWirtz, Intelligent Automation: Welcome to the World of Hyperautomation, Apress, 2019

E-RESOURCES

1. <https://nptel.ac.in/courses/112101098> -(Robotics)
2. <https://docs.uipath.com/> -(UiPath Documentation)



Chairman - Bos

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
1	3	2	1	2	2	1	-	-	1	1	1	-	-
2	3	3	3	2	3	1	-	-	1	1	1	-	-
3	3	3	3	2	3	1	-	-	1	1	1	-	-
4	3	3	2	3	3	1	-	-	1	1	1	-	-
5	3	3	3	3	3	2	-	-	2	2	2	-	-
AVG	3	2.8	2.4	2.4	2.8	1.2	-	-	1.2	1.2	1.2	-	-

Mapping of COs-Pos& PSOs



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





23MA0714

ADVANCED NUMERICAL METHODS

L T P C

3 0 0 3

OBJECTIVES

- To explore techniques for solving algebraic and transcendental equations.
- To introduce numerical techniques for solving matrix inversion and eigenvalue problems.
- To explain the concepts of interpolation and difference equations.
- To provide knowledge of numerical differentiation and integration.
- To explain various numerical methods for solving partial differential equations.

UNIT I SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS

9

Introduction – Basic properties of equations – Transformation of equations – Bisection method – Method of false position – Iteration method – Newton-Raphson Method – Some Deductions From Newton-Raphson Formula.

UNIT II MATRIX INVERSION AND EIGENVALUE PROBLEMS

9

Matrix inversion – Gauss-Jordan method – Factorization method – Partition method – Power method – Jacobi's method.

UNIT III INTERPOLATION AND DIFFERENCE EQUATIONS

9

Spline interpolation – inverse interpolation by Lagrange's method – Definition and order of difference equations – Formation of difference equations – Linear difference equations – Rules for finding the complementary function.

UNIT IV NUMERICAL DIFFERENTIATION AND INTEGRATION

9

Numerical differentiation: Formulae for derivatives – Maxima and minima of a tabulated function – Numerical Integration: Romberg's method – Gaussian integration – Gaussian quadrature for double integral approximation.

UNIT V NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

9

Finite difference approximations to partial derivatives – Solution of Laplace's equation – Solution of Poisson's equation – Solution of one dimensional heat equation – Hyperbolic equations – Solution of wave equation.

TOTAL: 45 PERIODS

**OUTCOMES**

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

- Apply numerical methods to solve algebraic and transcendental equations using iterative techniques.
- Understand the concept of matrix inversion and eigenvalue problems using numerical methods.
- Apply interpolation techniques and solve linear difference equations in numerical analysis.
- Apply numerical differentiation and integration methods to approximate derivatives and definite integrals.
- Analyze partial differential equations using finite difference methods for engineering applications.

TEXT BOOKS

1. Dr.Grewal,B.S., "Numerical Methods in Engineering and Science", Khanna Publishers, Eleventh Edition, 2023.
2. Dr.Kandasamy, P., "Numerical Methods", S.Chand & Company PVT.LTD, Seventeenth Edition, 2016.

REFERENCES

1. Burden, R.L and Faires, J.D, "Numerical Analysis", Cengage Learning, Tenth Edition, 2016.
2. Iyengar, S.R.K and Jain, R.K, "Numerical methods", New Age International (P) Ltd., Publishers, Seventh Edition, 2009.

E-RESOURCES

1. <https://nptel.ac.in/courses/111/107/111107105/> (Numerical Methods)
2. <https://nptel.ac.in/courses/127106019> (Numerical Methods)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	1	2	-	-	-	-	-	2	-	-
2	3	3	2	1	2	-	-	-	-	-	2	-	-
3	3	3	2	1	2	-	-	-	-	-	2	-	-
4	3	3	3	2	2	-	-	-	-	-	2	-	-
5	3	3	3	2	2	-	-	-	-	-	2	-	-
AVG	3	3	2.4	1.4	2	-	-	-	-	-	2	-	-

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


Chairman - BoS



**OBJECTIVES**

- To familiarize students with the fundamental concepts and processes of strategic cost management.
- To inculcate knowledge of the different stages of project execution and management.
- To enhance knowledge of cost behavior and profit planning in mechanical and process industries.
- To familiarize students with various pricing strategies followed in engineering projects.
- To impart knowledge of various quantitative techniques used in cost management.

UNIT I INTRODUCTION**9**

Introduction and overview of the strategic cost management process – Cost concepts in decision making – Relevant cost, Differential cost, Incremental cost and Opportunity cost – Objectives of a Costing System – Inventory valuation – Creation of a database for operational control – Provision of data for decision making.

UNIT II PROJECT**9**

Meaning, different types, why to manage, cost overruns centres, various stages of project execution – Conception to commissioning – Project execution as conglomeration of technical and nontechnical activities – Detailed Engineering activities – Pre project execution main clearances and documents – Project team: Role of each member – Importance of project site – Data required with significance – Project contracts – Types and contents – Project execution – Project cost control – Bar charts and network diagram.

UNIT III PROJECT COMMISSIONING**9**

Mechanical and process – Cost Behavior and Profit Planning – Marginal Costing – Distinction between marginal costing and absorption costing – Break-even Analysis – Cost volume-Profit Analysis – Various decision-making problems – Standard Costing and Variance Analysis.

UNIT IV PRICING STRATEGIES**9**

Pareto Analysis – Target costing – Life cycle costing – Costing of service sector – Just-in-time approach – Material requirement planning – Enterprise resource planning – Total quality management and theory of constraints – Activity-based cost management – Bench marking – Balanced score card and value-chain analysis – Budgetary control – Flexible budgets – Performance



budgets – Zero-based budgets – Measurement of divisional profitability pricing decisions including transfer pricing.

UNIT V QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT

9

Quantitative techniques for cost management – Linear programming – PERT/CPM – Transportation problems – Assignment problems – Simulation – Learning curve theory.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze the basics of the cost management process.
- Examine the stages of project execution from conception to commissioning.
- Construct suitable analytical techniques for project commissioning.
- Examine various pricing strategies followed in project implementation.
- Analyze different quantitative techniques used for cost management.

TEXT BOOKS

1. Charles T. Horngren, Srikant M. Datar and Madhav V. Rajan, "Cost Accounting A Managerial Emphasis", Pearson Education, Fourteenth Edition, 2023.
2. Charles T. Horngren and George Foster, "Advanced Management Accounting", Pearson Education, Thirteenth Edition, 2020.
3. QiuGuo Lin, "Cost management of engineering project", China Electric Power Press, Seventh Edition, 2021.

REFERENCES

1. Robert S Kaplan, Anthony A. Alkinson, "Management Accounting", Pearson Education, Fourth Edition, 2022.
2. Ashish K. Bhattacharya, "Principles & Practices of Cost Accounting", PHI Learning Private Limited, Sixth Edition, 2020.
3. Kenneth K Humpheys, "Project and cost engineers" handbook (cost management), CRC Press, Fourth Edition, 2023.

E-RESOURCES

1. <https://nptel.ac.in/courses/105/106/105106149/> (Types of Projects)
2. <https://nptel.ac.in/courses/110/104/110104073/> (Cost Management for Projects)



SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade,

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE - 637 205



Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	-	1	-	-	-	1	1	1	3	3
2	3	3	3	-	1	-	1	-	1	1	2	3	3
3	3	3	3	-	1	-	1	-	1	1	-	2	3
4	3	3	3	-	1	-	1	1	1	1	1	2	3
5	3	3	3	-	1	-	1	1	1	1	2	3	3
AVG	3	3	3	-	1	-	1	1	1	1	1.5	2.6	3

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

S. D. Subramanian
Chairman - BoS





SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade,
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



GENERAL ELECTIVES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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 WING LEVEL - 3	GE	3	0	0	3	40	60	100
23NCCL04	NCC ARMY WING LEVEL - 4	GE	3	0	0	3	40	60	100





23NCCL01

NCC AIRFORCE LEVEL-1

L T P C

(Common to All UG Programme NCC Students)

3 0 0 3

OBJECTIVES

- To familiarize students with the organizational structure of the National Cadet Corps (NCC), the duties and responsibilities of cadets, the incentives offered, and the significance of various NCC camps.
- To impart knowledge on personality development by enhancing communication skills, self-awareness, creative thinking, critical thinking, and leadership qualities.
- To introduce students to the qualities of effective leadership through the study of eminent leaders, their contributions, and the values required for responsible citizenship.
- To inculcate a sense of social responsibility by encouraging active participation in community service activities and promoting awareness of the role of youth in nation-building.
- To provide an understanding of the importance of health, hygiene, yoga, environmental cleanliness, and obstacle training while motivating students to contribute towards the vision of a Clean India.
- To provide practical training in foot drill, rifle drill, ceremonial drill, and social service activities for developing discipline, teamwork, leadership, and a sense of community responsibility.

UNIT I NCC GENERAL

7

Aims, objectives and Organization of NCC - incentives - duties of NCC Cadets - NCC camps - types - conduct.

UNIT II PERSONALITY DEVELOPMENT

7

Personality Development – Factors - Self Awareness - Communication skills –Empathy - Critical and Creative thinking - Decision making.

UNIT III LEADERSHIP

7

Leadership Capsule - Traits - Case studies - Leaders like APJ Abdul Kalam, RatanTata, Shivaji, Tipu Sultan, Rabindranath Tagore, N Narayana murthy

UNIT IV SOCIAL SERVICE

7

Social Service Capsule – Basics - Rural development programmes – NGOs -Contribution of Youth - Swatch Bharath Abhiyan, Social evils - Drug Abuse - Digital Awareness - Waste Management - Women Health and Sanitation - Tree Plantation -Traffic Awareness - Pollution.



UNIT V HEALTH AND HYGIENE

7

Hygiene and sanitation – First Aid – Introduction to Yoga – Adventure – Environmental awareness and conservation – Obstacle Training – Adventure.

PRACTICAL COMPONENT

10

S.No.	Name of the Experiment	CO Mapping	RBT
1	Foot Drill	CO1	Apply
2	Rifle Drill	CO1	Apply
3	Ceremonial Drill	CO2	Understand
4	Social Service and Community Development	CO4	Understand

TOTAL: 35+10= 45 PERIODS

OUTCOMES

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

- Explain the organizational structure of the NCC, the roles and responsibilities of cadets, and the significance of various NCC camps.
- Apply communication, self-awareness, and creative and critical thinking skills to demonstrate personality development and confidence.
- Analyze the leadership qualities and contributions of eminent leaders to develop effective leadership skills and responsible citizenship.
- Demonstrate social responsibility by participating in community service activities and promoting awareness of national development initiatives.
- Apply the principles of health, hygiene, yoga, environmental cleanliness, and obstacle training to maintain personal well-being and develop physical fitness.
- Demonstrate proficiency in foot drill, rifle drill, ceremonial drill, and social service activities by applying discipline, teamwork, leadership, and community service skills in practical situations.

TEXT BOOKS

1. Cadet Hand Book(Common Subjects),published by DG NCC.
2. Cadet Hand Book(Specialized Subjects),published by DG NCC.
3. ANO Handbook

REFERENCE BOOKS

1. Grooming tomorrow's Leaders, published by DG NCC.
2. Youth in Action, published by DGNCC.
3. The Cadet, Annual Journal of the NCC.
4. Précis Issued by respective Service Head quarters on specialized subject available to PI Staff as reference material.

E-RESOURCES

1. <https://www.indiancc.nic.in>
2. <https://www.indiancc.mygov.in>
3. https://www.play.google.com/MY_IAF
4. https://www.play.google.com/DGNCC_Training

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	—	—	—	3	3	2	2	—	2	—	—
CO2	2	3	2	—	—	3	2	3	3	3	2	—	—
CO3	2	3	2	2	—	3	3	2	2	2	2	—	—
CO4	3	2	2	2	—	3	3	2	3	2	2	—	—
CO5	3	2	2	2	2	3	3	2	—	—	2	—	—
CO6	2	2	3	—	—	3	3	3	3	2	2		
AVG.	2.5	2.3	2.2	2.0	2.0	3.0	2.8	2.3	2.6	2.25	2.0	—	—

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


Chairman - BoS



23NCCL02

NCC AIRFORCE LEVEL- 2

L T P C

(Common to All UG Programme NCC Students)

3 0 0 3

OBJECTIVES

- To familiarize students with the concepts of national security, national integration, and threats to the nation.
- To impart knowledge on leadership development, problem-solving techniques, emotional management, and time management skills.
- To introduce the principles of disaster management and encourage active participation in disaster response and relief activities.
- To inculcate an understanding of the significance of airmanship, air campaigns, and the role of the Indian Air Force in national service.
- To provide an insight into aeromodelling and its applications in aviation, while motivating students to explore the Armed Forces as a career.
- To impart practical knowledge of weapon assembling and reassembling while emphasizing safe handling procedures and operational efficiency.

UNIT I NATIONAL INTEGRATION AND AWARENESS

7

National Integration and Awareness - importance and necessity-factors affecting National integration-Unity in Diversity-Threats to National Security

UNIT II PERSONALITY DEVELOPMENT

7

Problem solving - Group discussions-Coping with stress and emotions-Change your mindset- Time management-Social skills-Team work-public speaking

UNIT III DISASTER MANAGEMENT

7

Disaster Management Capsule – Organization - Types -Essential services – Assistance - Civil Defence Organization - Initiative training-organizing skills - Dos and Don't's Fire Services and Fire Fighting.

UNIT IV GENERAL SERVICE KNOWLEDGE ON AIRCRAFT AND AIRMANSHIP

7

Armed forces and IAF Capsule-Modes of Entry in IAF-Aircraft types, capabilities and role-Air Campaigns-Principle of Flight-Forces acting on Aircraft-Airmanship – Navigation.



UNIT V AEROMODELLING

7

Introduction and Types of Aero Engine–Aircraft Controls–Introduction to Radars–Aero modelling capsule – Flying/Building of Aero models – Micro Light Flying – Simulator Flying.

PRACTICAL COMPONENT

10

S.No.	Name of the Experiment	CO Mapping	RBT
1	Foot Drill	CO1	Apply
2	Rifle Drill	CO1	Apply
3	Weapon Assembling and Reassembling	CO2	Apply
4	Basics of Aero modelling	CO5	Understand

TOTAL: 35+10= 45 PERIODS
OUTCOMES

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

- Apply the principles of national integration to explain the threats and factors affecting national security.
- Analyze the role of public speaking skills and problem-solving techniques in effective leadership and decision-making.
- Explain the types of disasters and the appropriate emergency response measures.
- Analyze the role of the Indian Air Force, aircraft, and airmanship in ensuring national security and defence.
- Apply the concepts of aeromodelling and radar handling to demonstrate an understanding of aircraft operations and flying principles.
- Analyze the importance of drill, weapon training, and aero modelling in developing leadership, teamwork, and military skills.

TEXT BOOKS

- Cadet Hand Book(Common Subjects),published by DG NCC.
- Cadet Hand Book(Specialized Subjects),published by DG NCC.
- ANO Hand Book

REFERENCES

- Grooming tomorrow's Leaders, published by DG NCC.
- Youth in Action, published by DG NCC.
- The Cadet, Annual Journal of the NCC.
- Précis Issued by respective Service Head quarters on specialized subject available to PI Staff as reference material.

E-RESOURCES

1. <https://www.indiancc.nic.in><https://www.indiancc.mygov.in>
2. https://www.play.google.com/MY_IAFs
3. https://www.play.google.com/DGNCC_Training

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	–	–	–	3	3	2	2	–	2	–	–
CO2	2	3	2	–	–	3	2	3	3	3	2	–	–
CO3	2	3	2	2	–	3	3	2	2	2	2	–	–
CO4	3	3	2	2	2	3	2	2	–	–	2	–	–
CO5	3	2	2	3	3	2	2	2	–	–	2	–	–
CO6	2	2	3	–	–	3	3	3	3	2	2	–	–
AVG.	2.5	2.5	2.2	2.3	2.5	2.8	2.5	2.3	2.5	2.3	2.0	–	–

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

U. Dindia
Chairman - BoS

**23NCCL03****NCC ARMY WING LEVEL-3****L TP C**

(Common to All UG Programme NCC Students)

3 0 0 3**COURSE PREREQUISITES: 75% Attendance in First Year of NCC Course****OBJECTIVES**

- To learn the basic structure of NCC and its organization, Incentives, duties of Cadets; imbibe the knowledge of various types of Camp.
- To motivate the cadets as confidence leaders by refining their personality and self-awareness, with the help of Communication skills and aware of creative, critical thinking abilities.
- To create an awareness on Military History and great heroes of India and to know about the important military operations
- To inspire the cadets to take part in the Social Service Activities and also to learn about the infantry battalion
- To acquire knowledge about the basics of health and hygiene, yoga, environment cleanliness and motivate young Indians towards the path of clean India and acquaint about obstacle training.
- To develop discipline, confidence, alertness, and coordination through the practice of basic foot drill movements and commands.

UNIT I NCC GENERAL**7**

Aims, objectives and Organization of NCC-incentives-duties of NCC Cadets-NCC camps- types - conduct.

UNIT II PERSONALITY DEVELOPMENT**7**

Personality Development -Factors-Self Awareness-Communication skills-Empathy-Critical and Creative thinking-Decision making.

UNIT III MILITARY HISTORY**7**

Military History - Biographies, Heroes Study of Battles of Indo- Pak War 1965, 1971 - Operation Meghdoot and Kargil.

UNIT IV SOCIAL SERVICE & INFANTRY BATTALION**7**

Social Service Capsule-Basics-Rural development programmes-NGOs-Contribution of Youth - Swatch Bharath Abhiyan, Social evils-Drug Abuse-Digital Awareness-Waste Management-Women



Health and Sanitation-Organisation of Infantry, characteristics

UNIT V HEALTH AND HYGIENE

7

Hygiene and sanitation – First Aid – Introduction to Yoga – Adventure – Environmental awareness and conservation – Obstacle Training -Adventure

TOTAL: 35 PERIODS

OUTCOMES

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

- Understand the basic organization of NCC and roles, responsibilities of cadets for the smooth functioning of all camps
- Develop the cadets personality and to think divergently to break functional fixedness
- Identify the Leadership traits of military heroes and learn about their organization
- Understand the concept and importance of Social service and evolution of infantry battalion
- Practice healthy practices to improve the personal sanitation and hygiene and get into the adventurous activities
- Execute drill procedures effectively while maintaining military etiquette, discipline, and coordination during parades.

TEXT BOOKS

1. Cadet Hand Book (Common Subjects), published by DGNCC.
2. Cadet Hand Book (Specialized Subjects), published by DGNCC.
3. ANO Handbook

REFERENCE BOOKS

1. Grooming tomorrow's Leaders, published by DG, NCC.
2. Youth in Action, published by DG, NCC.
3. The Cadet, Annual Journal of the NCC.
4. Précis Issued by respective Service Headquarters on specialized subject available to PI Staff as reference material.

E - RESOURCES

1. <https://www.indiancc.nic.in>
2. <https://www.indiancc.mygov.in>
3. https://www.play.google.com/MY_IAF
4. https://www.play.google.com/DGNCC_Training

**LIST OF DRILLS**

(Common to All UG Programme NCC Students)

1. Foot Drill
2. Rifle Drill
3. Ceremonial Drill
4. Social Service and Community Development

TOTAL = 10 PERIODS**Mapping of COs-POs & PSOs**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	-	-	-	2	-	3	2	2	1	-	-
2	-	2	-	-	-	2	-	2	3	3	2	-	-
3	2	2	-	-	-	3	-	3	3	2	3	-	-
4	-	2	2	-	-	3	3	3	2	2	2	-	-
5	2	2	-	-	-	3	3	2	2	1	2	-	-
6	2	2	3	-	-	2	-	2	3	2	2	-	-
AVG.	2	2	2.5	-	-	2.5	3	2.5	2.5	2	2	-	-

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


Chairman - BoS




23NCCL04

NCC ARMY WING LEVEL-4

L T P C

(Common to All UG Programme NCC Students)

3 0 0 3

COURSE PREREQUISITES: 75% Attendance in Second Year of NCC Course

OBJECTIVES

- To realize the importance of national security and threats for the nation and aware of National Integration.
- To create interest in cadet to develop into great leaders by teaching them about problem solving techniques, handling emotions and time management skills.
- To aware of disaster management and motivate the young minds to help during the time of disasters.
- To create a pool of organized, trained and motivated youth with authoritative qualities to serve in CAPF and to know the Modes of CAPF
- To learn about the use of Maps in army, usage of conventional signs, scale and grid systems.
- To develop discipline, confidence, alertness, and coordination through the practice of basic foot drill movements and commands.

UNIT I NATIONAL INTEGRATION AND AWARENESS

7

National Integration and Awareness - importance and necessity-factors affecting National integration-Unity in Diversity-Threats to National Security.

UNIT II PERSONALITY DEVELOPMENT

7

Problem solving - Group discussions-Coping with stress and emotions-Change your mindset-Time management-Social skills-Team work-public speaking.

UNIT III DISASTER MANAGEMENT

7

Disaster Management Capsule – Organization - Types -Essential services – Assistance - Civil Defence Organization - Initiative training-organizing skills - Dos and Don'ts Fire Services and Fire Fighting

UNIT IV INTRODUCTION TO ARMED FORCES

7

Army-Police and Central Armed Police Forces – Badges – Role – Tasks –Modes of Entry into Army, Police and CAPF



UNITV MAPS, CONVENTIONAL SIGNS, SCALE AND GRID SYSTEMS

7

CONVENTIONAL SIGNS – Scales And Grid Systems – Topographical Forms and Technical Terms, Cardinal Points And Types of North – Types of Bearing And Use of Service Protractor Google Maps & Applications

TOTAL: 35PERIODS

OUTCOMES

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

- Realize the importance of National integration, threats and factors affecting the National Security.
- Demonstrate their public speaking skills and problem solving techniques.
- Identify and analyze the problems during Disaster type and to give solutions during the emergency periods with their presence of mind
- Grasp the concept of CAPF and its importance to the nation and detailed Knowledge on modes of entry into CAPF.
- Obtain knowledge on maps, usage of conventional signs, learn about the features of land
- Execute drill procedures effectively while maintaining military etiquette, discipline, and coordination during parades.

TEXT BOOKS

1. Cadet Hand Book (Common Subjects), published by DGNCC.
2. Cadet Hand Book (Specialized Subjects), published by DGNCC.
3. ANO Hand Book

REFERENCE BOOKS

1. Grooming tomorrow's Leaders, published by DG, NCC.
2. Youth in Action, published by DG, NCC.
3. The Cadet, Annual Journal of the NCC.
4. Précis Issued by respective Service Headquarters on specialized subject available to PI Staff as reference material.

E - RESOURCES

1. <https://www.indiancc.nic.in>
2. <https://www.indiancc.mygov.in>
3. https://www.play.google.com/MY_IAFs
4. https://www.play.google.com/DGNCC_Training

LIST OF DRILLS

(Common to All UG Programme NCC Students)

1. Foot Drill
2. Rifle Drill
3. Weapon Assembling and Reassembling
4. Basics of Maps

TOTAL: 10 PERIODS

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	-	-	-	3	2	3	2	2	1	-	-
2	2	2	-	-	-	2	-	3	3	2	2	-	-
3	2	2	2	-	-	3	2	3	3	2	2	-	-
4	2	2	2	-	-	3	-	3	2	2	3	-	-
5	2	2	3	-	2	2	-	3	2	2	2	-	-
6	2	2	3	-	-	2	-	3	3	2	2	-	-
AVG.	2	2	2.5	-	2	2.5	2	3	2.5	2	2	-	-

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


Chairman - BoS

**ELECTIVE – MANAGEMENT**

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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	Supply Chain Management	GE	3	0	0	3	40	60	100
23MGT708	e-Waste Management	GE	3	0	0	3	40	60	100





23MGT701

PRINCIPLES OF MANAGEMENT

L T P C

3 0 0 3

OBJECTIVES

- To familiarize the basic concepts of management, managerial roles, business organizations and management approaches.
- To inculcate the planning process, strategic management concepts and decision-making techniques.
- To provide knowledge of organizational structure, authority relationships and human resource management functions.
- To impart knowledge of motivation, leadership, communication and individual and group behavior in organizations.
- To enhance the concepts of controlling, performance measurement and management control techniques.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

9

Definition of Management - Science or Art - Manager Vs Entrepreneur - types of managers - managerial roles and skills - Evolution of Management - Scientific, human relations, system and contingency approaches - Types of Business organization - Sole proprietorship, partnership, company - public and private sector enterprises - Organization culture and Environment - Current trends and issues in Management.

UNIT II PLANNING

9

Nature and purpose of planning - Planning process - Types of planning - Objectives - Setting objectives - Policies - Planning premises - Strategic Management - Planning Tools and Techniques - Decision making steps and process.

UNIT III ORGANISING

9

Nature and purpose - Formal and informal organization - Organization chart - Organization - structure - Types - Line and staff authority - Departmentalization - delegation of authority - Centralization and decentralization - Job Design - Human Resource Management - HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT IV DIRECTING

9

Foundations of individual and group behaviour - Motivation - Motivation theories -Motivational



techniques - Job satisfaction - Job enrichment - Leadership - types and theories of leadership - Communication - Process of communication - Barrier in communication -Effective communication - Communication and IT.

UNIT V CONTROLLING

9

System and process of controlling - Budgetary and non-Budgetary control techniques - Use of computers and IT in Management control - Productivity problems and management - Control and performance - Direct and preventive control - Reporting.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the principles of management, organizational forms and management theories.
- Analyze the planning tools and decision-making techniques in organizational situations.
- Apply the organizational structures and human resource management practices.
- Explain the leadership, motivation and communication approaches for organizational effectiveness.
- Examine the assess control systems and performance management techniques used in organizations.

TEXT BOOKS

1. Stephen P. Robbins and Mary Coulter, "Management", Fourteen Edition Prentice Hall (India) Pvt. Ltd., 2017.
2. Harold Koontz and Heinz Weihrich, "Essentials of management", Eleventh Edition, Tata McGraw Hill, 2020.

REFERENCES

1. Robert Kreitner and Mamata Mohapatra, "Management", Biztantra, 2008.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals of Management , Seventh Edition, Pearson Education", 2011.

E-RESOURCES

1. <https://nptel.ac.in/courses/110107150> - (Principles of Management)
2. <https://nptel.ac.in/courses/110105146> - (Principles of Management)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	-	-	-	-	1	-	-	-	-	-	-	-
2	-	1	1	-	-	-	-	-	-	-	-	-	-
3	1		-	2	-	1	-	2	-	1	1	-	-
4	-	1	1	1	2	-	1	2	-	-	-	-	-
5	1	-	-	-	1	1	-	-	3	-	1	-	-
AVG	1.6	1	1	1.5	1.5	1	1	2	3	1	1	-	-

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


Chairman - BoS



23MGT702

TOTAL QUALITY MANAGEMENT

L T P C

3 0 0 3

OBJECTIVES

- To guide students in understanding the philosophies and practices of total quality management.
- To familiarize students with the principles of TQM, including leadership, customer satisfaction, employee involvement, and continuous improvement.
- To introduce students to quality management tools and techniques for process analysis and improvement.
- To explain advanced quality improvement methods and performance measurement techniques used in organizations.
- To guide students in understanding Quality management systems, environmental management Systems and ISO standards for quality and environmental management.

UNIT I INTRODUCTION

9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Costs of quality.

UNIT II TQM PRINCIPLES

9

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I

9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II

9

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs – Performance measures.



UNIT V QUALITY MANAGEMENT SYSTEM

9

Introduction - Benefits of ISO Registration - ISO 9000 Series of Standards – Sector - Specific Standards - AS 9100, TS16949 and TL 9000 - ISO 9001 Requirements – Implementation – Documentation - Internal Audits – Registration - ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction - ISO 14000 Series Standards - Concepts of ISO 14001 - Requirements of ISO 14001- Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine the concepts, philosophies, frameworks, and customer-focused practices of Total Quality Management.
- Analyze the roles of leadership, employee involvement, continuous improvement, and supplier partnership in achieving organizational excellence.
- Analyze quality management tools and techniques, including Six Sigma, benchmarking, and FMEA, for process improvement and problem-solving.
- Differentiate the applications of Control Charts, Process Capability Analysis, QFD, Taguchi Methods and TPM in quality improvement.
- Compare the requirements and implementation procedures of quality management systems and environmental management systems based on ISO standards.

TEXT BOOKS

1. Dale H. Besterfield., "Total quality Management", Fifth Edition, Pearson Education India, 2019.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2022.
3. John S. Oakland, "Total Quality Management and Operational Excellence: Text with Cases", Fifth Edition, Routledge, 2024.

REFERENCES

1. James R. Evans and William M. Lindsay, "Managing for Quality and Performance Excellence" Twelfth Edition, Cengage Learning, 2023.
2. Poornima M. Charantimath, "Total Quality Management", Fourth Edition, Pearson Education India, 2020.

- David L. Goetsch and Stanley B. Davis, "Quality Management for Organizational Excellence", Ninth Edition, Pearson, 2022.

E-RESOURCES

- <https://nptel.ac.in/courses/110104080> - (Total Quality Management)
- https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_mg72 - (Total Quality Management II)

Mapping of COs-POs & PSOs

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

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

S. Subash
Chairman - BoS

**23MGT703****ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING****L T P C****3 0 0 3****OBJECTIVES**

- To introduce managerial economics for effective decision-making.
- To Familiarize students with production and cost concepts to analyse production optimization for business decisions
- To explore pricing decisions under different market structures and pricing objectives.
- To enhance the ability to interpret financial statements.
- To gain knowledge of capital budgeting techniques for investment decisions.

UNIT I DEMAND AND SUPPLY ANALYSIS**9**

Managerial Economics – Relationship with other disciplines – Firms: Types, objectives and goals – Managerial decisions – Decision analysis. Demand – Types of demand – Determinants of demand – Demand function – Demand elasticity – Demand forecasting – Supply – Determinants of supply – Supply function -Supply elasticity.

UNIT II PRODUCTION AND COST ANALYSIS**9**

Production function – Returns to scale – Production optimization – Least cost input Isoquants – Managerial uses of production function. Cost Concepts – Cost function – Determinants of cost – Short run and Long run cost curves – Cost Output Decision – Estimation of Cost.

UNIT III PRICING**9**

Determinants of Price – Pricing under different objectives and different market structures – Price discrimination – Pricing methods in practice.

UNIT IV FINANCIAL ACCOUNTING**9**

Balance sheet and related concepts – Profit & Loss Statement and related concepts – Financial Ratio Analysis – Cash flow analysis – Funds flow analysis – Comparative financial statements – Analysis & Interpretation of financial statements.

UNIT V CAPITAL BUDGETING**9**

Investments – Risks and return evaluation of investment decision – Average rate of return – Payback Period – Net Present Value – Internal rate of return.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply the principles of managerial economics for effective business decision-making.
- Analyse production and cost concepts to support production optimization and business decisions.
- Examine pricing decisions under different market structures and pricing objectives.
- Analyse financial statements to evaluate the financial performance of an organization.
- Compare capital budgeting techniques to evaluate investment opportunities and support investment decisions.

TEXT BOOKS

1. P. L. Mehta, "Managerial Economics: Analysis, Problems and Cases", Seventeenth Edition, Sultan Chand & Sons, 2022.
2. S. N. Maheshwari and S. K. Maheshwari, "Financial Accounting", seventh Edition, Vikas Publishing House Pvt. Ltd., 2023.

REFERENCES

1. Dominick Salvatore and Siddhartha K. Rastogi, "Managerial Economics: Principles and Worldwide Applications", Tenth Edition, Oxford University Press, 2024.
2. M. Pandey, Financial Management, Twelfth Edition, Pearson India, 2023.

E-RESOURCES

1. <http://www.digimat.in/nptel/courses/video/110101005/110101005.html>
2. <https://nptel.ac.in/courses/110101131>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	-	-	-	1	-	1	1	3	1	-	-
2	2	3	2	1	2	1	-	-	1	3	1	-	-
3	2	3	1	-	-	2	1	1	1	3	1	-	-
4	2	3	-	1	2	1	-	-	2	3	1	-	-
5	2	3	2	1	2	2	1	1	1	3	2	-	-
AVG	2	2.8	1.7	1	2.0	1.4	1	1	1.2	3	1.2	-	-

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

S. H. S.
Chairman - BoS

23MGT704

HUMAN RESOURCE MANAGEMENT

LT P C

3 0 0 3

OBJECTIVES

- To introduce the evolution and significance of Human Resource Management in organizations.
- To familiarize students with matching HR demand and supply with internal and external sources.
- To gain knowledge about executive development programs, common practices and benefits.
- To explore career management and mentor–protégé relationships.
- To enable an understanding of performance evaluation methods and feedback.

UNIT I PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT

9

Evolution of human resource management - The importance of the human factor - Challenges - Role of human resource manager Challenges for Human Resource Managers - Trends in Human Resource Policies – Computer Applications in Human Resource Management - Case analysis.

UNIT II HUMAN RESOURCE PLANNING AND RECRUITMENT

9

Importance of Human Resource Planning - Forecasting human resource requirement - matching supply and demand - Internal and External sources -. Recruitment, Selection, Placements, Induction – Case analysis.

UNIT III TRAINING AND EXECUTIVE DEVELOPMENT

9

Training need Analysis – Purpose – Training Evaluation methods – Benefits - Executive development – Self Development – Knowledge Management – Case analysis.

UNIT IV EMPLOYEE ENGAGEMENT

9

Compensation plan - Reward - Motivation – X,Y,Z Theories - Career management - Mentoring- Developmnet of Mentor - Protege relationships.

UNIT V PERFORMANCE EVALUATION AND CONTROL PROCESS

9

Performance Evaluation Methods - types – Feedback - Industry practices. Promotion, Demotion, Transfer and Separation - The control process - Importance -Methods - grievances – Causes - Implications - Redressal Methods – Artificial Intelligence and an Era of Human Resource – Benefits – Challenges - Case analysis

OUTCOMES

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

- Develop the skills needed to understand the significance of Human Resource Management.
- Differentiate internal and external sources of recruitment for effective Human Resource Planning.
- Analyze the effectiveness of HRM practices in supporting the strategic and operational needs of the organizations in a global economy.
- Examine career management and mentoring practices in organizations.
- Analyze performance evaluation methods practice and control processes.

TEXT BOOKS

1. Biswajeet Pattanayak, "Human Resource Management", Seventh Edition, PHI Learning Private Limited, 2025.
2. Dessler, G., & Varkkey, B, "Human Resource Management ", Pearson Education India, Seventeenth Edition, 2024.

REFERENCES

1. Aswathappa, K, " Human Resource Management", Tenth Edition, Tata McGraw-Hill Education, 2023.
2. Ivancevich, J. M., "Human Resource Management", McGraw Hill Education, Fourteenth Edition, 2021.

E-RESOURCES

1. https://open.umn.edu/opentextbooks/textbooks/71?utm_source=.com
2. <https://positivepsychology.com/theory-x-and-theory-y/>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	-	-	-	1	1	2	2	1	-	2	-	-
2	1	2	-	-	1	1	1	2	1	1	2	-	-
3	1	2	2	2	2	2	2	2	2	2	2	-	-
4	-	2	-	-	-	1	2	3	2	1	2	-	-
5	1	2	1	2	2	1	2	2	2	2	2	-	-
AVG	1	2	1.5	2	1.5	1.2	1.8	2.2	1.6	1.5	2	-	-

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

[Signature]
Chairman - BoS



OBJECTIVES

- To introduce the concepts, evolution, challenges, and ethical aspects of Knowledge Management.
- To understand knowledge sharing and tacit knowledge management.
- To explore technologies and tools supporting Knowledge Management.
- To impart knowledge of Knowledge Management strategies and organizational applications.
- To enhance understanding of future trends and case studies in Knowledge Management.

UNIT I INTRODUCTION

9

Introduction – The foundation of Knowledge Management – Cultural issues - technology applications - organizational concepts and processes - management aspects - and decision support systems. The Evolution of Knowledge management - Challenges Facing the Evolution of Knowledge Management - Ethics for Knowledge Management.

UNIT II CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING

9

Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets - Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance.

UNIT III TECHNOLOGIES AND TOOLS FOR KNOWLEDGE MANAGEMENT

9

Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval - Information Coding in the Internet Environment - Repackaging Information.

UNIT IV KNOWLEDGE MANAGEMENT STRATEGIES AND APPLICATIONS

9

Knowledge Management Strategy – Components of Knowledge Strategy – Knowledge Acquisition, Storage, Sharing and Application – Knowledge Management Frameworks and Models – Organizational Applications of Knowledge Management – Case Studies on Knowledge Management Practices – Challenges in Implementing Knowledge Management.



**UNIT V FUTURE TRENDS AND CASE STUDIES****9**

Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life -cycles of an organization.

TOTAL: 45 PERIODS**OUTCOMES**

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

- Examine Knowledge Management concepts, challenges and ethical aspects.
- Analyze knowledge sharing and tacit knowledge management practices.
- Apply technologies and tools for effective Knowledge Management.
- Compare Knowledge Management strategies, frameworks, and applications.
- Analyze future trends and case studies in Knowledge Management.

TEXT BOOKS

1. Dalkir, K. "Knowledge Management in Theory and Practice", Fourth Edition, MIT Press, 2023.
2. Becerra-Fernandez, I., & Sabherwal, R, "Knowledge Management: Systems and Processes" Third Edition. Routledge, 2023.

REFERENCES

1. Nonaka, I., & Takeuchi, H. "The Wise Company: How Companies Create Continuous Innovation", Oxford University Press, 2021.
2. Girard, J. P., & Girard, J. L., "Knowledge Management: Concepts, Methodologies, Tools, and Applications. IGI Global", 2022.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc23_mg96
2. <https://www.britannica.com/technology/search-engine>





Chairman - BOS

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
1	2	2	-	-	1	-	3	-	-	-	2	-	-
2	2	3	-	1	1	1	2	2	2	-	2	-	-
3	2	2	1	2	1	-	-	1	1	1	2	-	-
4	2	2	2	1	2	1	-	1	1	2	2	-	-
5	2	3	2	2	2	2	1	2	2	2	3	-	-
AVG	2	2.4	1.7	1.3	1.6	1.3	2.0	1.3	1.5	1.7	2.2	-	-

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

Mapping of Cos-Pos & PSOs



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





23MGT706

INDUSTRIAL MANAGEMENT

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamentals of management and organizations.
- To enhance planning, organizing, and staffing functions.
- To impart knowledge of leadership, communication, controlling, and decision-making.
- To familiarize students with organizational behavior and change management.
- To provide knowledge of productivity improvement and modern management practices.

UNIT I INTRODUCTION TO MANAGEMENT

9

Management: Introduction; Definition and Functions - Approaches to the study of Management - Mintzberg's Ten Managerial Roles - Principles of Taylor, Weber, Parker - Forms of Organization: Sole Proprietorship; Partnership Cooperative - Public Sector Vs Private Sector Organization - Business Environment: Economic, Social, Political, Legal - Trade Union.

UNIT II FUNDAMENTALS OF MANAGERIAL FUNCTIONS

9

Planning - Strategic Planning - Vision & Mission statement in Planning - Organizing - Departmentalization - Centralization and Decentralization - Authority & Responsibility - Staffing: Systems Approach; Recruiting and Selection Process.

UNIT III MANAGERIAL FUNCTIONS IN ENGINEERING AND TECHNOLOGY

9

Directing - Leadership Traits; Style; Morale; Managerial Grids (Blake-Mouton, Reddin) - Communication - Barriers - Controlling - Audit - Preventive Control - Decision Making.

UNIT IV ORGANIZATION THEORY

9

Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management - Motivation Theories - Change Management - Sources of Resistance - Overcoming Resistance - Guidelines to managing Conflict.

UNIT V PRODUCTIVITY AND MODERN TOPICS

9

Productivity - Concept - Measurements - Affecting Factors; Methods to Improve - Business Process Reengineering (BPR) - Benchmarking - SWOT/SWOC Analysis - Total Productive Maintenance - Management of Information Systems (MIS), Industry

TOTAL: 45 PERIODS



OUTCOMES

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

- Examine the fundamentals of management and organizations.
- Apply planning, organizing and staffing functions.
- Apply leadership, communication, controlling, and decision-making techniques.
- Analyse organizational behavior and change management practices.
- Compare productivity improvement techniques and modern management practices.

TEXT BOOKS

1. Koontz, H., Weihrich, H. and Cannice, M. V., "Essentials of Management: An International, Innovation and Leadership Perspective", Eleventh Edition, McGraw-Hill Education, 2021.
2. Govindarajan, M. and Natarajan, S., "Principles of Management, Prentice Hall of India / Pearson Education", New Delhi, 2009.

REFERENCES

1. Daft, Richard L., "Organization Theory and Design", Thirteenth Edition, Cengage Learning, 2020.
2. Certo, Samuel C. and Certo, S., "Trevis, Modern Management: Concepts and Skills", Fifteenth Edition, Pearson Education, 2020.

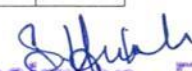
E-RESOURCES

1. https://www.jkkmcet.edu.in/software/uploads/syllabus/8d168a38585feb8e45346543f7aeaaff.pdf?utm_source=chatgpt.com
2. <https://sitams.ac.in/wp-content/uploads/2026/03/UNIT-II-MOB.pdf>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	-	-	-	-	1	1	-	-	2	1	-	-
2	1	2	-	-	1	-	-	1	1	3	-	-	-
3	1	2	-	-	-	1	1	2	2	2	-	-	-
4	1	2	-	-	-	2	2	2	2	1	1	-	-
5	1	2	1	-	2	1	-	1	1	3	2	-	-
AVG	1	2	1	-	1.5	1.3	1.3	1.5	1.5	3.7	1.3	-	-

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


Chairman - BoS

**23MGT707****SUPPLY CHAIN MANAGEMENT****LT P C****3 0 0 3****OBJECTIVES**

- To introduce the major decisions in supply chain management.
- To familiarize students with the concepts of supplier selection and contract negotiation.
- To explore the impact of uncertainty on network design.
- To enhance knowledge of multiple-location inventory management concepts.
- To gain knowledge of supply chain integration concepts and their advancements in current trends.

UNIT I INTRODUCTION**9**

Supply Chain - Fundamentals – Evolution - Role in Economy - Importance - Decision Phases
Supplier – Manufacturer - Customer chain. - Enablers/ Drivers of Supply Chain Performance.
Supply chain strategy Supply Chain Performance Measures.

UNIT II STRATEGIC SOURCING**9**

Outsourcing - Make Vs buy - Identifying core processes - Market Vs Hierarchy - Make Vs buy continuum - Sourcing strategy Supplier Selection and Contract Negotiation. Creating a world class supply base - Supplier Development - World Wide Sourcing.

UNIT III SUPPLY CHAIN NETWORK**9**

Distribution Network Design - Role - Factors Influencing Options, Value Addition - Distribution Strategies - Models for Facility Location and Capacity allocation. Distribution Center Location Models. Supply Chain Network optimization models. Impact of uncertainty on Network Design - Network Design decisions using Decision trees.

UNIT IV PLANNING DEMAND, INVENTORY AND SUPPLY**9**

Managing supply chain cycle inventory. Uncertainty in the supply chain - Analyzing impact of supply chain redesign on the inventory - Risk Pooling - Managing inventory for short life cycle products - multiple item - multiple location inventory management. Pricing and Revenue Management.

UNIT V CURRENT TRENDS**9**

Supply Chain Integration - Building partnership and trust in SC Value of Information: Bullwhip Effect - Effective forecasting - Coordinating the supply chain. SC Restructuring - SC Mapping SC process restructuring, Postpone the point of differentiation - IT in Supply Chain - Agile Supply Chains



Reverse Supply chain. Agra Supply Chains

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply supply chain management principles in major supply chain decision areas.
- Examine supplier selection processes and contract negotiation strategies in supply chain operations.
- Analyze the impact of uncertainty on supply chain network design decisions.
- Apply appropriate approaches for managing multiple-location inventory systems.
- Explain the concepts of supply chain integration and their evolution in current industry trends.

TEXT BOOKS

1. Sunil Chopra, "Supply Chain Management: Strategy, Planning & Operation", PHI Learning, Eighth Edition, 2025.
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, and Ravi Shankar "Designing and Managing the Supply Chain: Concepts, Strategies, and Cases", Tata McGraw-Hill, Fourth Edition, 2022.

REFERENCES

1. Ballou Ronald H, "Business Logistics and Supply Chain Management", Fifth Edition, Pearson, 2021.
2. Shapiro Jeremy F, "Modeling the Supply Chain", Second Reprint, Pearson, 2022.

E-RESOURCES

1. [https://www.tutorialspoint.com/supply_chain_management\(SCM tutorial\).](https://www.tutorialspoint.com/supply_chain_management(SCM_tutorial))
2. [https://www.mixmove.io/post/supply-chain-integration\(supply-chain-integration\)](https://www.mixmove.io/post/supply-chain-integration(supply-chain-integration))

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

**OBJECTIVES**

- To understand e-waste generation, composition, hazards, and impacts.
- To gain knowledge of global e-waste trade and recycling practices.
- To enhance understanding of e-waste control measures and regulatory frameworks.
- To impart knowledge of e-waste handling and management practices.
- To familiarize students with international e-waste legislations and policies.

UNIT I INTRODUCTION

9

E- waste composition and generation - Global context in e- waste - E-waste pollutants - E waste hazardous properties - Effects of pollutant (E- waste) on human health and surrounding environment - domestic e-waste disposal - Basic principles of E waste management - Technologies for recovery of resources from electronic waste - resource recovery potential of e-waste - steps in recycling and recovery of materials - technologies for recovery of materials - occupational and environmental health perspectives of recycling e-waste in India.

UNIT II E-WASTE HAZARDOUS ON GLOBAL TRADE

9

Essential factors in global waste trade economy - Free trade agreements as a means of waste trading - Import of hazardous e-waste in India - India's stand on liberalizing import rules - E-waste economy in the organized and unorganized sector - Estimation and recycling of e-waste in metro cities of India.

UNIT III E- WASTE CONTROL MEASURES

9

Need for stringent health safeguards and environmental protection laws in India - Extended Producers Responsibility (EPR) - Import of e-waste permissions - Producer- Public-Government cooperation - Administrative Controls & Engineering controls - monitoring of compliance of Rules - Effective regulatory mechanism strengthened by manpower and technical expertise - Reduction of waste at source.

UNIT IV E- WASTE MANAGEMENT HANDLING

9

E-waste (Management and Handling) Rules, 2022 - and E-Waste (Management) Rules - Salient Features and its likely implication - Government assistance for TSDFs.



UNITV THE INTERNATIONAL LEGISLATION

9

The Basel Convention - The Bamako Convention - The Rotterdam Convention - Waste Electrical and Electronic Equipment (WEEE) Directive in the European Union - Restrictions of Hazardous Substances (RoHS) Directive.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain e-waste generation, composition, hazards, and environmental impacts.
- Analyze global e-waste trade and recycling practices.
- Apply e-waste control measures and regulatory frameworks.
- Describe e-waste handling, management, and recycling processes.
- Analyze international e-waste legislations and policies.

TEXTBOOKS

1. Priya, A. (Ed.), "Management of Electronic Waste: Resource Recovery, Technology and Regulation", First Edition, John Wiley & Sons, 2024.
2. Kumar.S, & Kumar, V., "Electronic Waste Management: Policies, Processes, Technologies, and Impact", John Wiley & Sons, 2024.

REFERENCES

1. Johri, R, "E-Waste: Implications, Regulations, and Management in India and Current Global Best Practices", First Edition, TERI Press, New Delhi, 2008.
2. Kumar, A., Rathore, P. S., Dubey, A. K., Srivastav, A. L., Dutt, V., & Ananth Kumar.T, "Sustainable Management of Electronic Waste", Second Edition, John Wiley & Sons, 2024.

E-RESOURCES

1. <https://news.mit.edu/2013/ewaste-mit>.
2. [https://www.who.int/news-room/fact-sheets/detail/electronic-waste-\(e-waste\)](https://www.who.int/news-room/fact-sheets/detail/electronic-waste-(e-waste))

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	2	1	1	2	1	-	2	-	1	-	-
2	1	3	2	2	1	2	1	1	2	2	2	-	-
3	2	2	3	2	2	2	2	1	2	2	2	-	-
4	2	2	3	2	2	2	1	2	1	2	2	-	-
5	2	3	2	2	1	2	1	1	2	2	2	-	-
AVG	1.8	2.4	2.4	1.8	1.4	2	1.2	1.3	1.8	2	1.8	-	-

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


Chairman - BoS

MANDATORY COURSES - I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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	-	-	-



23MDC501

INTRODUCTION TO WOMEN AND GENDER STUDIES

L T P C

3 0 0 0

OBJECTIVES

- To introduce foundational concepts of sex, gender, masculinity, femininity, and socialization.
- To examine structural systems including patriarchy, essentialism, binaryism, power, and hierarchy.
- To study major theoretical frameworks of feminism (e.g., Liberal, Marxist, Radical, Eco feminist).
- To examine the history and evolution of global, national, and local women's movements.
- To analyze how gender is constructed and represented across language, popular visual media, and social media.

UNIT I CONCEPTS

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT II FEMINIST THEORY

Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

UNIT III WOMEN'S MOVEMENTS:

Global, National and Local Rise of Feminism in Europe and America. Women's Movement in India.

UNIT IV GENDER AND LANGUAGE

Linguistic Forms and Gender. Gender and narratives.

UNIT V GENDER AND REPRESENTATION

Advertising and popular visual media. Gender and Representation in Alternative Media. Gender and social media.

OUTCOMES

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

- Identify and articulate concepts of socialization, binaryism, essentialism, and hegemony in social structures.
- Differentiate among various feminist theories and explain their core ideological foundations.
- Illustrate the milestones of women's rights movements in Europe, America, and India.
- Deconstruct linguistic forms and literary narratives to expose implicit gender biases.
- Assess media representations of gender roles in advertising and alternative media critically

Chairman - BoS



23MDC502

ELEMENTS OF LITERATURE

L T P C

3 0 0 0

OBJECTIVES

- To explain students aware of the finer sensibilities of human existence through art.
- To develop students' appreciation of different literature forms as modes of human expression.
- To enhance reading, critical thinking, discussion, and writing skills through literary studies.
- To familiarize students with the essential elements, modes, and patterns of fiction and narrative perspective.
- To explore the representational, theatrical, and rhetorical elements of drama and poetry

UNIT I RELEVANCE OF LITERATURE

Enhances Reading, thinking, discussing and writing skills. Develops finer sensibility for better human relationship. Increases understanding of the problem of humanity without bias. Providing space to reconcile and get a cathartic effect.

UNIT II ELEMENTS OF FICTION

Fiction, fact and literary truth, Fictional modes and patterns. Plot character and perspective.

UNIT III ELEMENTS OF POETRY

Emotions and imaginations. Figurative language. (Simile, metaphor, conceit, symbol, pun and irony). Personification and animation. Rhetoric and trend

UNIT IV ELEMENTS OF DRAMA

Drama as representational art, Content mode and elements, Theatrical performance, Drama as narration, mediation and persuasion, Features of tragedy, comedy and satire.

READINGS

1. An Introduction to the Study of English Literature, W.H. Hudson, Atlantic, 2007.
3. An Introduction to Literary Studies, Mario Klarer, Routledge, 2013.
4. The Experience of Poetry, Graham Mode, Open college of Arts with Open Univ Press, 1991.
5. The Elements of Fiction: A Survey, Ulf Wolf (ed), Wolfstuff, 2114.
6. The Elements of Drama, J.L. Styan, Literary Licensing, 2011.

OUTCOMES

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

- Demonstrate enhanced reading, thinking, and writing skills by engaging with literary texts.
- Develop finer interpersonal sensibilities and an unbiased understanding of human issues.
- Experience catharsis and emotional reconciliation through literary analysis.
- Identify key figurative devices (metaphor, simile, irony, conceit) and emotional dimensions in poetry.
- Analyze dramatic performance, features of tragedy, comedy, satire, and narrative structures



Chairman - BoS

23MDC503

FILM APPRECIATION

L T P C

3 0 0 0

OBJECTIVES

- To introduce the development of film as an art and entertainment form.
- To explore the century-long evolution of film language, movement, and form.
- To instruct students on how to read a film text and appreciate its structural nuances.
- To examine technical components including equipment, screenplays, roles, and the filmmaking process.
- To guide students in studying film theory, criticism, and visual storytelling joyfully

Theme – A: The Component Of Films

A-1: The material and equipment

A-2: The story, screenplay and script

A-3: The actors, crew members, and the director

A-4: The process of film making... structure of a film

Theme – B: Evolution Of Film Language

B-1: Film language, form, movement etc.

B-2: Early cinema... silent film (Particularly French)

B-3: The emergence of feature films: Birth of a Nation

B-4: Talkies

Theme – C: Film Theories And Criticism/Appreciation

Theme – D: Development of Films

D-1: Representative Soviet films

D-2: Representative Japanese films

D-3: Representative Italian films

D-4: Representative Hollywood film and the studio system

Theme - E: Indian Films

E-1: The early era

E-2: The important films made by the directors

E-3: The regional films

E-4: The documentaries in India



READING: A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.

OUTCOMES

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

- Explain the roles of materials, crew members, screenplays, and directors in film production.
- Trace the historical transition from silent cinema and early French films to talkies and feature films.
- Apply visual and auditory cinematic language to "read" films as complex texts.
- Evaluate film theories and engage in critical film appreciation.
- Demonstrate an understanding of storytelling structure and narrative techniques in modern cinema.


Chairman - BoS



23MDC504

DISASTER RISK REDUCTION AND MANAGEMENT

L T P C

3 0 0 0

OBJECTIVES

- To impart knowledge on core concepts of hazards, vulnerability, resilience, and disaster risks.
- To familiarize students with international frameworks (Sendai Framework) and community-based risk reduction strategies.
- To explain the legislative, policy, and institutional frameworks governing disaster management in India.
- To introduce tools, technology, and early warning systems used in preparedness and damage assessment.
- To build practical response skills using case studies, field work, and mock drills.

UNIT I HAZARDS, VULNERABILITY AND DISASTER RISKS

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India

UNIT II DISASTER RISK REDUCTION (DRR)

Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT III DISASTER MANAGEMENT

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA- DDMA-NRDF- Civic Volunteers)

UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management

UNIT V DISASTER MANAGEMENT: CASE STUDIES

Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill

OUTCOMES

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

- Categorize natural, human-induced, and climate-related disasters and assess India's vulnerability profile.
- Formulate disaster risk reduction measures using structural, non-structural, and indigenous methods.
- Understand institutional roles (NDMA, SDMA, DDMA) and legal provisions under the Disaster Management Act (2005).
- Apply GIS, information technology, and standard operating procedures for risk assessment and relief planning.
- Perform damage assessments and participate in mock drills, practical response plans, and field interventions.


Chairman - BoS



OBJECTIVES

- To understand the meaning of the Constitution law and Constitutionalism.
- To realize the fundamental rights.
- To understand the execution powers of union and states.
- To be aware of the Constitutional powers.
- To acquaint with other Constitutional functionaries.

UNIT I INTRODUCTION

Meaning of the Constitution law and constitutionalism - Historical perspective of the Constitution of India - Preamble - Salient features and characteristics of the Constitution of India - Citizenship.

UNIT II FUNDAMENTAL RIGHTS

Scheme of the fundamental rights - The scheme of the fundamental duties and its legal status - The directive principles of state policy - Its importance and implementation.

UNIT III UNION AND STATE EXECUTIVE

Federal structure and distribution of legislative and financial powers between the Union and the States - Parliamentary form of Government in India - The Constitution powers and status of the President of India - Governor - Appointment, powers and functions.

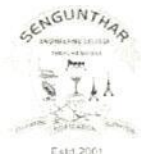
UNIT IV CONSTITUTIONAL POWERS

Amendment of the Constitutional powers and procedure - The historical perspectives of the Constitutional amendments in India - Emergency provisions: National emergency, President rule, financial emergency.

UNIT V OTHER CONSTITUTIONAL FUNCTIONARIES

Election Commission of India: Organization, powers and functions, Union Public Service Commission, State Public Service Commission - Local Self Government.





OUTCOMES

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

- Understand the salient features and characteristics of the Constitution of India.
- Analyze the scheme of the fundamental rights and duties.
- Evaluate in detail the powers between the Union and the States.
- Know the concept of Constitutional powers.
- Recognize other Constitutional functionaries.

Chairman - BoS



MANDATORY COURSES - II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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	-	-	-



23MDC601

**WELL-BEING WITH TRADITIONAL PRACTICES-
YOGA, AYURVEDA AND SIDDHA**

L T P C

3 0 0 0

OBJECTIVES

- To enjoy life happily with fun filled new style activities that help to maintain health also
- To adapt a few lifestyle changes that will prevent many health disorders
- To be cool and handbill every emotion very smoothly in every walk of life
- To learn to eat cost effective but healthy foods that are rich in essential nutrients
- To develop immunity naturally that will improve resistance against many health disorders

UNIT I HEALTH AND ITS IMPORTANCE

Definition - Importance of maintaining health - More importance on prevention than treatment Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational/Professional health

UNIT II DIET

Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis – hypertension – PCOD – infertility – ADHD – sleeplessness -helps to reduce the risk of heart diseases - keeps the teeth and bones strong Balanced Diet and its 7 Components - Carbohydrates – Proteins – Fats – Vitamins – Minerals - Fibre and Water.

Food additives and their merits & demerits - Effects of food additives - Types of food additives - Food additives and processed foods - Food additives and their reactions

Definition of BMI and maintaining it with diet Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM

Common cooking mistakes Different cooking methods, merits and demerits of each method

UNIT III ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH

AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy. Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life.

Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Panchcheekarana Theory / (Five Element Theory) 96 fundamental Principles - Uyir Thathukkal (Tri-Dosha Theory) - Udal Thathukkal



Prevention of illness with our traditional system of medicine

Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - **Secondary Prevention** - To lower the rate of established cases of a disorder or illness in the population (prevalence) - **Tertiary Prevention** - To decrease the amount of disability associated with an existing disorder.

UNIT IV MENTAL WELLNESS

Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life - Short term and long term effects of emotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions.

Stress management - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement. Sleep - Sleep and its importance for mental wellness - Sleep and digestion. Immunity - Types and importance - Ways to develop immunity

UNIT V YOGA

Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.

OUTCOMES

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

- Identify and explain the ten types of health, including physical, mental, emotional, spiritual, and environmental health.
- Analyze the role of a balanced diet and its 7 components in preventing lifestyle disorders like diabetes, hypertension, and arthritis.
- Understand the principles of Siddha and Ayurveda systems, including the Five Element Theory, Tri-Dosha Theory, and daily/seasonal regimens (Dinacharya/Ritucharya).
- Apply stress management techniques, sleep hygiene practices, and emotion-regulation strategies to enhance mental wellness.
- Demonstrate basic yogasanas and understand the Eight Limbs of Yoga for health disorder prevention and cure.


Chairman - BoS



23MDC602

HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA

L T P C

3 0 0 0

OBJECTIVES

- To enjoy life happily with fun filled new style activities that help to maintain health also.
- To adapt a few lifestyle changes that will prevent many health disorders.
- To be cool and handle every emotion very smoothly in every walk of life.
- To learn to eat cost effective but healthy foods that are rich in essential nutrients.
- To develop immunity naturally that will improve resistance against many health disorders.

UNIT I CONCEPTS AND PERSPECTIVES

Meaning of History Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism. Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

UNIT II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA

Introduction to the works of D.D. Kosambi, Dharmpal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.

UNIT III SCIENCE AND TECHNOLOGY IN ANCIENT INDIA

Technology in pre-historic period Beginning of agriculture and its impact on technology Science and Technology during Vedic and Later Vedic times Science and technology from 1st century AD to C-1200.

UNIT IV SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA

Legacy of technology in Medieval India, Interactions with Arabs Development in medical knowledge, interaction between Unani and Ayurveda and alchemy Astronomy and Mathematics: interaction with Arabic Sciences Science and Technology on the eve of British conquest

UNIT V SCIENCE AND TECHNOLOGY IN COLONIAL INDIA

Science and the Empire Indian response to Western Science Growth of techno-scientific institutions

UNIT VI SCIENCE AND TECHNOLOGY IN A POST-INDEPENDENT INDIA

Science, Technology and Development discourse Shaping of the Science and Technology Policy





Developments in the field of Science and Technology Science and technology in globalizing India
Social implications of new technologies like the Information Technology and Biotechnology

OUTCOMES

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

- Explain the concepts, perspectives, and significance of history, science, and technology in India.
- Examine the contributions of major historians to the historiography of science and technology in India.
- Analyze the development of science and technology in Ancient and Medieval India and their societal contributions.
- Analyze the influence of colonial rule on scientific progress and institutional development in India.
- Evaluate the advancements in science and technology in post-independent India and their impact on development and globalization.


Chairman - BoS



23MDC603 POLITICAL AND ECONOMIC THOUGHT FOR A HUMAN SOCIETY L T P C

3 0 0 0

OBJECTIVES

- Define key historical concepts like determinism, relativism, causation, and historical positivism as applied to science and technology.
- Recognize the historiographical contributions of scholars such as D.D. Kosambi, Dharampal, and Debiprasad Chattopadhyay.
- Explain the technological advancements made during ancient and medieval Indian history, including interactions with Arabic sciences.
- Evaluate the growth of techno-scientific institutions and the Indian response to Western science during the colonial period.
- Assess the social implications of emerging technologies and science policy decisions in post-independent and globalizing India

COURSE TOPICS:

Considerations for humane society, holistic thought, human being's desires, harmony in self, harmony in relationships, society, and nature, societal systems. **(9 lectures, 1 hour each)**

(Refs: A Nagaraj, M K Gandhi, JC Kumarappa)

Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. **(5 lectures)**

(Refs: Adam Smith, J S Mill)

Fascism and totalitarianism. World war I and II. Cold war. **(2 lectures)**

Communism – Mode of production, theory of labour, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models.

(Refs: Marx, Lenin, Mao, M N Roy) **(5 lectures)**

Welfare state. Relation with human desires. Empowered human beings, satisfaction. (3 lectures)

Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one's lives.

Relationship with nature. (6 lectures)

(Refs: M K Gandhi, Schumacher, Kumarappa)

Essential elements of Indian civilization. **(3 lectures)**

(Refs: Pt Sundarlal, R C Mazumdar, Dharampal)

Technology as driver of society, Role of education in shaping of society.

Future directions. **(4 lectures)**

(Refs: Nandkishore Acharya, David Dixon, Levis Mumford)

Conclusion **(2 lectures)**



OUTCOMES

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

- Understand the core considerations required for a humane society and achieving harmony across self, society, and nature.
- Compare the theoretical foundations and historical implementations of free-market capitalism, imperialism, and communism.
- Analyze the relation between human desires, empowerment, satisfaction, and the mechanisms of a welfare state.
- Apply Gandhian economic and political thought (Swaraj, decentralized polity) to contemporary societal and environmental challenges.
- Evaluate future directions for society by considering technology as a driver and education.


Chairman - BoS





23MDC604

STATE, NATION BUILDING AND POLITICS IN INDIA

L T P C

3 0 0 0

OBJECTIVES

- To provide an understanding of the state, its main organs (Executive, Legislature, Judiciary), separation of powers, and the concept of sovereignty.
- To acquaint students with the legacies of the national movement and constitutional development in India.
- To explain the reasons for adopting a Parliamentary-federal system and the broad philosophy of the Constitution of India.
- To examine the changing nature of the Indian political system, new social movements, and challenges to nation-building.
- To discuss issues concerning national integration and nation-building with the aim of developing a future vision for better governance.

TOPICS

Understanding the need and role of State and politics. Development of Nation-State, sovereignty, sovereignty in a globalized world. 183 Organs of State – Executive, Legislature, Judiciary. Separation of powers forms of government unitary-federal, Presidential-Parliamentary, and The idea of India.

1857 and the national awakening.

1885 Indian National Congress and development of national movement – its legacies.

Constitution making and the Constitution of India.

Goals, objective and philosophy. Why a federal system? National integration and nation-building

Challenges of nation-building – State against democracy (Kothari) New social movements. The changing nature of Indian Political System, the future scenario. What can we do?

OUTCOMES

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

- Understand the theoretical aspects of the state, its organs, operationalization, and sovereignty in a globalized world.
- Explain the historical background, philosophy, goals, and objectives behind the founding of the Indian Constitution.
- Analyze the rationale behind adopting a federal-parliamentary system and the broad streams of national integration.
- Identify major challenges to nation-building, social movements, and institutional difficulties within the democratic setup.
- Devise perspectives for active participation in the system to improve governance and delivery for the common citizen.


Chairman - BoS





OBJECTIVES

- To understand the introduction and basic terminologies of safety.
- To enable the students to learn about the important statutory regulations and standards.
- To enable students to conduct and participate in various safety activities in the industry.
- To have knowledge about workplace exposures and hazards.
- To assess various hazards and consequences through various risk assessment techniques

UNIT I SAFETY TERMINOLOGIES

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold LimitValue (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT II STANDARDS AND REGULATIONS

Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006

UNIT III SAFETY ACTIVITIES

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

UNIT IV WORKPLACE HEALTH AND SAFETY Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety- Toxic gas Release

UNIT V HAZARD IDENTIFICATION TECHNIQUES Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- 21⁷ Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment





OUTCOMES

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

- Understand the basic concept of safety.
- Obtain knowledge of Statutory Regulations and standards
- . Know about the safety Activities of the Working Place.
- Analyze on the impact of Occupational Exposures and their Remedies
- Obtain knowledge of Risk Assessment Techniques.


Chairman - BoS



MINOR / HONOURS DEGREE





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



DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

REGULATIONS 2023

(REVISION II)

MINOR / HONOURS DEGREE

ELECTRIC VEHICLES

CURRICULUM AND SYLLABI



CURRICULUM AND SYLLABI

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

(MINOR/HONOURS DEGREE – ELECTRIC VEHICLES)

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

CourseCode	Name of the Subject	Category	Periods /Week			Credit	Maximum Marks			
			L	T	P		C	CIA	ESE	TOT
THEORY										
23EEET01	Electric and Hybrid Vehicles	PC	3	0	0	3	40	60	100	
23EEET02	Electric Motors and Drives for Electric Vehicles	PC	3	0	0	3	40	60	100	
23EEET03	Advanced EV Technologies	PC	3	0	0	3	40	60	100	
EMBEDDED COURSE										
23EEEE01	Battery and Controls for Electric Vehicles	PC	3	0	2	4	50	50	100	
EMPLOYABILITY ENHANCEMENT COURSE										
23EEEP01	Project Work	EEC	0	0	12	6	60	40	100	
Total			19							

- PC : Professional Core
 EEC : Employability Enhancement Courses
 L : Lecture
 T : Tutorial
 P : Practical
 C : Credit Point
 CIA : Continuous Internal Assessment
 ESE : End Semester Examination
 TOT : Total



23EEET01

ELECTRIC AND HYBRID VEHICLES

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge on the fundamentals, components, and classifications of electric vehicles.
- To familiarize with battery technologies and battery pack design for EV applications.
- To acquire knowledge on electric machines used in electric vehicles.
- To enhance understanding of EV drive train systems and their components.
- To foster awareness of hybrid electric vehicle architectures and energy management strategies.

UNIT I INTRODUCTION TO ELECTRIC VEHICLES

9

History and evolution of Evs - Components of electric vehicles - Comparison with internal combustion engines: Technology, benefits, and challenges - EV classification and electrification levelsb - EV terminology and concepts - Efficiency analysis for EVs vs. ICE vehicles.

UNIT II BATTERY TECHNOLOGIES FOR EVs

9

Battery basics and types - Key parameters: Capacity, discharge rate, state of charge, depth of discharge - Technical characteristics of EV batteries - Battery pack design principles - Properties and performance of EV batteries - Overview of battery safety and thermal runaway prevention.

UNIT III ELECTRIC MACHINES FOR EV APPLICATIONS

9

Motor and engine rating for Evs - Requirements of EV motors - DC machines and BLDC in Evs - Three-phase AC machines - Induction motors for Evs - Permanent magnet machines - Switched reluctance machines in EV applications - Introduction to motor cooling techniques.

UNIT IV EV DRIVE TRAIN SYSTEMS AND COMPONENTS

9

Transmission configurations for Evs - Drive train components: Gears, chain Drive, Belt drive differentials, clutches - Brake systems and regenerative braking - Motor sizing for EV applications - Integration of drive train components - Basics of torque vectoring in EV drive trains.

UNIT V HYBRID ELECTRIC VEHICLE ARCHITECTURES

9

Types of hybrid configurations - Series, parallel, and series-parallel - Design considerations for



HEVs - Drive train layouts for different hybrid architectures - Sizing of components in hybrid systems - Energy management strategies in HEVs - Range extenders in hybrid vehicles - Retrofit hybrid system design.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the concepts, components, and classifications of electric vehicles.
- Apply battery technologies and battery pack design principles for EV applications.
- Analyze the performance of electric machines used in electric vehicles.
- Examine the operation of EV drive train systems and their components.
- Apply hybrid electric vehicle architectures and energy management strategies.

TEXT BOOKS

1. Iqbal Hussain, "Electric & Hybrid Vehicles – Design Fundamentals", CRC Press, Third Edition, 2022.
2. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, Second Edition, 2019.

REFERENCES

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, Third Edition, 2020.
2. Sandeep Dhameja, "Electric Vehicle Battery Systems", Newnes, Second Edition, 2022

E-RESOURCES

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

Mapping of COs-POs & PSOs

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

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

Chairman - BoS

SEMESTER IV

23EEET02

ELECTRIC MOTORS AND DRIVES FOR ELECTRIC VEHICLES

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge on electric vehicle motor requirements, drive systems, and power semiconductor devices.
- To acquire knowledge on the operation and control of DC motors and drives for electric vehicle applications.
- To provide knowledge on induction motor drives, inverter configurations, and control techniques used in EVs.
- To develop knowledge on permanent magnet synchronous motor drives and their field-oriented control strategies.
- To familiarize with special electric machines and emerging drive technologies for electric vehicle applications.

UNIT I FUNDAMENTALS OF EV MOTORS AND DRIVES

9

EV motor requirements - Comparison of motor types for EVs - Torque-speed characteristics - Power semiconductors in EV drives - IGBTs and MOSFETs - Basic drive types and selection criteria for EVs - Overview of motor efficiency maps.

UNIT II DC MOTORS AND DRIVES FOR EVs

9

PMDC motor principles and characteristics - DC motor control techniques - DC-DC converters for PMDC motors - Chopper control - Closed-loop control strategies - Regenerative braking in DC drives - Introduction to multiphase DC motors for EVs.

UNIT III AC INDUCTION MOTORS AND DRIVES FOR EVs

9

Induction motor operation in EVs; IGBT-based inverter design; PWM techniques for induction motor control; V/f control principles; Vector control basics; Efficiency considerations in induction motor drives. Brief overview of thermal management in EV drives

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS (PMSM) AND DRIVES

9

PMSM principles and advantages for EVs - PMSM types - surface mounted and interior - Field-oriented control of PMSM - PMSM drive system design - Comparison between PMSM and induction motor drives for EVs - Introduction to noise, vibration, and harshness (NVH) considerations in PMSM.

UNIT V SPECIAL ELECTRIC MACHINES FOR EVs

9

Brushless DC (BLDC) motors - hub and inner rotor types - BLDC motor control techniques - Switched Reluctance Motors (SRM) for EVs - SRM drive strategies - In-wheel motor technology - Axial flux motors - Thermal management in EV motors and Drive - Overview of fault-tolerant motor designs.

TOTAL : 45 PERIODS

OUTCOMES

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

- Discuss characteristics and parameters of various EV motors
- Analyze electric drive concepts specific to EVs
- Design and analyze control systems for DC and AC EV motors
- Examine advanced motor technologies used in modern EVs
- Develop drive systems for special EV motors

TEXT BOOKS

1. Iqbal Hussain, "Electric & Hybrid Vehicles – Design Fundamentals", CRC Press, Third Edition, 2022.
2. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, Second Edition, 2019.

REFERENCES

1. Ali Emadi, "Advanced Electric Drive Vehicles", CRC Press, First Edition, 2023.
2. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles", CRC Press, Third Edition, 2020.

E-RESOURCES

1. <https://nptel.ac.in/courses/108104140> - Electric Drives
2. <https://nptel.ac.in/courses/108108077> - Electric Vehicles

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

**SEMESTER V****23EEET03****ADVANCED EV TECHNOLOGIES****L T P C****3 0 0 3****OBJECTIVES**

- To impart knowledge of advanced charging technologies and Vehicle-to-grid (V2G) systems used in electric vehicles.
- To familiarize with lightweight materials and thermal management techniques for improving EV Performance and efficiency.
- To develop understanding of autonomous driving technologies and their applications in electric vehicles.
- To enhance awareness of EV economics, government policies, regulations and cyber security aspects related to electric mobility.
- To inculcate knowledge of electric vehicle maintenance, diagnostics, battery management and end-of-life recycling practices.

UNIT I ADVANCED CHARGING TECHNOLOGIES AND V2G**9**

Wireless charging systems - Ultra-fast charging - Vehicle-to-Grid (V2G) technology - Smart charging infrastructure - Charging standards and protocols - Integration with renewable energy sources - Overview of extreme fast charging technologies and challenges.

UNIT II LIGHTWEIGHT MATERIALS AND THERMAL MANAGEMENT**9**

Advanced materials for EV body and chassis - Composite materials - Weight reduction strategies - Battery thermal management systems - Powertrain cooling - Cabin climate control for EVs - Introduction to structural batteries in EVs.

UNIT III AUTONOMOUS DRIVING AND EV INTEGRATION**9**

Sensors and Perception systems for EVs - Autonomous driving levels - Energy management in autonomous EVs - Integration of EV and autonomous technologies - Safety considerations - Introduction to ADAS and Connected Vehicles - Sensor fusion in autonomous EVs Cameras - LiDAR (Light Detection and Ranging) - RADAR (Radio Detection and Ranging) - GPS (Global Positioning System) / GNSS (Global Navigation Satellite System) - Accelerometers and Gyroscopes.

UNIT IV EV ECONOMICS, POLICY, AND CYBER SECURITY**9**

Total cost of ownership analysis - Government incentives and policies - Market trends and forecasting - Cybersecurity threats in EVs - Security protocols and best practices - Over-the-air



updates - Comparative study of 2 wheeler and 3 wheeler Retrofit unit Vs New EV.

UNIT V EV MAINTENANCE, DIAGNOSTICS, AND RECYCLING

9

EV-specific maintenance procedures - Diagnostic tools and techniques - Troubleshooting EV systems - Battery second-life applications - Recycling processes for EV components - Environmental impact assessment - Overview of EV battery remanufacturing and repurposing.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze advanced charging technologies and V2G systems.
- Examine lightweight materials and thermal management techniques in EVs.
- Apply the integration of autonomous driving technologies in EVs.
- Examine EV economics, policies, and cyber security considerations.
- Analyze EV maintenance, diagnostics, and end-of-life recycling.

TEXT BOOKS

1. Carla Fabiana Chiasserini et al., "Electric Vehicles in Smart Grids: Charging Strategies", Springer, 2021.
2. David Greenwood, "Advanced Electric Drive Vehicles", CRC Press, 2020.

REFERENCES

1. Seref Soylu, "Electric Vehicles - Modelling and Simulations", InTech, 2022.
2. Tom Denton, "Electric and Hybrid Vehicles", Routledge, 2020.

E-RESOURCES

1. <https://nptel.ac.in/courses/108103009> - (Advanced Electric Vehicles)
2. <https://www.edx.org/course/electric-vehicle-technology-business> - (Electric Vehicles: Technology, Business, and Policy)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS



SEMESTER VI

23EEEE01

BATTERY AND CONTROLS FOR ELECTRIC VEHICLES

LT P C

(Lab Embedded Theory Course)

3 0 2 4

OBJECTIVES

- To impart knowledge on different energy storage systems, battery characteristics, and performance criteria.
- To familiarize with battery modeling, management systems, and state-of-charge estimation techniques.
- To develop understanding of battery testing, disposal, recycling, and environmental impacts.
- To instruct on EV charging technologies, charger types, and communication protocols.
- To foster awareness of charging connectors, standards, renewable integration, and V2G concepts.
- To develop skills in battery testing, EV charging, solar integration, and motor control techniques.

UNIT I ENERGY STORAGE SYSTEMS AND BATTERY CHARACTERISTICS

9

Types of energy storage: Lead Acid, Nickel-based, Lithium-based, Metal Air batteries - Ultra capacitors - Flywheel Energy Storage - Battery specifications – Efficiency - Electrical parameters - Heat generation - Performance criteria for EV batteries - Power and energy requirements - Battery parameter estimation techniques.

UNIT II BATTERY MODELING AND MANAGEMENT SYSTEMS

9

General modeling approach - Simulation models for Li-ion and NiCd batteries – Parameterization - Battery selection for EVs/HEVs - Traction battery pack design - State of charge estimation - Cell equalization - Thermal management - Battery Management System (BMS) components and functions - Overview of cell balancing techniques in battery packs.

UNIT III BATTERY TESTING, DISPOSAL, AND RECYCLING

9

Safety testing - Transport and storage limitations - Recycling and second-life applications - Environmental impacts - Recycling methods for EV batteries - Fuel Cells and Hydrogen-based system design - Accelerated aging tests for EV batteries



UNIT IV EV CHARGING TECHNOLOGIES AND INFRASTRUCTURE

9

Types of EV chargers - AC and DC charging - Charger modes - EVSE associated charge times - AC and DC Pile Chargers - EVSE Power Module selection - Communication Protocols - Open Charge Point Protocol (OCPP) - Bharat DC001 & AC001 Charger specifications - Overview of cyber security in EV charging infrastructure.

UNIT V CHARGING CONNECTORS AND RENEWABLE INTEGRATION

9

AC and DC charger types and connectors - Charging standards (IEC 61851-1, IEC 61851-24, 62196-2) - PV module technologies for EV charging - Inverter selection and sizing - Cable and earthing selection - Relevant IEC standards for solar integration - bidirectional charging and V2G concepts.

LIST OF EXPERIMENTS

1. Battery characterization and performance evaluation
2. Battery management system simulation
3. EV charger efficiency and performance testing
4. Charging protocol implementation and testing
5. Solar PV integration with EV charging station
6. EV charger efficiency and performance testing (AC and DC charging)
7. Simulation and Implementation and testing of different PWM techniques for motor control

TOTAL: 45 + 15 = 60 PERIODS

OUTCOMES

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

- Explain the types, characteristics, and performance criteria of batteries and energy storage systems.
- Analyze battery modeling, management systems, and state-of-charge estimation techniques.
- Examine battery testing methods, recycling processes, and environmental impacts.
- Apply EV charging technologies, charger types, and communication protocols.
- Analyze charging connectors, standards, renewable integration, and V2G concepts.
- Design electric drive systems, allowing for performance optimization and problem-solving.

TEXT BOOKS

1. Ibrahim Dinçer et al., "Thermal Management of Electric Vehicle Battery Systems", John Wiley & Sons, 2019.
2. James Larminie, John Lowry, "Electric Vehicle Technology Explained", John Wiley & Sons, Second Edition, 2022.

REFERENCES

1. Chris Mi et al., "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", Wiley, Second Edition, 2021.
2. Amir Khajepour et al., "Electric and Hybrid Vehicles: Technologies, Modeling and Control: A Mechatronic Approach", John Wiley & Sons, 2019.

E-RESOURCES

1. <https://nptel.ac.in/courses/113105102> - (Battery Modeling)
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	PSO1	PSO2
1	3	3	3	3	3	2	-	-	-	-	3	3	2
2	3	3	3	3	3	2	-	-	-	-	3	3	2
3	3	3	3	3	3	2	-	-	-	-	3	3	2
4	3	3	3	3	3	2	-	-	-	-	3	3	2
5	3	3	3	3	3	2	-	-	-	-	3	3	2
6	3	3	3	3	3	2	2	3	3	2	3	3	2
AVG	3	3	3	3	3	2	2	3	3	2	3	3	2

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


Chairman - BoS



23EEEP01

SEMESTER VII
PROJECT WORK

L T P C
0 0 12 6

OBJECTIVES

- To develop knowledge to formulate a real world problem and projects goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

PROCESS DESCRIPTION

- For Project work out of 100 marks, the maximum marks for Continuous Internal Assessment is fixed as 60 and the End Semester Examination (project report evaluation and viva voce examination) carries 40 marks. Project work shall be assigned to a single student.
- The project work shall be undertaken by students either in industry or in the college.
- The total credit for project work is 6.
- There shall be three reviews (Zeroth Review, (Review I and Review II, each 100 marks)) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee.
- The committee shall consist of the Supervisor, Project Coordinator and one of the faculty members.
- The student(s) is expected to submit the project report on or before the last working day of the semester. The ESE for the project work shall consist of the evaluation of the final project report submitted by the student or students of the project group by an external examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner and an internal examiner (other than supervisor). The project coordinator shall be the internal examiner. The COE shall appoint the External Examiner for the ESE of the Project Work. The project report shall be submitted as per the approved guidelines given by Controller of Examinations.



**OUTCOMES**

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

- Formulate real-world problems.
- Design and express technical solutions using appropriate tools and techniques.
- Test and validate prototypes for efficiency and cost-effectiveness, and present their work effectively through reports and oral demonstrations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, "-" - No Correlation


Chairman - BoS





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



DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

REGULATIONS 2023

(REVISION II)

MINOR / HONOURS DEGREE

SENSORS TECHNOLOGY

CURRICULUM AND SYLLABI



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
THEORY									
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
EMBEDDED COURSE									
23EERE01	Principles of Sensors	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EESP01	Project Work	EEC	0	0	12	6	60	40	100
Total			19						

PC	:	Professional Core
EEC	:	Employability Enhancement 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 impart knowledge on the fundamentals, properties, and synthesis of nanomaterials and nanostructures.
- To familiarize with various techniques used for the characterization of nanomaterials.
- To acquire knowledge on metal nanoparticles, nanowires, and their fabrication methods for sensor applications.
- To inculcate the concepts of carbon nanotubes and their use in sensor technologies.
- To enhance understanding of metal oxide nanostructures, sensing mechanisms, and their applications.

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

- Explain the fundamentals, types, properties, and synthesis methods of nanomaterials and nanostructures.
- Apply various characterization techniques for analyzing the properties of nanomaterials.
- Analyze the fabrication methods and sensing applications of metal nanoparticles and nanowire-based sensors.
- Examine the synthesis, fabrication, and working principles of carbon nanotube-based sensors.
- Analyze the synthesis methods, sensing mechanisms, and applications of metal oxide-based nanostructured sensors.

TEXT BOOKS

1. Dieter Vollath, "Nanomaterials: An Introduction to Synthesis, Properties and Applications", Wiley, New Jersey, Second Edition, 2019.
2. Guozhong Cao, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications", Imperial College Press, London, Second Edition, 2021

REFERENCES

1. Martin Pumera, "Nanomaterials for Electrochemical Sensing and Bio sensing", Pan Stanford, First Edition, 2022.
2. Michael A. Carpenter, Sanjay Mathur, Andrei Kolmakov, "Metal Oxide Nanomaterials for Chemical Sensors", Springer, NewYork, First Edition, 2018.

E-RESOURCES

1. [https://nptel.ac.in/courses/118104008-\(Nanomaterial\)](https://nptel.ac.in/courses/118104008-(Nanomaterial))
2. [https://nptel.ac.in/courses/108106173-\(sensor\)](https://nptel.ac.in/courses/108106173-(sensor))



SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade,

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)

Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



Mapping of COs-POs & PSOs

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

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


Chairman - BoS





SEMESTER IV

23EEST02

WIRELESS SENSOR NETWORKS

LT P C

3 0 0 3

OBJECTIVES

- To impart knowledge on network communication protocols used in embedded systems.
- To familiarize with embedded wireless communication technologies and IP-based wireless sensor networks.
- To acquire knowledge on the architecture, characteristics, and design considerations of wireless sensor networks.
- To inculcate the concepts of medium access control protocols and communication techniques in WSNs.
- To enhance understanding of sensor network architecture, data dissemination, and gateway-based communication.

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 transceiver design 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 MAC protocol.

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





OUTCOMES

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

- Explain the applicability and limitations of communication protocols for are alltime WSN application.
- Analyze the behavior of Mobile Adhoc Networks (MANETs) and correlates the infrastructure-based networks.
- Apply the routing protocols function and their implications in data transmission delay and bandwidth.
- Analyze networks with an attempt to reduce issue of broad cast and flooding techniques.
- Examine the 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, First Edition, 2021.
2. Jun Zheng, Abbas Jamalipour, "Wireless Sensor Networks: A Networking Perspective", Wiley-IEEE Press, USA, First Edition, 2019.

REFERENCES

1. Waltenegus W.Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", John Wiley & Sons, NewJersey, First Edition, 2018.
2. Rlan F. Akyildiz, Mehmet Can Vuran, "Wireless Sensor Networks", John Wiley & Sons, NewJersey, First Edition, 2021.

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	PSO1	PSO2
1	3	3	2	3	2	1	1	-	1	-	3	3	2
2	3	3	2	3	2	1	1	-	1	-	3	3	2
3	3	3	2	3	2	1	1	-	1	-	3	3	2
4	3	3	2	3	2	1	1	-	1	-	3	3	2
5	3	3	2	3	2	1	1	-	1	-	3	3	2
AVG	3	3	2	3	2	1	1	-	1	-	3	3	2

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


Chairman - BoS

**SEMESTER V****23EEST03****FLEXIBLE AND WEARABLE SENSORS****LT P C****3 0 0 3****OBJECTIVES**

- To impart knowledge on the fundamentals, materials, and fabrication technologies of flexible electronics.
- To familiarize with materials and novel patterning methods used for flexible electronic devices.
- To acquire knowledge on thin film transistors, plastic electronics, and smart textile technologies.
- To inculcate the concepts of wearable electronics, haptic devices, and tactile display technologies.
- To enhance understanding of knitted electronic textiles and their sensing applications.

UNIT I OVERVIEW OF FLEXIBLE ELECTRONICS TECHNOLOGY**9**

History of flexible electronics - Materials for flexible electronics: degrees of flexibility, 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 etch mask 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:

- Explain the technology developments in the flexible electronics technology.
- Identify the suitable materials and its processing for the development of thin film electronics.
- Examine the pattern and develop with suitable patterning methods.
- Analyze the process involved in the transformation of electronics from foils to textiles
- Examine the developing wearable sensors for physical and chemical parameters

TEXTBOOKS

1. Michael J. McGrath, Cliodhna Ni Scanail, Dawn Nafus, "Sensor Technologies Healthcare, Wellness and Environmental Applications", Apress Media LLC, New York First Edition, 2021.
2. William S. Wong, Alberto Salleo, Flexible Electronics: Materials and Applications, Springer, New York, First Edition, 2021.

REFERENCES

1. Edward Sazonov, Michael R. Newman, "Wearable Sensors: Fundamentals, Implementation and Applications", Academic Press, Cambridge, Second Edition, 2023.
2. Kate Hartman, "Make: Wearable Electronics: Design, prototype, and wear your interactive garments", Maker Media, Netherlands, Second Edition, 2018.

E-RESOURCES

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



SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

NAAC Accredited with 'A' Grade.

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956

TIRUCHENGODE- 637 205



Mapping of COs-POs & PSOs

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

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

Chairman - BoS



**SEMESTER VI****23EESE01****PRINCIPLES OF SENSORS****LT P C****3 0 4 4****OBJECTIVES**

- To enhance the fundamentals, classification, performance characteristics, and working principles of optical and semiconductor sensors.
- To foster the intensity, polarization, and interferometric sensing techniques using optical fibers.
- To instruct the principles and characteristics of velocity, acceleration, and inertial sensors.
- To familiarize the working principles of position, displacement, direction, and level sensors.
- To acquire knowledge of flow, temperature, and acoustic sensors and their measurement techniques.
- To inculcate the principles and applications of strain, force, pressure, displacement, temperature, and non-contact measurement systems using electrical and electromechanical sensors.

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 optic liquid 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 - electret 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 not suitable 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 = 60 PERIODS

OUTCOMES

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

- Explain the operation and applications of optical detectors and semiconductor-based sensors.
- Apply the principles of intensity, phase and polarization-based sensors in measurement systems.
- Analyze different velocity, acceleration and gyroscopic sensors for motion measurement.
- Describe the suitable sensors for position, displacement and level measurement applications.
- Examine the appropriate sensors for flow, temperature, and acoustic measurements.
- Identify the suitable sensors and measurement techniques to develop and demonstrate practical sensor-based measurement systems.

TEXTBOOKS

1. Jacob Fraden, "Hand Book of Modern Sensors: physics, Designs and Applications", Springer, New York, Fourth Edition, 2020.
2. Jon. S. Wilson, "Sensor Technology Hand Book", Elsevier, Netherland, First Edition, 2019.

REFERENCES

1. Gerd Keiser, "Optical Fiber Communications", , McGraw-Hill Science, Delhi, Fourth Edition, 2022.
2. John G Webster, "Measurement, Instrumentation and sensor Handbook", CRC Press, Florida, Second Edition, 2020.

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	PSO1	PSO2
1	3	3	2	3	2	1	1	-	1	-	3	3	2
2	3	3	2	3	2	1	1	-	1	-	3	3	2
3	3	3	2	3	2	1	1	-	1	-	3	3	2
4	3	3	2	3	2	1	1	-	1	-	3	3	2
5	3	3	2	3	2	1	1	-	1	-	3	3	2
6	3	3	2	3	2	1	1	3	1	2	3	3	2
AVG	3	3	2	3	2	1	1	3	1	2	3	3	2

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


Chairman - BoS



SEMESTER VII

23EESP01

PROJECT WORK

L T P C

0 0 12 6

OBJECTIVES

- To develop knowledge to formulate a real world problem and projects goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

PROCESS DESCRIPTION

- For Project work out of 100 marks, the maximum marks for Continuous Internal Assessment is fixed as 60 and the End Semester Examination (project report evaluation and viva voce examination) carries 40 marks. Project work shall be assigned to a single student.
- The project work shall be undertaken by students either in industry or in the college.
- The total credit for project work is 6.
- There shall be three reviews (Zeroth Review, (Review I and Review II, each 100 marks)) during the semester by a review committee. The student shall make presentation on the progress made before the committee. The Head of the Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee.
- The committee shall consist of the Supervisor, Project Coordinator and one of the faculty members.
- The student(s) is expected to submit the project report on or before the last working day of the semester. The ESE for the project work shall consist of the evaluation of the final project report submitted by the student or students of the project group by an external examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner and an internal examiner (other than supervisor). The project coordinator shall be the internal examiner. The COE shall appoint the External Examiner for the ESE of the Project Work. The project report shall be submitted as per the approved guidelines given by Controller of Examinations.



OUTCOMES

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

- Formulate real-world problems.
- Design and express technical solutions using appropriate tools and techniques.
- Test and validate prototypes for efficiency and cost-effectiveness, and present their work effectively through reports and oral demonstrations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, "-" - No Correlation


Chairman - BoS

SCHEME

Credit Summary



CURRICULUM AND SYLLABI
FOR B.E. / B.Tech. DEGREE PROGRAMMES
(MINOR /HONOURS DEGREE)
CREDIT SUMMARY
B.E. – ELECTRICAL AND ELECTRONICS ENGINEERING

Category	Credits Per Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
PC	-	-	6	6	6	8	-	-	26
EEC	-	-	-	-	-	-	12	-	12
Total	-	-	6	6	6	8	12	-	38

