Meenakshi Sundararajan Engineering College

(An Autonomous Institution)

Managed by I.I.E.T Society, Approved by AICTE, New Delhi,
Affiliated to Anna University, Chennai,
Accredited by NAAC with 'A' grade and NBA for programs applied,
Recognized by UGC with 2(f) & 12(B) status

CURRICULUM AND SYLLABUS REGULATIONS 2024

CHOICE BASED CREDIT SYSTEM

Powered by

Meenakshi Sundararajan Career Development Cell

Achievers Excellence Program

Meenakshi Sundararajan Innovation and Incubation Centre

MSEC JAPANESE CLUB

Institutions' Innovation Council

Societal Beneficial Innovation

MATLAB Enabled Campus

363, Arcot Road, Kodambakkam, Chennai - 600 024.
www. msec.edu.in

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Prof. K. R. Sundararajan, a well-known educationalist, established the Indian Institute of Engineering Technology (I.I.E.T) society in the year 1947 in Chennai. The total area of 14 acres was purchased with enormous hardship and was donated to the IIET Society for the cause of education. The society's main objective is to provide quality education and it has been ensured since 1951.

The IIET Society has the following to its credit :-

- An uninterrupted and continuous education since 1951 in its premises
- All Colleges run by the institution are ranked among the top 5 – top 10 programs in Tamil Nadu
- 350 KW Solar Power Plant Generating upto 70% of its electricity needs
- Significant portion of the students are first generation learners
- Campus holds approximately 7000 plus students from the ages of 4 to 35 plus.
- Large Green Campus in the heart of the city of Chennai, Tamil Nadu
- In existence since 1947 – Completed 75 years
- Targeting to be Carbon Neutral from the end of the year 2025

The society currently has the following institutions :-

- **Meenakshi Sundararajan Engineering College(MSEC)** - established in 2001 & affiliated to Anna University offering engineering programs with about 2000 plus students.
- **Meenakshi Sundararajan School of Management(MSSM)** - established in 2000 & affiliated to University of Madras offering MBA programs with about 100 plus students.
- **The NEST School (TNS)**- established in 2022 offering IB (International Baccalaureate) & CAIE (Cambridge) boards.

All of the institutions have earned an enviable name and are rated as one among Top 10 colleges in the Tamil Nadu state in their respective programs. Efforts are on to make the campus carbon neutral in 2 years (end of 2025) by using our community of staff and students.

Meenakshi Sundararajan Engineering College (MSEC) was established by the IIET Society in 2001. MSEC is defined by two keywords "Industry Ready" & "Vibrancy". Creating a new generation of self- actualized learners is our raison d'etre. If children are our future, then education is the key to their future. When education is shaped around them, and not the other way around, we are laying the foundation for a future/world where creativity, diversity and caring, independent-thinkers thrive. Our curricula thrive on continuous learning while interacting with and incorporating real-world situations and challenges.

MSEC's Hallmark of Quality

- Affiliated to Anna University, Chennai
- Approved by AICTE, New Delhi
- Accredited by NBA for programs in:
  - Civil Engineering
  - Computer Science and Engineering
  - Electronics and Communication Engineering
  - Mechanical Engineering
  - Electrical and Electronics Engineering
  - Information Technology
- Accredited by NAAC with a prestigious "A" grade
- Declared under Section 2(f) and 12(B) of the UGC Act
- Conferred with Autonomous status for 10 years (2024-25 to 2033-34) by the University Grants Commission (UGC) on February 1, 2024
- Meenakshi Sundararajan Innovation and Incubation Centre (MSIIC)
- Meenakshi Sundararajan Career Development Cell (MSCDC)
- MSEC Research Centre (MSEC RC)
- Center of Excellence – Industry Tie Up in Specialized Labs
- Industry MOU's – 200 Plus

Vision of the Institute

To impart state-of-the-art technical education, including sterling values and shining character, producing engineers who contribute to nation building thereby achieving our ultimate objective of sustained development of an unparalleled society, nation and world at large.

Mission of the Institute

Meenakshi Sundararajan Engineering college, Chennai constantly strives to be a Centre of Excellence with the singular aim of producing students of outstanding academic excellence and sterling character to benefit the society, our nation and the world at large.

To achieve this, the college ensures

- Continuous upgradation of its teaching faculty to ensure a high standard of quality education and to meet the ever-changing needs of the society
- Constant interaction with its stakeholders
- Linkage with other educational institutions and industries at the national and international level for mutual benefit
- Provision of research facilities and infrastructure in line with global trends
- Adequate opportunities and exposure to the students through suitable programs, to mould their character and to develop their personality with an emphasis on professional ethics and moral values.

We offer following courses:

S.No	Course	Intake
	Undergraduate courses in B.E / B. Tech	
01	B.E Civil Engineering	60
02	B.E Computer Science and Engineering	120
03	B.E Electronics and Communication Engineering	120
04	B.E Electrical & Electronics Engineering	60
05	B.E Mechanical Engineering	60
06	B. Tech Information Technology	120
07	B. Tech Artificial Intelligence & Data Sciences	120
	Postgraduate courses in M.E / M. Tech	
08	M.E. Construction Engineering and Management	18
09	M.E. Computer Science and Engineering	18
10	M.E. Embedded System Technologies	18
11	M.E Energy Engineering	18

DEPARTMENT OF HUMANITIES AND SCIENCE

The H&S Department stands out for its commitment to providing a well-rounded academic experience for first-year students. Covering key subjects like Physics, Chemistry, Mathematics, English, and Tamil. The department boasts a high pass percentage in semester exams, a testament to the hard work and dedication of the faculty. This year, the department enhanced offerings with industry and alumni talks, foreign language courses, engaging games, and specialized coaching for AEP and ICS. Additionally, the department introduced an industry-oriented and department-specific syllabus to better prepare students for future challenges and opportunities

DEPARTMENT OF CIVIL ENGINEERING

The Civil Engineering Department at our college, established in 2002, is a beacon of academic excellence and research innovation. Offering both undergraduate program and postgraduate program in M.E. Construction Engineering and Management, the department is committed to integrating advanced technologies and sustainable practices into its curriculum. The department boasts state-of-the-art laboratories and strong industry collaborations. Graduates of the department have made significant contributions to civil engineering, both nationally and internationally, and continue to shape the future of the discipline through unwavering commitment to excellence.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

The Department of Computer Science and Engineering was established in 2001. It has its mission to inculcate innovative thinking and analytical abilities in addition to imparting quality education in the theory and application of Computer Science and Engineering. The department offers UG and PG programmes with State-of-the-art Computer laboratories equipped with high end hardware and software packages provided with high-speed leased line connectivity. The department takes pride in its academic excellence and outstanding placement records. It has consistently produced 68 university rank holders till 2023 batch and accredited by National Board of Accreditation.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

The Electrical and Electronics Engineering Department, established in 2003, is expanding its offerings to M.E. program in Embedded System Technologies from the 2024-25 academic year. With a focus on knowledge - based training, the department faculty empowers students with a deep understanding of concepts and industry - ready skills. The department forged partnerships with 22 companies through MOUs, facilitating collaboration and knowledge exchange.

The Electrical Technocrats Association (ETA) is a vibrant platform for technical activities, including the publication and showcasing of newsletters by staff and students every fortnight. Our mission is to drive technological advancements, foster research, and address industry needs.

DEPARTMENT OF MECHANICAL ENGINEERING

Meenakshi Sundararajan Engineering College inaugurated the Department of Mechanical Engineering in the academic year 2011-12. The department has well qualified faculties with excellent teaching, training and industrial experience. It has state-of-the-art laboratories which include VMC, CNC Wire Cut, Spark Erosion, 3D CMM etc catering to academic, consultancy and research requirements. The department's endeavor is to develop its students to be industry ready when they graduate. Students of mechanical engineering department gain industrial exposure and are prepared to face future challenges by carrying out their Final Year Project work in various PSU/Private sectors as per their field of interest relevant to their program. The department has a memorandum of understanding with various Institutions, Industries and Research organizations for collaborative research and development work. There is a huge potential in the department for Consultancy as well as Technology and Product incubation.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

The Department of Electronics and Communication Engineering, established in 2001, has grown significantly increasing its sanctioned intake from 60 to 120 in 2010. With NBA accreditation, the department is committed to delivering quality education, producing graduates who excel technically, socially, and professionally. Its state-of-the-art infrastructure, featuring ICT-enabled classrooms and advanced laboratories with cutting-edge tools like Cortex M4, Spartan 6, IoT kits, MATLAB, Cadence and PSPICE that supports academic excellence.

The Department's industry linkages with renowned organizations including ISRO, DRDO, NLTVC, and Ericson enhance students' technical skills through interactive events.

The Department's achievements include academic excellence, impressive placement records, and students' accomplishments in sports, arts, and culture, with alumni globally represented in top companies like Intel, Yahoo, and Apple.

DEPARTMENT OF INFORMATION TECHNOLOGY

The department of Information Technology was started in the year 2001 with an intake of 60 students focusing on the area. The department has won laurels to to the college. The department constantly strives with the singular aim of producing students with outstanding academic excellence and sterling character to benefit the society, our nation and the world at large. The department's commitment to high academic standards and successful student placements. It has consistently produced 65 university rank holders till 2023 batch and accredited by National Board of accreditation. Campus Agreement has been signed with leading software and hardware giants like Microsoft, IBM, Adobe and HP. The department has received a certificate partnership as a "Center of Excellence" with Virtusa Technology.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

The Department of Artificial Intelligence & Data Science was established in 2021 with an initial intake of 60 students, which was subsequently increased to 120 in 2024. Our department boasts a team of highly qualified, experienced, and competent faculty members and features spacious infrastructure with modern amenities, including six well-equipped computer laboratories with backup and internet facilities. We emphasize continuous knowledge enrichment through seminars, guest lectures, workshops, and skill enhancement programs for both students and faculty, and engage in meticulous academic planning to ensure a well-structured approach to each semester. Additionally, our student-driven club, serves as an incubation center, nurturing innovative ideas and fostering creativity.

INTERNAL QUALITY ASSURANCE CELL (IQAC)

MSEC established the Internal Quality Assurance Cell (IQAC) in 2016 to develop and implement quality standards and benchmarks in key performance areas. In alignment with the National Education Policy (NEP) 2020 and subsequent reforms, the IQAC has been further strengthened to ensure compliance with the new policy directives.

Through IQAC, the institute strive to:

- Maintain and enhance the quality of education and services
- Align with our institution's vision and mission
- Foster a culture of continuous improvement and excellence
- Ensure accountability and transparency in institutional functioning
- Promote innovative practices in teaching, learning, and research
- Develop and implement effective quality benchmarks and parameters
- Facilitate student-centered learning and feedback mechanisms
- Enhance faculty development and capacity building
- Strengthen industry-academia partnerships and collaborations
- Ensure efficient governance and administrative processes
- Promote a culture of sustainability and social responsibility
- Facilitate accreditation and ranking processes
- Identify and mitigate quality assurance risks

CONTROLLER OF EXAMINATION

The institution, granted autonomous status by UGC and Anna University from the academic year 2024-2025, has established the Controller of Examinations (COE) office to oversee assessment processes with confidentiality, ensuring quality and standards. The COE conducts fair examinations, declares results, and manages examination activities for Internal Assessment Tests (IATs) and Semester End Examinations (SEE). Their yearly schedule includes planning, coordinating, conducting, evaluating, and reviewing exams, as well as issuing certificates and transcripts. The COE ensures smooth conduct, maintains exam integrity, and coordinates with stakeholders, adapting to the institution's specific needs and exam cycle.

MEENAKSHI SUNDARARAJAN RESEARCH CENTRE(MSRC)

The MSEC Research Centre has a steadfast commitment to fostering a strong research culture. It empowers students and faculties in their intellectual exploration and discovery. The center aims to advance knowledge, drive neoteric innovation, and contribute to the broader academic and industrial fraternity ultimately aimed at uplifting humankind.

THE MEENAKSHI SUNDARARAJAN CAREER DEVELOPMENT COMMITTEE (MSCDC)

The Meenakshi Sundararajan Career Development Committee (MSCDC) is a strategic group dedicated to fostering students' professional growth and development. Our mission is to support students in achieving their career goals, fostering a culture of professional growth and development.

The MSCDC plays a vital role in aligning individual career goals through various initiatives, including:

1. Career Pathways
2. Specialised Expert Talk & Guidnace on Different Career Pathways
3. Higher Education – Awareness Sessions on various Geographical Locations
4. University Fairs
5. Training / Coaching Programs for different Competitive Exams
6. Repository / Text Books for various Competitive Exams

By providing a career pathway, we help students understand the opportunities available to them and what is required to achieve their career goals. We encourage students as they navigate their professional journey, providing them with the tools, knowledge, and opportunities needed for successful career development.

OFFICE OF STUDENTS AFFAIRS

Our mission is to create a supportive and inclusive educational environment that empowers students to succeed in their academic, personal, and professional lives. We achieve this by:

- Providing individualized support and responding to student needs
- Fostering a culture of academic integrity and excellence
- Promoting personal hygiene, cleanliness, discipline and sprucing
- Encouraging a moral code of conduct and respect for others
- Cultivating a sense of campus decency and decorum
- Modeling exemplary behavior and attitudes

By fulfilling these responsibilities, the institution aims to inspire students to become responsible, successful, and compassionate individuals who make a positive impact in their communities.

COLLEGE COUNSELING SERVICES

College counseling services are essential in supporting students' overall well-being and academic success. These services often encompass various areas, including healthy mind well-being, career guidance, and academic counseling. Here's a breakdown of the typical counseling services available for college students in the institution:

Individual Counseling: One-on-one sessions with RCI registered counselors or psychologists to address personal issues such as stress, anxiety, depression, relationship problems, and any other psychological concerns.
Group Counseling: Support groups where students with similar issues can share experiences and strategies for coping in a safe and supportive environment.
Crisis Intervention: Immediate support for students in distress, trauma response, and any emergency psychological concerns.

TRAINING AND PLACEMENT CELL

Meenakshi Sundararajan Engineering College training and placement cell is committed to providing exceptional placement opportunities for its students. The Placement Cell takes meticulous efforts to ensure that students are recruited by top-notch companies in the industry.
The training pathway is established starting from the first semester with 180 Hours of Placement training which includes Communications Skills, Aptitude Training. Specialised Programming, Guidance on Certifications, Projects, Competitions, Grooming, Etiquette, Group Discussion and Mock Interviews.

The Placement Cell functions under the leadership of Placement Officer, Faculty representatives and Coordinators from each department. The Cell's ultimate aim is to achieve 100% placement. Its Other Functions include

1. Implementation of the training pathway at appropriate semesters
2. Industry Talks
3. Alumni Talks
4. Arranging Internships & Projects
5. Centers of Excellence with Industry
6. Industry Specialised training & guidance

This comprehensive training empowers students to face the campus interviews with confidence through enhancing their employability skills for a successful future.

DEPARTMENT OF PHYSICAL EDUCATION

Our college campus boasts an array of sports facilities, including

- Basketball Court
- Badminton Court
- Pickle Ball Court
- Volleyball
- Cricket / Foot Ball / Athletics Ground
- Tennis Court
- Kho Kho

The institution is much dedicated in nurturing the talent through specific college sports teams :

- Expert coaching and mentorship
- Formation of new sports teams
- Dedicated Sports Hour (1 hour/week)
- Regular Sports Day events - that are meticulously planned for maximum student participation.

DEPARTMENT OF SAFETY AND SECURITY

MSEC's Safety Department include the Chief Security Officer (Retd. Lt. Col), Trained & Certified Safety Officers (18) and Chief Safety Officer.

The department ensures a secure and hazard-free environment within the campus through:

- Monitoring all areas of the campus to ensure a secure environment
- Conducting daily reviews and maintaining a register to track and address any safety issues
- Performing maintenance tasks such as securing compound walls, replacing damaged fencing, and ensuring proper drainage
- Educating the community through regular safety awareness programs and training sessions
- Organizing fire drills and evacuation procedures to prepare for emergencies
- Identifying and mitigating potential hazards to prevent accidents
- Developing and implementing comprehensive safety policies to guide the community
- Continuously monitoring CCTV cameras to quickly respond to any security incidents

The department's proactive approach helps to prevent accidents, minimizes risks, and fosters a culture of safety among students, staff, and faculty members.

MEENAKSHI SUNDARARAJAN INNOVATION AND INCUBATION CENTRE (MSIIC)

Meenakshi Sundararajan Innovation and Incubation Centre (MSIIC) is a dynamic and forward-thinking organization dedicated to fostering innovation, entrepreneurship, and skill development etc. Our center serves as a catalyst for a transformative change - providing aspiring entrepreneurs with the resources, mentorship, and support that is needed to turn their ideas into successful ventures. MSIIC is dedicated to promoting entrepreneurship and an innovative mindset among students and entrepreneurs at institutions. Through mentorship MSIIC helps to develop talents and support their initiatives, provide knowledge on market access and funding, and empower individuals to identify opportunities, take risks, and create positive change. The institution solely believes in entrepreneurship as a catalyst for innovation and societal impact, providing resources and a supportive environment for individuals to thrive and make a difference in their communities and beyond. Its activities include

1. Managing the 100 Seat Innovation & Incubation Center
2. Guidance to both Internal & External Start-ups from Ideation to Funding
3. Competitions – Identification & Mentoring
4. Conducting Competitions :- 30 Hour Hackathons, All India Hackathons etc.
5. Managing Student Clubs
6. Art & Music Festival
7. Skill Development / Value Added Courses
8. Societal Beneficial Projects

MSEC STUDENTS CLUBS

MSEC Students Clubs were initiated with the objective to provide a platform for students to discover, showcase and improve their interests, strengths and passion. There are 7 clubs in our college namely, AI Epoch Club, Eco Design Club, Adyant Coding Club, Renewables Club, Nodenova IOT Club, Dev Dynasty Web App Development Club and Product Development Club. Clubs foster vibrant student community in the campus by conducting variety of events and activities which include workshops, seminars, technical and non-technical events, campus benefit projects, long term projects such as SAE Baja etc that cater to diverse interests. Clubs help the students to collaborate with different disciplines and exchange knowledge with peer groups.

Vision of the department	Mission of the department
To impart qualitative education, to produce competent graduates in Electrical and Electronics Engineering with innovative research abilities and best suited to meet the industrial needs.	• To provide quality education to students in the field of Electrical and Electronics Engineering. • To inculcate innovative skills and improve research capabilities to bridge the gap between academia and industry. • To develop social responsibility with moral and professional ethical values.

PROGRAM OUTCOMES (PO) and PROGRAM SPECIFIC OUTCOMES (PSO)

PO1	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and

	receive clear instructions.
PO11	Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
PSO1	Able to understand the principles and working of electrical components, Circuits, Systems and Control that are forming a part of power generation, transmission, distribution, utilization, conservation and energy saving.
PSO2	Able to apply mathematical methodologies to solve problems related with electrical engineering using appropriate engineering tools and algorithms.
PSO3	Able to use knowledge in various domains to identify research gaps and hence toprovide solution which leads to new ideas and innovations.

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Department: Electrical and Electronics Engineering, R2024, CBCS

Curriculum for I to VIII Semesters

SEMESTER I

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
	U24IP101	Induction Program- Universal Human values						
THEORY								
1	U24EN101	Technical English	HSMC	30	2	0	0	2
2	U24MA101	Mathematical Foundation for Engineers	BSC	60	3	1	0	4
3	U24PH104	Physics for Electrical Engineering	BSC	45	3	0	0	3
4	U24CY103	Chemistry for Electrical and Electronics Engineering	BSC	45	3	0	0	3
5	U24TA101	தமிழர்மரபு / Heritage of Tamils	HSMC	15	1	0	0	1
6	U24ME104	Basic Civil and Mechanical Engineering	ESC	45	3	0	0	3
THEORY CUM PRACTICAL (TCP)								
7	U24CS101	Programming in C	ESC	90	2	0	4	4
PRACTICAL								
9	U24BS101	Physics and Chemistry Laboratory	BSC	60	0	0	4	2
10	U24TP110	Communication Skills Laboratory-I	HSMC	30	0	0	2	1
11	U24ED111	Design Thinking - Building Innovation & Solutioning Mindset	EDIC	15	0	0	1	0.5
TOTAL				**435**	**17**	**1**	**11**	**23.5**

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SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
	U24IP201	Value Added Course – II (Biology for Engineers)	VAC	30				
THEORY								
1	U24EN201	Professional English	HSMC	30	2	0	0	2
2	U24MA204	Mathematics for Electrical Engineering	BSC	60	3	1	0	4
3	U24TA201	தமிழரும் தொழில்நுட்பமும் Tamils and Technology	HSMC	15	1	0	0	1
4	U24PH204	Physics for Electrical Engineering -II	BSC	45	3	0	0	3
5	U24CY201	Green and Sustainable Chemistry	BSC	30	2	0	0	2
THEORY CUM PRACTICAL								
6	U24CS201	Python Programming	ESC	90	3	0	3	4.5
7	U24CE204	Engineering Graphics for Electrical and Electronics Engineering	ESC	75	3	0	2	4
PRACTICAL								
8	U24ME101	Engineering Practices Laboratory	ESC	60	0	0	4	2
9	U24TP210	Communication Skills Laboratory-II	HSMC	30	0	0	2	1
10	U24ED211	Design Thinking - Decoding Innovation Opportunity	EDIC	15	0	0	1	0.5
TOTAL				**450**	**17**	**1**	**12**	**24**

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SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
		VAC		30				
THEORY								
1	U24MA304	Transforms and Partial Differential Equations	BSC	60	3	1	0	4
2	U24EE301	Electrical Machines -I	PCC	45	3	0	0	3
3	U24MC313	Foreign Language (Japanese/French)	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
4	U24EE302	Electronic Devices and Circuits	PCC	90	3	0	3	4.5
5	U24CS308	Data Structures	PCC	75	3	0	2	4
6	U24EE303	Circuit Analysis	PCC	90	3	0	3	4.5
PRACTICAL								
7	U24EE304	Electrical Machines -I Laboratory	PCC	45	0	0	3	1.5
8	U24TP310	General Aptitude & Logical Reasoning	EEC	30	0	0	2	1
9	U24ED311	Innovation Tool Kits / Ignite	EDIC	15	0	0	1	0.5
10	U24RM312	Introduction to Problem Solving	RMC	15	0	0	1	0.5
TOTAL				**480**	**17**	**1**	**15**	**23.5**

#Mandatory Course is a Non-credit Course.

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SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
		VAC		30				
THEORY								
1	U24MA402	Linear Algebra and Numerical Methods	PCC	60	3	1	0	4
2	U24EE401	Electromagnetic Theory	PCC	45	3	0	0	3
3	U24EE402	Digital Logic Circuits	PCC	45	3	0	0	3
4	U24EE403	Electrical Machines - II	PCC	45	3	0	0	3
5	U24MC413	Indological studies	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
6	U24EE404	Integrated Circuits	PCC	90	3	0	3	4.5
PRACTICAL								
7	U24EE405	Electrical Machines - II laboratory	PCC	45	0	0	3	1.5
8	U24TP410	Critical and Creative Thinking Skills	EEC	30	0	0	2	1
9	U24ED411	Idea and Simulation Lab	EDIC	15	0	0	1	0.5
10	U24RM412	Conceptualization	RMC	15	0	0	1	0.5
TOTAL				420	17	1	10	21

#Mandatory Course is a Non-credit Course.

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SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
		VAC		30				
THEORY								
1	U24EE501	Transmission and Distribution	PCC	45	3	0	0	3
2	U24EE502	Measurements and Instrumentation	PCC	45	3	0	0	3
3		Professional Elective I	PEC	45	3	0	0	3
4		Professional Elective II	PEC	45	3	0	0	3
THEORY CUM PRACTICAL								
5	U24EE503	Microprocessor and Microcontroller	PCC	75	3	0	2	4
6	U24EE504	Control Systems	PCC	75	3	0	2	4
PRACTICAL								
7	U24TP510	Analytical and Logical Thinking Skills	EEC	30	0	0	2	1
8	U24EE505	Summer Internship*	EEC					1
9	U24RM512	Domain Specific Experiments /Methodology/Algorithms	RMC	30	0	0	2	1
10	U24MC513	Fitness for Life-Yoga, Food nutrition	MC#	30	0	0	2	0
11	U24ED511	Prototype & Market Validation	EDIC	15	0	0	1	0.5
TOTAL				**435**	**18**	**0**	**11**	**23.5**

***Two weeks Summer Internship carries one credit and it will be done during IV semester summer vacation and same will be evaluated in V semester.**

#Mandatory Course is a Non-credit Course.

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Department: Electrical and Electronics Engineering, R2024, CBCS

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
		VAC		30				
THEORY								
1	U24EE601	Power System Analysis	PCC	45	3	0	0	3
2	U24EE602	Digital Signal Processing	PCC	45	3	0	0	3
3		Open Elective I	OEC	45	3	0	0	3
4		Professional Elective III	PEC	45	3	0	0	3
5		Professional Elective IV	PEC	45	3	0	0	3
6	U24MC613	Integrated Disaster Management	MC#	30	2	0	0	0
THEORY CUM PRACTICAL								
7	U24EE603	Power Electronics	PCC	75	3	0	2	4
PRACTICAL								
8	U24RM612	Data Collection, Analysis And Interpretation	RMC	15	0	0	1	0.5
9	U24TP610	Employability Skills & Problem Solving Techniques	EEC	30	0	0	2	1
10	U24ED611	Business Management-Go to Market & Start-up Journey	EDIC	15	0	0	1	0.5
TOTAL				**405**	**20**	**0**	**6**	**21**

#Mandatory Course is a Non-credit Course.

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SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
		VAC		30				
THEORY								
1	U24MG701	Engineering Economics and Finance Management	HSMC	45	3	0	0	3
2		Open Elective II	OEC	45	3	0	0	3
3		Open Elective III	OEC	45	3	0	0	3
4		Professional Elective V	PEC	45	3	0	0	3
5		Professional Elective VI	PEC	45	3	0	0	3
6	U24MC713	Constitution Of India	MC	30	2	0	0	0
THEORY CUM PRACTICAL								
7	U24EE701	Renewable Energy Systems	PCC	75	3	0	2	4
8	U24EE702	Power System Operation and Control	PCC	75	3	0	2	4
PRACTICAL								
9	U24EE703	Summer Internship*	EEC					1
10	U24RM712	Testing	RMC	15	0	0	1	0.5
TOTAL				**420**	**23**	**0**	**5**	**24.5**

***Two weeks Summer Internship carries one credit and it will be done during VI semester summer vacation and same will be evaluated in VII semester.**

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SEMESTER VIII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
		VAC		30				
PRACTICAL								
1	U24EE801	Project Work	EEC	240	0	0	16	8
TOTAL				**240**	**0**	**0**	**16**	**8**
OVERALL TOTAL								**169**

VERTICAL 1: POWER ENGINEERING

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
1	U24EEPE1	Utilisation and Conversion of Electrical Energy	PEC	3	3	0	0	3
2	U24EEPE2	Smart Grid	PEC	3	3	0	0	3
3	U24EEPE3	Power Quality	PEC	3	3	0	0	3
4	U24EEPE4	Energy Management and Auditing	PEC	3	3	0	0	3
5	U24EEPE5	HVDC and FACTS	PEC	3	3	0	0	3
6	U24EEPE6	Protection and Switch Gear	PEC	3	3	0	0	3
7	U24EEPE7	High Voltage Engineering	PEC	3	3	0	0	3

VERTICAL 2: CONVERTERS AND DRIVES

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
1	U24EECD1	Special Electrical Machines	PEC	4	2	0	2	3
2	U24EECD2	Electrical Drives	PEC	4	2	0	2	3
3	U24EECD3	SMPS and UPS	PEC	4	2	0	2	3
4	U24EECD4	Power Electronics for Renewable Energy Sources	PEC	4	2	0	2	3
5	U24EECD5	Control of Power Electronic Circuits	PEC	4	2	0	2	3
6	U24EECD6	Multilevel Power Converter Circuits	PEC	4	2	0	2	3

VERTICAL 3: EMBEDDED SYSTEMS

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
1	U24EEES1	Embedded System Design	PEC	4	2	0	2	3
2	U24EEES2	Embedded Control for Electric Drives	PEC	4	2	0	2	3
3	U24EEES3	Smart System Automation	PEC	4	2	0	2	3
4	U24EEES4	VLSI Design	PEC	4	2	0	2	3
5	U24EEES5	Embedded System for Automotive Applications	PEC	4	2	0	2	3
6	U24EEES6	Embedded Processors	PEC	4	2	0	2	3

VERTICAL 4: ELECTRIC VEHICLE TECHNOLOGY

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
1	U24EEEV1	Battery Management System	PEC	3	3	0	0	3
2	U24EEEV2	Electric Vehicle Architecture	PEC	4	2	0	2	3
3	U24EEEV3	Design of EV Charging System	PEC	4	2	0	2	3
4	U24EEEV4	Testing of Electric Vehicle	PEC	3	3	0	0	3
5	U24EEEV5	Grid Integration Of Electric Vehicles	PEC	4	2	0	2	3
6	U24EEEV6	Intelligent Control of Electric Vehicles	PEC	4	2	0	2	3

VERTICAL 5: ADVANCED CONTROL

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
1	U24EEAC1	Process Modeling and Simulation	PEC	3	3	0	0	3
2	U24EEAC2	Computer Control of Processes	PEC	3	3	0	0	3
3	U24EEAC3	System Identification	PEC	3	3	0	0	3
4	U24EEAC4	Model Based Control	PEC	3	3	0	0	3
5	U24EEAC5	Non Linear Control	PEC	3	3	0	0	3
6	U24EEAC6	Optimal Control	PEC	3	3	0	0	3

VERTICAL 6: DIVERSIFIED COURSES

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
1	U24EEDC1	Design and Modelling of Renewable Energy Systems	PEC	3	3	0	0	3
2	U24EEDC2	Power System Transients	PEC	3	3	0	0	3
3	U24EEDC3	PLC and SCADA	PEC	3	3	0	0	3
4	U24EEDC4	Energy Storage Systems	PEC	3	3	0	0	3
5	U24EEDC5	Hybrid Energy Technology	PEC	3	3	0	0	3

EDIC – Entrepreneurial Development and Innovation Courses

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
1	U24ED111	Design Thinking - Building Innovation and Solutioning Mindset	EDIC	15	0	0	1	0.5
2	U24ED211	Design Thinking - Decoding Innovation Opportunity	EDIC	15	0	0	1	0.5
3	U24ED311	Innovation tool kits	EDIC	15	0	0	1	0.5
4	U24ED411	Idea & simulation lab	EDIC	15	0	0	1	0.5
5	U24ED511	Prototype and Market Validation	EDIC	15	0	0	1	0.5
6	U24ED611	Business Management - Go To Market & Start-up Journey	EDIC	15	0	0	1	0.5

Placement Training by EduTech

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
1	U24TP110	Communication Skills Laboratory-II Laboratory-I	HSMC	30	0	0	2	1
2	U24TP210	Communication Skills Laboratory-II	HSMC	30	0	0	2	1
3	U24TP310	General Aptitude & Logical Reasoning	EEC	30	0	0	2	1
4	U24TP410	Critical and Creative Thinking Skills	EEC	30	0	0	2	1
5	U24TP510	Analytical and Logical Thinking Skills	EEC	30	0	0	2	1
6	U24TP610	Employability Skills & Problem Solving Techniques	EEC	30	0	0	2	1

RMC – Research Methodology Courses

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	TCP	PERIODS PER WEEK			CREDITS
					L	T	P	
1	U24RM312	Introduction to Problem Solving	RMC	15	0	0	1	0.5
2	U24RM412	Hypothesis	RMC	15	0	0	1	0.5
3	U24RM512	Domain Specific Experiments/ Methodology/Algorithms	RMC	30	0	0	2	1
4	U24RM612	Technical Writing and Research Ethics	RMC	15	0	0	1	0.5
5	U24RM712	Data Collection, Analysis and Interpretation	RMC	15	0	0	1	0.5

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CATEGORY OF COURSES AND CREDIT DISTRIBUTION

S. No.	Subject Area	Credits per Semester								Total Credits
		1	2	3	4	5	6	7	8	
1	HSMC	4	4	0	0	0	0	3	0	11
2	BSC	12	9	4	0	0	0	0	0	25
3	ESC	7	10.5	0	0	0	0	0	0	17.5
4	PCC	0	0	17.5	19	14	10	8	0	68.5
5	PEC	0	0	0	0	6	6	6	0	18
6	OEC	0	0	0	0	0	3	6	0	9
7	EEC	0	0	1	1	2	1	1	8	14
8	MC			√	√	√	√	√		0
9	EDIC	0.5	0.5	0.5	0.5	0.5	0.5			3
10	RMC			0.5	0.5	0.5	1	0.5		3
Total		23.5	24	23.5	21	23	21.5	24.5	8	**169**

HSMC - Humanities, Social Sciences and Management Courses

BSC - Basic Sciences Courses

ESC - Engineering Sciences Courses

PCC - Professional Core Courses

PEC - Professional Elective Courses

OEC - Open Elective Courses

EEC - Employability Enhancement Courses

MC - Mandatory Courses / Non-Credit

EDIC - Entrepreneurial Development and Innovation Courses

RMC - Research Methodology Courses

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U24IP101	INDUCTION PROGRAMME
Modules	
1	**Universal Human Values I (UHV I)**
To help the student to see the need for developing a holistic perspective of life.	
To sensitize the student about the scope of life – individual, family (interpersonal relationship), society and nature/existence.	
Strengthening self-reflection.	
To develop more confidence and commitment to understand, learn and act accordingly.	
2	**Physical Health and Related Activities**
To understand the basic principles to remain healthy and fit.	
To practice them through exercise, games etc.	
Involving health center, staff, sports coaches, faculty, staff, students sports team etc.	
3	**Familiarization of Department/ Branch and Innovation**
To get a broad perspective about goals of institution, department/branch in the context of the world, the nation, the state, and region.	
To get an idea of how the institution operates to fulfill its goals through various disciplines of education, research, development, and practice.	
To get an idea of how students can connect /participate in it.	
4	**Visit to a Local Area**
For a student to relate to the social environment of the educational institution as well as the surroundings, a place wherein their most significant years students will scribble some indelible memories, an absolute necessity is generated for city visits to let students understand the environment through interaction with the people, place and history.	
5	**Lectures by Eminent People**
Guest lectures are a great way to help the students gain a perspective on many different things in the world. Eminent personalities in different fields of expertise like academics, sports, industry, business etc. can share their story and talk about important subjects like career, entrepreneurship, government policies and technology	
6	**Proficiency Modules**
This module is to help fill the gaps in basic competency required for further inputs to be absorbed. It includes efforts to make the student proficient in interpersonal communication and expression.	
7	**Literature / Literary Activities**
To develop the clarity of humanistic culture and its expression through literature, students may be exposed to local, regional, national, or international literature. It will help them in understanding traditional and contemporary values and thought.	
8	**Creative Practices**
This module is to help develop the clarity of humanistic culture and its creative, joyful expression. The students can choose one skill related to visual arts or performing arts.	
9	**Extra-Curricular Activities**
Wellness Sessions	
10	**Extra Activities**
Anti-Ragging Briefing	
Informal Interactions	
Club / Council / Committee/ Scholarship Briefings	

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U24EN101	TECHNICAL ENGLISH	L	T	P	C
		2	0	0	2

Course Objectives

1	To improve the communicative competence of learners
2	To develop the basic reading and writing skills of first year engineering and technology students.
3	To help learners develop their speaking skills and speak fluently in real contexts.
4	To help learners use language effectively in professional contexts.
5	To help learners develop their listening skills, which will enable them to listen to lectures and comprehend them by asking questions; seeking clarifications.

UNIT 1 INTRODUCTION TO EFFECTIVE COMMUNICATION — **6**

What is effective communication? Why is communication critical for excellence during study, research and work? Describe the seven C's of effective communication - As a learner explain the need to do to enhance your English language and communication skills to get the best out of this course

DEVELOPING COMMUNICATION SKILLS:
Listening: Listening for taking notes and seeking clarifications (classroom lectures)
Speaking: Self- introduction, short conversations in formal and informal contexts
Reading: Comprehension of short technical texts – Skimming and scanning
Writing: Precis Writing, Email Writing, Literature review
Grammar: Tenses, Question types: Wh / Yes or No
Vocabulary development: Root words – Prefixes & Suffixes, Standard Abbreviations & Acronyms.

UNIT 2 NARRATION AND SUMMATION — **6**

Speaking: Narrating personal experience / Events
Reading: Reading biographies, travelogues, newspaper reports
Writing: Paraphrasing, Formal and informal Letter
Grammar: Prepositions, Subject-verb Agreement
Vocabulary development: One-word substitution

UNIT 3 LANGUAGE DEVELOPMENT — **6**

Speaking: Product and process description
Reading: Reading reviews, advertisements
Writing: Writing Instructions, Report writing (Industrial report, Survey report & Accident report)
Grammar: Discourse Markers, Degrees of comparison
Vocabulary development: Compound nouns, Homophones and homonyms

UNIT 4 RECOMMENDATIONS AND TRANSCODING — **6**

Speaking: Just a minute, greeting in conversation
Reading: Non-verbal communication (tables, pie charts etc.)
Writing: Writing recommendations, Transferring information (chart, graph etc.)
Grammar: Error corrections
Vocabulary development: Fixed and semi fixed expressions

UNIT 5 LANGUAGE FOR WORKPLACE — **6**

Speaking: Short presentations on Technical topics
Reading: Reading Editorial columns
Writing: Writing minutes of meeting
Grammar: Simple, compound and complex sentences
Vocabulary development: Verbal analogies

TOTAL PERIODS — **30**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	To use appropriate words in a professional context
CO2	To gain understanding of basic grammatical structures and use them in the right context.
CO3	To read and infer the denotative and connotative meanings of technical texts
CO4	To write definitions, descriptions, narrations and essays on various topics
CO5	To participate effectively in informal conversations, introduce themselves and their friends and express opinions in English

TEXT BOOKS

English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)

English for Science & Technology Cambridge University Press, 2021.

English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES

Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.

A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.

English For Technical Communication (With CD) By Aysha Viswamohan, McGraw Hill Education, ISBN: 0070264244.

Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.

Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

CO-PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	-	3	-	2	-	-	-
AVG	-	-	-	-	-	-	-	0.4	1.6	2.6	-	0.4	-	-	-

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U24MA101	MATHEMATICAL FOUNDATION FOR ENGINEERS	L	T	P	C
		3	1	0	4

Course Objectives

1	To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
2	To familiarize the students with differential calculus.
3	To familiarize the student with functions of several variables. This is needed in many branches of engineering.
4	To make the students understand various techniques of integration.
5	To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT 1 MATRICES — **9+3**

Introduction - characteristic equation - Eigenvalues and Eigenvectors of a real matrix –Properties of Eigenvalues and Eigenvectors (without proof) – Cayley - Hamilton theorem (statement and applications only) – Diagonalization of matrices by orthogonal transformation –Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

MATLAB: To find matrix operations addition,multiplication ,transpose and inverse of the matrix and also to find eigenvalue and corresponding eigenvectors.

UNIT 2 DIFFERENTIAL CALCULUS — **9+3**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum,product, quotient, chain rules) - The equations of tangent line and normal line, velocity and acceleration - Interval of increasing and decreasing functions-Maxima and Minima of functions of one variable - Intervals of concavity and convexity.

MATLAB: To determine maxima and minima for one variable.

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

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

MATLAB: To determine maxima and minima for two variables.

UNIT 4 INTEGRAL CALCULUS — **9+3**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration : Integration by parts, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

MATLAB: To find the area using single integral.

UNIT 5 MULTIPLE INTEGRALS — **9+3**

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

MATLAB: To find the area and volume using double and triple integral.

TOTAL PERIODS — **60**

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Course Outcomes	
At the end of the course, the student will be able to	
CO1	Use the matrix algebra methods for solving practical problems
CO2	Apply differential calculus tools in solving various application problems.
CO3	Able to use differential calculus ideas on several variable functions.
CO4	Apply different methods of integration in solving practical problems
CO5	Apply multiple integral ideas in solving areas, volumes and other practical problems

TEXT BOOKS

1.Veerarajan.T,"Engineering Mathematics,for semester I and II", Updated second Edition,TataMcgraw Hill Education , private Limited ,2019.

2.GrewalB.S and GrewelJ.S .“Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 45th Edition, 2020.

3.Won Y.Yang,YoungK.Choi,JaekwonKim,ManCheol Kim, H.JinKim,Taeho Im, "Engineering Mathematics with MATLAB" CRC Press Publishers , I st Edition , 2017.

REFERENCES

1.Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.

2.Kandasamy.P.,Thilagavathy.K and Gunavathy.K.,"Engineering Mathematics For First Year B.E/B.Tech,Seventh Edition 2008 S.Chand and Co.,New Delhi.

3.Bali. N.P and Manish Goyal, “A Textbook of Engineering Mathematics, Semester-I”, ninth Edition, Laxmi Publications Pvt. Ltd, 2016.

4. Engineering Mathematics: First year.Calculus and Analytical Geometry,Volume,M.K.Venketaraman,National Publishing company,1965.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	1	-
CO5	3	3	3	1	-	-	-	-	-	-	-	-	-	1	-
AVG	3	2.6	2.6	0.6	0.2	-	-	-	-	-	-	-	-	1	-

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U24PH104	PHYSICS FOR ELECTRICAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

1	To introduce the fundamental concepts of electromagnetism, including Maxwell's equations and the properties of electromagnetic waves.
2	To introduce the concept of lasers and their applications in various fields, including telecommunications, manufacturing, and medicine.
3	To establish a sound grasp of knowledge on different optical properties of materials, and how they can be engineered for specific applications.
4	Learn how transistors are used as amplifiers, switches, and building blocks in electronic circuits, and analyze transistor circuits through mathematical modeling and simulation.
5	To make the students to understand the basics of dielectric materials and insulation.

UNIT 1 ELECTROMAGNETIC WAVES	**9**

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception- Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence

UNIT 2 ELECTRICAL PROPERTIES OF MATERIALS	**9**

Classical free electron theory - Expression for electrical conductivity – Thermal conductivity, expression - Quantum free electron theory : Fermi- Dirac statistics – Density of energy states – Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode -Electron in periodic potential – Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.Energy bands in solids – tight binding approximation - Electron effective mass – concept of hole.

UNIT 3 SEMICONDUCTORS AND TRANSPORT PHYSICS	**9**

Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – Carrier transport in Semiconductors: Drift, mobility and diffusion – Hall effect and devices – Ohmic contacts – Schottky diode.

UNIT 4 TRANSISTORS AND POWER DEVICES	**9**

PN diode, Zener diode, Tranisistor-CE,CC,CB amplifiers,JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage - Channel length modulation MOSFET Characteristics – Comparison of MOSFET with JFET. Power Devices-UJT, SCR, Diac, Triac.

UNIT 5 DIELECTRICS	**9**

Electrical susceptibility – Dielectric constant – Electronic, ionic, orientation and space charge polarization – Frequency and temperature dependence of polarization – Internal field – Clausius – Mosotti relation (derivation) – Physical significance of Maxwell's equations - Dielectric loss – Dielectric breakdown – Uses of dielectric materials in capacitor and transformer- Dielectric materials and its applications.

TOTAL PERIODS	**45**

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Course Outcomes	
At the end of the course, the student will be able to	
CO1	Solve problems related to wave equations, calculate properties such as wavelength, frequency, and wave velocity, and discuss real-world applications of electromagnetic waves in technologies like radio communication, radar, and medical imaging.
CO2	Explain phenomena such as interference, diffraction, and laser amplification, and understand how these concepts are applied in devices like optical fibers, spectrometers, and laser pointers.
CO3	Demonstrate an understanding of the working principles of various optical devices such as lenses, mirrors, and photodetectors, and discuss their applications in fields like imaging,telecommunications, and spectroscopy.
CO4	Demonstrate an understanding of the working principles of basic diodes and their usage in upgraded electronic devices such as FET,SCR and the their working
CO5	Discuss practical applications of dielectric materials such as capacitors, insulating coatings, and dielectric resonators in electronic circuits, power systems, and telecommunications.

TEXT BOOKS

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017

2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.

3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGrawHill (Indian Edition), 2017

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1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009

2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004

3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019

4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015

5. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. SpringerVerlag, 2012.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-
AVG	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24CY103	CHEMISTRY FOR ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

1	To make the students to be aware of various treatment processes of water for potable and industrial purposes.
2	To familiarize the knowledge about Thermodynamics and Batteries used in electronic industry.
3	To introduce the basic concepts of phase rule and Nano materials with its applications.
4	To apply the knowledge on usage of electrochemical derivations with its applications to form sensor like materials.
5	To impart the principles and applications of sensors and spectroscopy in various industries.

UNIT 1 WATER TECHNOLOGY — **9**

Introduction-Characteristics of water – Hardness – Types of hardness - Estimation by EDTA (problems on hardness) –Alkalinity – Determination (problems on alkalinity) – Boiler feed water – Requirements – Priming and foaming, Scales and sludges Caustic embrittlement and Boilercorrosion – Application - External conditioning (Ion Exchange,zeolite) – Internal conditioning (Carbonate,phosphate,calgon,sodium aluminate conditioning) — Brackish water treatment - Reverse osmosis.

UNIT 2 CHEMICAL THERMODYNAMICS AND ENERGY STORAGE DEVICES — **9**

Introduction - Thermodynamic process (isothermic, isobaric, isochoric and adiabatic processes) - Internal energy – first law of thermodynamics (Mathematical statement& limitation) - Enthalpy - Second law of thermodynamics - Entropy - Entropy change of an ideal gas & problems - Free energy - work function – Gibbs Helmholtz equation-Van't Hoff isotherm-derivation, applications. Batteries – Types of batteries – Characteristics-Definition of Electricity storage density and power discharge rate--Principle, working and applications of lead-acid battery, Ni–Cd and lithium ion batteries – Fuel cell.

UNIT 3 PHASE RULE AND NANOMATERIALS — **9**

Phase rule - Introduction, definition of terms - phase, components and degree of freedom - phase diagram- one component system -water system - reduced phase rule - thermal analysis and cooling curves - two component systems - lead-silver system. Nanomaterials-Classification-Properties and uses-. Synthesis–Top down method (Ball milling)and Bottom up methods –Laser Evaporation method -chemical vapour deposition, - Applications of nanomaterials - Application - A Case Study – Medicine, Agriculture, Industry and Electronics.

UNIT 4 ELECTROCHEMISTRY — **9**

Introduction-Electrodes-Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes –Standard Hydrogen electrode - Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox-Fe^{2} + vs dichromate and precipitation – Ag + vs Cl - titrations) and conduct metric titrations (acid-base – HCl vs, NaOH) titrations,

UNIT 5 SENSORS AND SPECTROSCOPY — **9**

Sensors, types of sensors. Chemical Sensors – characteristics and elements - Carbon dioxide, glucose detector, Mosquito, and Pregnancy test. Electrochemical sensors – potentiometric sensors, amperometric sensors, polarization techniques - Working Principles and Applications. Integrated and Smart sensors, Definitions and applications of various smart sensors-types- , Humidity sensor, UV sensor and Ultra Sonic Sensors. Introduction-importance of spectroscopy-types of spectroscopy-Spectrum-Electromagnetic radiation-Electromagnetic spectrum-Absorption of Electromagnetic radiation-Types of energy present in molecules-Molecular spectra-Energy level diagram-Ultraviolet (UV) and visible spectroscopy-Infra red spectroscopy.

TOTAL PERIODS — **45**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Understand the basic principles of water quality parameters, and analyse the various water treatment processes for domestic and industrial applications.
CO2	Understand the basic knowledge on the basic concepts of thermodynamics and can be able to recognize the different energy storage devices.
CO3	Develop a deep knowledge on understanding of the basic concepts of phase rule and nano materials with its applications.
CO4	Apply the basic principles of electrochemistry and execute the applications in industries.
CO5	Have a thorough knowledge on sensors and spectroscopy with its vast applications.

TEXT BOOKS

1. P. C. Jain and Monica Jain, “Engineering Chemistry”, 17th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2018.

2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.

3. S.S. Dara, “A Text book of Engineering Chemistry”, S. Chand Publishing, 12th Edition, 2018.

4. Annalisa Bonfiglo and Danilo De Rossi, Wearable Monitoring Systems, Springer, 2011

5.Zhang and Yuan-Ting, Wearable Medical Sensors and Systems,Springer, 2013

6. Edward Sazonov and Micheal R Neuman, Wearable Sensors: Fundamentals,

7. Mehmet R. Yuce and JamilY.Khan, Wireless Body Area Networks Technology, Implementation applications,Pan Stanford Publishing Pte.Ltd, Singapore, 2012

REFERENCES

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Text book of nanoscience and nanotechnology”, Universities Press-IIM Series in Metallurgy and Materials Science, 2018.

2. O.G. Palanna, “Engineering Chemistry” McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.

3.Hagen Klauk, “Organic Electronics: Materials, Manufacturing and Applications”, Wiley-VCH, 2006.

4. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

5.Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar Venkatasubramanian, Body,Area Networks Safety, Security, and Sustainability, Cambridge University Press, 2013

6.Guang-Zhong Yang, Body Sensor Networks, Springer, 2006

E-LINK : https://www.mdpi.com/1618644

E-JOURNAL: Flexible thermoelectric generator and energy management electronics powered by body heat

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	2	2	2	1	3	1	-	3		-	-
CO2	3	2	1	1	1	1	1	-	1	1	-	3		-	-
CO3	3	-	1	-	1	-	2	-	1	1	-	3		-	-
CO4	3	1	2	-	2	2	2	-	2	1	-	3	-	-	-
CO5	3	1	1	-	1	1	2	-	1	1	-	3	-	-	-
AVG	3	1.25	1.2	1	1.4	1.5	1.8	1	1.6	1	-	3	-	-	-

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24TA101	தமிழர்மரபு HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

அலகு I மொழி மற்றும் இலக்கியம் **UNIT I LANGUAGE AND LITERATURE**	**3**
இந்தியமொழிக்குடும்பங்கள் – திரொவிடமொழிகள் – தமிழ்ஒருசெம்மொழி – தமிழ்செல்விலக்கியங்கள் – சங்கஇலக்கியத்தின் சமயசார்பற்றதன்மை – சங்கஇலக்கியத்தில் பகிர்தல்அறம் – திருக்குறளில் மேலாண்மைகருத்துக்கள் – தமிழ்க்காப்பியங்கள், தமிழகத்தில் - சமணபௌத்தசமயங்களின்தாக்கம் - பக்திஇலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் – தமிழில் நவீனஇலக்கியத்தின்வளர்ச்சி – தமிழ்இளகியவளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு Language Families in India - Dravidian Languages – Tamil as aClassical 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	
அலகு II மரபு – பாறைஓவியங்கள் முதல் நவீனஓவியங்கள்வரை - சிற்பக்கலை **UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART - SCULPTURE**	**3**
நடுகல்முதல்நவீனசிற்பங்கள்வரை - ஐம்பொன்சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள்தயாரிக்கும் கைவினைப்பொருட்கள், பொம்பைகள் - தேர்செய்யும்கலை - சுடுமண்சிற்பங்கள் - நாட்டுப்புறதெய்வங்கள் - குமரிமுனையில்திருவள்ளுவர்சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூகபொருளாதாரவாழ்வில் கோவில்களின்பங்கு 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	
அலகு III நாட்டுப்புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள் **UNIT III FOLK AND MARTIAL ARTS**	**3**
தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஒயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின்விளையாட்டுகள் Therukoothu, Karagattam, VilluPattu, KaniyanKoothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.	
அலகு IV தமிழர்களின் திணைக்கோட்பாடுகள் **UNIT IV THINAI CONCEPT OF TAMILS**	**3**
தமிழகத்தின்தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்கஇலக்கியத்தில் அகம்மற்றும் புறக்கோட்பாடுகள் – தமிழர்கள்போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில்தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககாலநகரங்களும் துறைமுகங்களும் – சங்ககாலத்தில் ஏற்றுமதிமற்றும் இறக்குமதி – கடல்கடந்தநாடுகளில் சோழர்களின்வெற்றி	

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	
அலகு V இந்தியதேசியஇயக்கம் மற்றும் இந்தியபண்பாட்டிற்குத்தமிழர்களின்பங்களிப்பு **UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	**3**
இந்தியவிடுதலைப்போரில்தமிழர்களின்பங்கு – இந்தியாவின் பிறபகுதிகளில் தமிழ்பண்பாட்டின்தாக்கம் - சுயமரியாதைஇயக்கம் - இந்தியமருத்துவத்தில், சித்தமருத்துவத்தின்பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ்புத்தகங்களின் அச்சுவரலாறு Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.	
TOTAL PERIODS	**15**

TEXT BOOK CUM REFERENCE BOOKS

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

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24ME104	BASIC CIVIL AND MECHANICAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

1	To provide the students an illustration of the significance of the Civil and Mechanical Engineering Profession in satisfying the societal needs.
2	To help students acquire knowledge in the basics of surveying and the materials used for construction.
3	To provide an insight to the essentials of components of a building and the infrastructure facilities.
4	To explain the component of power plant units and detailed explanation to IC engines their working principles.
5	To explain the Refrigeration & Air-conditioning system.

UNIT: 1 PART A: OVERVIEW OF CIVIL ENGINEERING	**9**
Civil Engineering contributions to the welfare of Society - Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering – National building code – terminologists: Plinth area, Carpet area, Floor area, Buildup area, Floor space index - Types of buildings: Residential buildings, Industrial buildings.	
UNIT: 1 PART B:OVERVIEW OF MECHANICAL ENGINEERING	
Overview of Mechanical Engineering - Mechanical Engineering Contributions to the welfare of Society – Specialized sub disciplines in Mechanical Engineering – Manufacturing, Automation, Automobile and Energy Engineering - Interdisciplinary concepts in Mechanical Engineering.	
UNIT: 2 SURVEYING AND CIVIL ENGINEERING MATERIALS	**9**
Surveying: Objects – Classification – Principles – Measurements of Distances and angles – Leveling – Determination of areas– Contours. Civil Engineering Materials: Bricks – Stones – Sand – Cement – Concrete – Steel - Timber - Modern Materials, Thermal and Acoustic Insulating Materials, Decorative Panels, Water Proofing Materials. Modern uses of Gypsum, Pre-fabricated Building component (brief discussion only)	
UNIT: 3 BUILDING COMPONENTS AND INFRASTRUCTURE	**9**
Building plans – Setting out of a Building - Foundations: Types of foundations - Bearing capacity and settlement – Brick masonry – Stone Masonry – Beams – Columns – Lintels – Roofing – Flooring – Plastering. Types of Bridges and Dams – Water Supply Network - Rain Water Harvesting – Solid Waste Management - Introduction to Highways and Railways - Introduction to Green Buildings.	
UNIT: 4 INTRODUCTION TO THERMODYNAMICS	**9**
Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work. First law of thermodynamics – application to closed and open systems, internal energy, specific heat capacities, enthalpy, steady flow process with reference to various thermal equipments (only description and no problems). Second law of thermodynamics – Kelvin-Planck's and Clausius statements of second law. Reversibility and irreversibility. Carnot cycle, reversed carnot cycle, efficiency, Performance and applications (only description and no problems).	
UNIT: 5 INTERNAL COMBUSTION ENGINES AND POWER PLANTS	**9**
Classification of Power Plants- Working principle of steam, Gas, Diesel, Hydro -electric and Nuclear Power plants- Internal combustion engines as automobile power plant – Four stroke and two stroke Engines – Working principle of Petrol and Diesel Engines – Comparison of four stroke and two stroke engines. Working principle of Boilers-Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps – Comparison Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps.	
TOTAL PERIODS	**45**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Understanding profession of Civil and Mechanical engineering.
CO2	Summarize the planning of building, infrastructure and working of Machineries.
CO3	Apply the knowledge gained in respective discipline
CO4	Illustrate the ideas of Civil and Mechanical Engineering applications.
CO5	Appraise the material, Structures, machines and energy.

TEXT BOOKS

1. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018
2. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain,Basic Civil Engineering, Lakshmi Publication, First edition, 2004
3. R K Rajput,Basic Mechanical Engineering, Lakshmi Publication, Fourth edition, 2007

REFERENCES

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2018.
2. Ramamrutham S., “Basic Civil Engineering”, Dhanpat Rai Publishing Co.(P) Ltd, 2013.
3. Seetharaman S., “Basic Civil Engineering”, Anuradha Agencies, 2005.
4. Shantha Kumar SRJ., “Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, 2000.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	1	-	-	-	2	-	-	-
CO2	2	2	1	-	-	-	-	1	-	-	-	2	-	-	-
CO3	2	1	1	-	-	-	-	1	-	-	-	2	-	-	-
CO4	2	2	1	-	-	-	-	1	-	-	-	2	-	-	-
CO5	2	2	1	-	-	-	-	1	-	-	-	2	-	-	-
AVG	2	2	1	-	-	-	-	1	-	-	-	2	-	-	-

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24CS101	PROGRAMMING IN C	L	T	P	C
		2	0	4	4

Course Objectives

1	To understand the structure and syntax of C Language
2	To develop C programs using arrays and strings
3	To develop modular applications in C using functions
4	To develop applications in C and apply the concept code reusability using pointers and structures
5	To do input/output and understand the basics of file handling mechanisms in C .

UNIT 1 BASICS OF C PROGRAMMING — **6+12**

Introduction to Problem Solving: Algorithm, Flowchart, Pseudocode. Programming Basics: Applications of C Language-Structure of C program -Identifiers-Data Types – Variables-Constants – Keywords – Operators – Input/output statements, Decision making statements - Looping statements - Expressions-Precedence and Associativity – Expressions Evaluation, Type conversions.

Practical:

1.Algorithm, pseudocode, flowcharts for simple scientific and statistical problems
2.I/O statements, operators, expressions and decision-making constructs(if, if-else, break, continue
3.C Programming using Simple statements and expressions
4.Create Looping statements- for, while, do-while.

Case Study: Develop a system to manage student records, including personal information, academic performance, and attendance. Enrich with appropriate Algorithm ,a neat Flowchart, Pseudocode.

UNIT 2 ARRAYS AND STRINGS — **6+12**

Arrays: Introduction – Declaration of Arrays – Storing Values in Array – Accessing elements of the Array– Calculating the length of the Array – Operations on Array – one dimensional arrays – Two dimensional Arrays – String: Declaring, Initializing, Printing and reading strings, String input and output functions, String handling functions, Arrays of strings.

Practicals:

1.Create simple programs for one dimensional and two dimensional arrays.
2.Practice all string handling functions.

Case Study : Use arrays for Storing Student Information,for Managing Grades ,for Attendance Tracking .

UNIT 3 FUNCTION AND STORAGE CLASS — **6+12**

Library functions: Math functions, other miscellaneous functions such as getchar(), putchar(), malloc(), calloc(). User defined functions - function definition, functions declaration, function call, scope of variables - local variables, global variables. Function parameters: Parameter passing- call by value & call by reference, function return values, Passing arguments to Functions. Recursive functions. Storage classes-auto, register, static, extern, scope rules.

Practical:

1.Implementation of C Program using user defined functions (Pass by value and Pass by reference).
2.Implementation of Recursion Function

Case Study : Use functions to add and display more students,calculate average grades,sort students by average grade.

UNIT 4 STRUCTURES AND POINTERS — **6+12**

Basics of structures-structure data types, type definition, accessing structures, Structure operations, Complex structures-nested structures, structures containing arrays, Array of structures, Structures and Functions, Unions. Pointers: Understanding Computer Memory –Memory Management-Dynamic memory Allocation-Memory leaks-Introduction to Pointers – declaring Pointer Variables – Pointer Expressions and Pointer Arithmetic – Null Pointers – Generic Pointers - Passing Arguments to Functions using Pointer – Pointer and Arrays –Use of pointers in self-referential structures, notion of linked list

Practical:

1.C Programming using Pointers.
2.Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

Case Study: Use complex structures operation in a student management system	
UNIT 5 MACROS AND FILE PROCESSING	**6+12**
Preprocessor Directives: Introduction to preprocessor directives in Simple macros using `#define`, conditional macros using `#ifdef`, `#ifndef`, `#endif`, `#else`, and `#elif`. Files: Introduction to Files – Opening a file – Reading Data from Files – Writing Data to Files – Detecting the End-of-file –Closing a file – Sequential access file-Random Access Files – Binary Files – Command line arguments. **Practical:** 1.Programming using macros and storage classes 2.Implementation of Command line Arguments like argc,argv 3.Files- reading and writing, file operations, random access 4.Develop an application for any one of the following scenarios : Student Management System /Stock Management System/ Banking Application / Ticket Reservation System **Case Study:** Make a separate file for the student management system to read,write,delete ,access data from it.	
TOTAL PERIODS	**90**

Course Outcomes

At the end of the course, the student will be able to	
CO1	Create simple applications in C using basic constructs
CO2	Create C programs using arrays and strings
CO3	Create modular applications in C using functions.
CO4	Create modular applications in C using structures and pointers.
CO5	Create applications using macros and file processing

TEXT BOOKS

1. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.

2. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016

REFERENCES

1. Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018.

2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020

3. Byron S. Gottfried, “Schaum’s Outline of Theory and Problems of Programming with C”, McGraw-Hill Education, 1996.

4.. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013.

5. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	1	-	-	1
CO2	2	2	-	-	-	-	-	-	-	-	-	1	-	-	1
CO3	2	2	2	2	-	-	-	1	-	1	-	1	-	-	1
CO4	2	2	2	-	1	1	-	-	1	-	1	1	-	-	1
CO5	2	-	2	2	1	1	-	1	1	1	1	1	-	-	1
AVG	2	2	2	2	1	1	-	1	1	1	1	1	-	-	1

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24BS101	PHYSICS & CHEMISTRY LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives	
1	This session aims to provide the learners hands-on-training on the practical applications of the concepts learnt in the theoretical sessions on bending of beams, application of laser,. The course will also train the learner to observe good lab practices, record readings and analyse and interpret the results.
2	This session aims to provide the learners hands-on-training on the practical applications of the concepts learnt in the theoretical sessions on water treatment, electrochemistry, lubricants, composites and nanomaterials using simple chemical methods. The course will also train the learner to observe good lab practices, record readings and graphically represent the results, as well as analyse and interpret the influence of reaction conditions on the results.

LIST OF EXPERIMENTS

PHYSICS LABORATORY	
1	Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects
2	Simple harmonic oscillations of cantilever.
3	Uniform bending – Determination of Young's modulus
4	Laser- Determination of the wave length of the laser using grating
5	Ultrasonic Interferometer-Determination of compressibility of given liquid
6	a) Optical fibre -Determination of Numerical Aperture and acceptance angle b) Compact disc- Determination of width of the groove using laser.
7	Non-uniform bending - Determination of Young's modulus

CHEMISTRY LABORATORY	
1	Estimation of mixture of acids by conductometric titration
2	Estimation of iron by potentiometric titration
3	Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
4	Determination of alkalinity in a water sample
5	Estimation of hardness of water by EDTA method
6	Estimation of hydrochloric acid by pHmetric method
7	Determination of chloride content of water sample by Argentometric method
8	Determination of viscosity of a polymer using ostwald's viscometer
9	Estimation of iron content using spectrophotometer
TOTAL PERIODS	**60**

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Course Outcomes	
At the end of the course, the student will be able to	
CO1	Gain knowledge about torque and rigidity modulus of a material and understand the principles of simple harmonic motion and bending of beams
	Estimate the strength of given mixture of acids using conductance measurements under the principle of conductometric titration and Estimate the strength of given iron using EMF measurements with the help of potentiometer and have a knowledge on redox reaction
CO2	Comprehend the principles of stress,strain& elasticity of the given materials & Gain knowledge about diffraction of laser light.
	Estimate the strength of given salt using conductance measurements under the principle of precipitation titration and Determine and estimate the amount of different types of alkalinities in water.
CO3	Understand how sound waves are traveling in liquid medium and comprehend the light accepting power of given optical fibre and its transmission
	Employ complexometric titrations to estimate total hardness of a water sample and Determine the amount of chloride present in water using Argentometric method.

TEXTBOOKS

1. Mechanics Part I and Part II, Narayanamoorthy National Publishing Company, 2001
2. Optics -Dr.Murugesan
3. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Textbook of Quantitative Chemical Analysis.

REFERENCES

1. Engineering physics Visvesvaraya Technological University
2. Vogel's Textbook of Quantitative Chemical Analysis (2009)

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24TP110	COMMUNICATION SKILLS LABORATORY-1	L	T	P	C
		0	0	2	1

Course Objectives	
1	To improve the communicative competence of learners
2	To help learners use language effectively in academic /work contexts
3	To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
4	To use language efficiently in expressing their opinions via various media.
5	To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.

PART A	6
Listening: Listening as a key skill- its importance -Listening for general information-specific details - Introduction to classmates – Audio / video (formal & informal) Speaking: Making telephone Calls, Introducing a friend, Making polite requests, polite offers and replying to polite requests - Understanding basic instructions for filling out a bank application Reading: The ILETS Reading Section - reading passages Writing: Write a descriptive paragraph	

PART B	6
Listening: Listen to a process information Speaking: Small talk on general topics and current scenario Reading: The TOEFL Reading Section includes two reading passages, each approximately 700 words long, with 10 questions per passage Writing: Itinerary Writing	

PART C	6
Listening: Listen to event narration and stories **Speaking:** Picture description- describing locations in workplaces **Reading:** Short Stories **Writing:** Essay Writing	

PART D	6
Listening: Listening to discussions and debates **Speaking:** Role Play **Reading:** The TOEFL Reading Section includes two reading passages, each approximately 700 words long, with 10 questions per passage **Writing:** Paraphrasing	

PART E	6
Listening: listening/watching documentaries **Speaking:** Formal and informal talk -making predictions- talking about a given topic-giving opinions. **Reading:** The IELTS Reading Section - reading passages **Writing:** Developing Hints	

TOTAL PERIODS	30

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Course Outcomes	
At the end of the course, the student will be able to	
CO1	To listen and comprehend complex academic texts
CO2	To speak fluently and accurately in formal and informal communicative contexts
CO3	To express their opinions effectively in both oral and written medium of communication
CO4	Ability to listen/view and comprehend different spoken discourses/excerpts different accents and to speak clearly in simple language
CO5	Ability to read and evaluate texts critically
List of experiments	
1	Self Introduction / Introducing a friend
2	Small talk
3	Essay Writing (descriptive / narrative / issue-based/ argumentative / analytical.)
4	Listening to TED Talks (Being an active listener: giving verbal and non-verbal feedback)
5	Developing Hints

ASSESSMENT PATTERN .

End Semester speaking & Writing will be conducted in the classroom

TEXT BOOKS

1. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford University Press, Oxford: 2011.
2. Richards,C. Jack. & David Bholke. Speak Now Level 3. Oxford University Press, Oxford: 2010

REFERENCES

1. Bhatnagar, Nitin and MamtaBhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010
2. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014
3. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014
4. English and Soft Skills, Dr. S.P. Dhanavel, Orient BlackSwan, 2013
5. Vargo, Mari. Speak Now Level 4. Oxford University Press: Oxford, 2013.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	3	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
AVG	-	-	-	-	-	-	-	-	1.2	3	-	1.8	-	-	-

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24ED111	DESIGN THINKING - BUILDING INNOVATION SOLUTIONING MINDSET	L	T	P	C
		0	0	1	0.5

Course Objectives

1	Expose the students to the fields of innovation and entrepreneurship and strengthen their interest in these fields.
2	To discuss the relevance and importance of innovation and entrepreneurship to the students to improve their everyday life and future careers.
3	Illustrate the macro perspective of innovation in entrepreneurship .
4	To Design the entrepreneurship process.
5	Develop innovation and entrepreneurship processes to improve students to the skill set .

UNIT 1	**1**
What is innovation - Why is innovation important -Types of innovation - The Innovation process	
UNIT 2	**2**
Introduction to Problem Solving-The role of problem - solving in innovation and product development -The importance of real-time problem statements- Problem Identification and Definition	
UNIT 3	**2**
What is entrepreneurship (and how is it different from innovation) -Types of entrepreneurship -The Human side of entrepreneurship	
UNIT 4	**2**
Misconceptions about entrepreneurship -The process of developing entrepreneurship - Module building entrepreneurship mindset- Developing a solution thinking mind set to identify tools and techniques	
UNIT 5	**8**
Case study on adoption of new technology for innovation: Perspective of institutional and corporate entrepreneurship - A New Market Through E-Commerce. Case Studies- Promote Learning And Provide Inspiration in Innovate Entrepreneurship.	
TOTAL PERIODS	**15**

Course Outcomes

At the end of the course, the student will be able to

CO1	Understand basic concepts in the fields of innovation and entrepreneurship
CO2	Understand what a business model is and the process of problem solving.
CO3	Summarize the learning in developing an entrepreneurial idea, formed through innovative practices.
CO4	Model the correct problem solving methodologies with tools and techniques.
CO5	Design innovative solutions for real time problems.

TEXT BOOKS

1 Lorraine Marchand,"The Innovation Mindset: Eight Essential Steps to Transform Any Industry",Columbia Business School Publishing (13 September 2022)

REFERENCES

1. Peter F. Drucker," Innovation and Entrepreneurship" .

2.Martha Corrales-Estrada "Innovation and Entrepreneurship: A New Mindset for Emerging Markets",Emerald Publishing Limited (27 September 2019)

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	2	-	1	1	1	-	-	-	2	-	-	-
CO2	2	1	1	-	1	-	1	-	-	-	2	2	-	1	1
CO3	2	1	1	2	-	-	-	1	-	-	-	2	-	-	-
CO4	-	1	1	2	2	-	-	-	-	-	-	2	-	-	-
CO5	-	1	1	2	3	1	-	-	1	1	2	2	-	-	1
AVG	2	1	1	2	2	1	1	1	1	1	2	2	-	1	1

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U24IP201	BIOLOGY FOR ELECTRICAL AND ELECTRONICS ENGINEERS	L	T	P	C
		3	0	0	0

Course Objectives	
1	To introduce bioelectrical phenomena and different imaging techniques
2	To explore the electrical properties of biological systems
3	To study about micro electromechanical systems and various signal processing techniques

MODUE I	8

Bioelectrical Phenomena

Technological developments like **electrocardiograms (ECGs)**, **electroencephalograms (EEGs)**, and **electromyography (EMG)**, which measure the electrical activity of the heart, brain, and muscles.

Imaging technologies including **MRI**, **CT scans**, and **ultrasound** and Pacemaker, Cochlear implant, Endoscopy/Cameras and Working Principles, Signal processing.

MODUE II	8

Emulating biological processes in engineering design. Electrical properties of the nervous system or sensory organs, to inspire new technologies like **bio-inspired robotics**, **adaptive control systems**, and **sensory networks**.

Electrophysiology

Electrophysiology involves studying the electrical properties of cells and tissues, especially neurons and muscle cells, designing equipment for **recording bioelectrical signals.**

MODULE III	8

Bio-MEMS (Microelectromechanical Systems)

Miniature devices that can be used in biological applications, such as **lab-on-a-chip** systems for diagnostics or **microfluidic devices** that manipulate tiny amounts of fluids for biomedical research.

Signal Processing in Biological Systems
Generation of signals that can be analyzed for medical diagnosis or research (e.g., **heart rate variability** analysis for cardiovascular health).
Techniques such as **filtering**, **Fourier analysis**, and **machine learning** applied to interpret complex biological data.

MODULE –IV	6
PRACTICAL DEMO	
TOTAL PERIODS	**30**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Understand and explain the bioelectrical phenomena and different imaging techniques

CO2	To explore the electrical properties of biological systems
CO3	Develop knowledge on microelectron mechanical systems and various signal processing techniques

TEXT BOOKS	
1	Physics for Paramedical and Allied Health Science Courses, G Purushothaman, S Qairunnisa, CBS Publishers &Distributors Pvt Ltd
2	Biomedical Engineering: Bridging Medicine and Technology", W. Mark Saltzman Publisher: Oxford University Press,2009,1st Edition
3.	Electrophysiological Methods: A Guide for Neuroscientists", Andrew D. Kehoe, Cambridge University Press, 2007, 1st Edition

REFERENCES	
1	Introduction to Biomedical Engineering" John Enderle, Joseph Bronzino Elsevier,Year: 2011,4th Edition
2	Medical Instrumentation: Application and Design" ,John G. Webster,Wiley 2009,4th Edition
3	"BioMEMS: Technologies and Applications",H. Z. Zhao, H. G. Zhang, Y. F. Zhang Springer 2007,1st Edition

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	**PO2**	**PO3**	**PO 4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO1 1**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1	-	-	1	-	-	-	-	-	-	1	-	1
CO2	2	2	1	-	-	1	-	-	-	-	-	-	2	-	1
CO3	2	2	1	-	-	1	-	-	-	-	-	-	2	-	1

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24EN201	PROFESSIONAL ENGLISH	L	T	P	C
		2	0	0	2

Course Objectives	
1	To engage learners in meaningful language activities to improve their reading and writing skills.
2	To enhance learners' vocabulary with a focus on technical terms and enabling them to communicate more effectively in both technical and professional contexts.
3	To master key grammar concepts and apply those concepts to produce clear and correct written communication
4	To help learners understand the purpose, audience, contexts of different types of writing.
5	To demonstrate an understanding of job applications and interviews for internship and placements.

UNIT 1 APPLIED LANGUAGE SKILLS	**6**
Reading: Reading user manuals, brochures, posters, pamphlets **Writing:** Review Writing (Book Review and Movie Review) **Grammar:** Tenses, Prepositional phrases **Vocabulary Development:** Technical vocabulary (synonyms and antonyms)	
UNIT 2 PRACTICAL WRITING AND GRAMMAR SKILLS	**6**
Reading: Reading longer technical texts **Writing:** Writing response to a complaint letter **Grammar:** Active and passive voice, Infinitives and Gerunds **Vocabulary Development:** Sequence words, Misspelled words	
UNIT 3 PROFESSIONAL WRITING AND ANALYTICAL READING	**6**
Reading: Case Studies, Excerpts from literary texts, news reports etc. **Writing:** Letter to the Editor, Checklists **Grammar:** If Conditionals, Articles **Vocabulary Development:** Collocation, Cause and effect expression	
UNIT4 DEVELOPING WRITING AND LANGUAGE SKILLS	**6**
Reading: Reading for detailed comprehension, newspaper articles **Writing:** Essay writing **Grammar:** Reported speech, Modals **Vocabulary Development:** Conjunctions	
UNIT 5 LANGUAGE SKILLS FOR CAREER SUCCESS	**6**
Reading: Company profiles, Statement of purpose, an excerpt of interview with professionals **Writing:** Job / Internship application – Cover letter & Resume **Grammar:** Relative Clauses, Numerical adjectives **Vocabulary Development:** Single sentence definition	
TOTAL PERIODS	**30**

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Read and comprehend various forms of technical and informational texts and extract the necessary information for application or analysis.
CO2	Improve vocabulary to articulate ideas clearly and effectively in professional and academic contexts.
CO3	Use grammar accurately in written communication.
CO4	Demonstrate proficiency in writing clear, structured responses, reviews, essays, and professional documents using appropriate tone, format, and language.

CO5	Create professional documents as well as communicate effectively in professional scenarios, ensuring success in job and internship applications.

TEXT BOOKS

English for Engineers & Technologists Orient Black Swan Private Ltd. Department of English, Anna University, (2020 edition)

English for Science & Technology Cambridge University Press, 2021.

English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.

2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi

3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003

4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.

5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

CO-PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Program Outcomes (POs) and Program Specific Outcomes PSOs'

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

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24MA204	MATHEMATICS FOR ELECTRICAL ENGINEERING	L	T	P	C
		3	1	0	4

Course Objectives

1	To introduce the basic concepts of differential equation and to find its solutions.
2	To understand the basic concept of Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.
3	To acquaint the knowledge of Analytic functions and conformal mapping.
4	To make the students to understand the methods of complex analysis be used for efficiently solving the problems that occur in various branches of engineering disciplines.
5	To familiarize the students with Gradient, divergence and curl of a vector point function and related identities

UNIT 1 DIFFERENTIAL EQUATIONS — **9+3**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients .Application:All the circuit analysis equations.

UNIT 2 LAPLACE TRANSFORMS — **9+3**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.Application:Design of electric circuits,control system and integrated circuits.

UNIT 3 ANALYTIC FUNCTIONS — **9+3**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions w = z + c, cz, 1/z, - Bilinear transformation.

UNIT 4 COMPLEX INTEGRATION — **9+3**

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour

UNIT 5 VECTOR CALCULUS — **9+3**

Differentiation of vectors: Gradient, Divergence, Curl and Directional derivatives – Line, Surface and Volume Integrals - Statement of Green's, Gauss divergence and Stoke's theorem - Simple applications involving rectangular parallelepiped and cubes.

TOTAL PERIODS — **60**

Course Outcomes

At the end of the course, the student will be able to

CO1	Apply various techniques in solving differential equations
CO2	Examine the concepts of Laplace transformation and solve differential equations with given boundary conditions.
CO3	Identify and construct analytic function and application of conformal mapping.
CO4	Apply complex integration to evaluate contour integrals.
CO5	Estimate vector identities and interpret some integral theorems in a vector field

TEXT BOOKS
1.Veerarajan.T,"Engineering Mathematics,for semester I and II", Updated second Edition,TataMcgraw Hill Education , private Limited ,2019.
2.GrewalB.S and GrewelJ.S .“Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 45th Edition, 2020.
3.Won Y.Yang,YoungK.Choi,JaekwonKim,ManCheol Kim, H.JinKim,Taeho Im, "Engineering Mathematics with MATLAB" CRC Press Publishers , I st Edition , 2017.
REFERENCES
1.Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley andSons, 10th Edition, New Delhi, 2016.
2.Kandasamy.P.,Thilagavathy.K and Gunavathy.K.,"Engineering Mathematics For First Year B.E/B.Tech,Reprint Edition 2014,S.Chand and Co.,New Delhi.
3.Bali. N.P and Manish Goyal, “A Textbook of Engineering Mathematics, Semester-I”, ninth Edition, Laxmi Publications Pvt. Ltd, 2016.

	CO/PO, PSO Mapping (3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	1		-	-	-	-	-	-	-	1	-	-
CO2	3	2	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	2	1	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	2	1	-	-	-	-	-	-	-	-	1	-	-
AVG	3	2	2	1	0.2	-	-	-	-	-	-	-	1	-	-

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24TA201	தமிழரும் தொழில்நுட்பமும் /TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

அலகு I நெசவுமற்றும் பானைத்தொழில்நுட்பம்: **UNIT I WEAVING AND CERAMIC TECHNOLOGY**	**3**

சங்ககாலத்தில் நெசவுத்தொழில் – பானைத்தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல்குறியிடுகள்

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

அலகு II வடிவமைப்பு மற்றும் கட்டிடக்தொழில்நுட்பம்: **UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY**	**3**

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககால-த்தில்வீட்டுப்பொருட்களில் வடிவமைப்பு – சங்ககாலத்தில் கட்டுமானபொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடைஅமைப்புபற்றியவிவரங்கள் - மாமல்லபுரச்சிற்பங்களும், கோவில்களும் – சோழர்காலத்துப்பெருங்கோவில்கள் மற்றும் பிறவழிபாட்டுத்தலங்கள் - நாயக்கர்காலகோவில்கள் – மாதிரிகட்டமைப்புகள் பற்றிஅறிதல், மதுரைமீனாட்சி அம்மன் ஆலயம்மற்றும் திருமலைநாயக்கர்மஹால் - செட்டிநாடுவீடுகள் – பிரிட்டிஷ்காலத்தில் சென்னையில் இந்தோ-சரோசெனிக்கட்டிடக்கலை

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)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

அலகு III உற்பத்தித்தொழில்நுட்பம் : **UNIT III MANUFACTURING TECHNOLOGY**	**3**

கப்பல்கட்டும்கலை - உலோகவியல் - இரும்புத்தொழிற்ச்சாலை - இரும்பைஉருக்குக்குதல், எஃகு – வரலாற்றுச்சான்றுகளாகசெம்பு மற்றும் தங்கநாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணிஉருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடிமணிகள் - சுடுமண்மணிகள் - சங்குமணிகள் - எலும்புத்துண்டுகள் - தொல்லியல்சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின்வகைகள்

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

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத்தொழில்நுட்பம்: **UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY**	**3**

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக்குமிழித்தூம்பின்முக்கியத்துவம் - கால்நடைபராமரிப்பு - கால்நடைகளுக்காகவடிவமைக்கப்பட்டகிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச்சார்ந்த செயல்பாடுகள் - கடல்சார்அறிவு - மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல்குறித்தபண்டைய அறிவு - அறிவுசார்சமூகம்

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu 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.	
அலகு V அறிவியல்தமிழ் மற்றும் கணித்தமிழ் : **UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING**	**3**
அறிவியல்தமிழின்வளர்ச்சி - கணித்தமிழ்வளர்ச்சி – தமிழ்நூல்களைமின்பதிப்பு செய்தல் – தமிழ்மென்பொருட்கள் உருவாக்கம் – தமிழ் இனையக்கல்விக்கழகம் – தமிழ் மின்நூலகம் – இணையத்தில்தமிழ் அகராதிகள் – சொற்குவைத்திட்டம். 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 PERIODS	**15**

TEXT BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல் மற்றும் கல்வியியல்பணிகள்கழகம்)
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம் (விகடன்பிரசுரம்)
3. கீழடி – வைகைநதிக்கரையில் சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம் (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 C ivilization on the banks of river Vaigai' (Jointly Published by:DepartmentofArchaeology& Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24PH204	PHYSICS FOR ELECTRICAL ENGINEERING- II	L	T	P	C
		3	0	0	3

Course Objectives

1	to provide students with a comprehensive understanding of the fundamental principles governing electrostatics, electric fields, electric potential, capacitance, and electrical circuits.
2	provide a comprehensive understanding of the fundamental principles of magnetism, its relationship with electric fields, and the mathematical frameworks that describe magnetic phenomena.
3	develop an understanding of the different types of magnetic behavior exhibited by materials, the underlying theories that explain these behaviors, and their practical applications in technology.
4	to understand the fundamental principles that govern the interaction between light and matter in semiconductor and organic semiconductor devices,
5	to provide a deep understanding of the physical principles and practical methods for creating, characterizing, and utilizing nanomaterials and plasma technology.

UNIT 1 ELECTRICITY	**9**
Electric monopoles - Electric field- Electric flux - Electric potential - electrical energy- capacitor-Conductors and Insulators-Electric dipole and polarization - electric current -voltage sources- resistance-Maxwell's equation for electrostatics – E due to straight conductors, circular loop, infinite sheet of current -electric field intensity (D) - Electric potential	
UNIT 2 MAGNETISM	**9**
Sources of magnetism- Monopoles-Magnetic field and force-magnetic field and current distribution-magnetic dipole- Magnetic potential energy-Inductor- Electric and magnetic field comparison,Maxwell's equation for magnetostatics - B in straight conductors, circularloop, infinite sheet of current - Lorentz force, magnetic field intensity (H) – Magnetic flux density (B) – magnetic materials – Magnetization	
UNIT 3 MAGNETIC MATERIALS	**9**
Properties of dia, para, ferro, anti ferro and ferri magnetic materials -Langevin's theory of paramagnetism – Weiss theory of Ferromagnetism – Domain theory of ferromagnetism - hysteresis – soft and hard magnetic materials – Ferrites – Applications -magnetic recording and readout - Storage of magnetic data, Tapes, floppy, magnetic disc drives –Bubble memory.	
UNIT 4 OPTICAL PROPERTIES OF MATERIALS	**9**
Optical processes in semiconductors: optical absorption and emission, charge injection and recombination, optical absorption, loss and gain -– Optoelectronic devices: light detectors and solar cells – light emitting diode – LASER Diodes- optical processes in organic semiconductor devices –excitonic state – Electro-optics and nonlinear optics: Modulators (Amplitude type)– plasmonics(qualitative).	
UNIT 5 PLASMA TECHNOLOGY AND NANO MATERIALS	**9**
Plasma Technology: properties of plasma- types of plasma- thermal and non-thermal plasma-Production of glow discharge plasma-Cold plasma- applications in textile and biomedical field. Nano Materials - synthesis - plasma arcing – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparticles and applications. – Carbon nano tubes – fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications. Content Beyond Syllabus: Spintronics	
TOTAL PERIODS	**45**

Course Outcomes

At the end of the course, the student will be able to

CO1	To impart knowledge on the concepts of electrostatics and explain electric potential, energy

	density and their applications
CO2	To explain the concepts of magnetostatics and its applications
CO3	To understand the behavior of magnetic materials and applications
CO4	To establish a sound, grasp of knowledge on different optical properties of materials, optical displays and applications
CO5	To understand the properties of plasma and nanomaterials and its applications

TEXT BOOKS

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017

2.E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.

3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGrawHill (Indian Edition), 2017.

REFERENCES

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009

2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004

3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019

4.D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

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

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24CY201	GREEN AND SUSTAINABLE CHEMISTRY	L	T	P	C
		2	0	0	2

Course Objectives

1	To give the basic knowledge on role of chemistry to mitigate environmental and global challenges.
2	To understand the global climatic change and the necessity for the preservation of ecosystem.
3	To become familiar with the safe design of synthesis and to minimize the generation of hazardous substances.
4	To understand the need of various energy resources for sustainable development.
5	To integrate the chemistry with environment, technology and public health.

UNIT 1 ROLE OF CHEMISTRY - CURRENT CHALLENGES FOR SUSTAINABLE DEVELOPMENT — **6**

Role of chemistry in addressing the challenges for sustainable development and solving global issues. Nexus among biosphere environment, human and animal health. Introduction to bio-diversity-threats and conservation of bio-diversity. Millennium development goals (MDG) and sustainable development goals (SDG), clean development mechanism (CDM).

UNIT 2 SUSTAINABLE ENVIRONMENTAL CHEMISTRY — **6**

Climate change – greenhouse effect - global warming - sea level rise - intrusion and inundation, , ozone layer depletion, Elnino and LaNina – carbon credits, carbon trading ,carbon foot print, legal provision for environmental protection, coastal zone management-soft and hard measures, Ecosystem – estuaries - corals, mangroves, wetlands, sand dunes etc.

UNIT3 PRINCIPLES OF SUSTAINABLE GREEN CHEMISTRY — **6**

Sources, reactions and effect of chemicals in environments – Factory effluent and treatment, Handling of Hazards-Design of green pesticides for agriculture - Introduction to Biocides: types and applications, Organic Insecticides – Carbamates, Chlorinated hydrocarbons, cypermethrin, Pyrethrin, silica gel, rotenone- synthesis properties and practical applications. -reduction of toxicity, improved recycling and improved product performance.

UNIT4 SUSTAINABLE ENERGY — **6**

Present energy challenges and the possible energy solutions - Solar energy- Solar panels -Solar water heater- solar heat collector and applications- Wind energy- Types – production - advantages and disadvantages- applications. Nuclear energy – production - advantages and disadvantages-applications. Geothermal energy – Production and applications – Bio fuels.

UNIT5 GOOD HEALTH AND WELL BEING -WATER-SOIL-AIR — **6**

Ground water contamination and contamination of water bodies. The role of chemistry in developing appropriate technological solutions for water treatment using Electrodialysis, Forward osmosis and advanced oxidation using photocatalysis and waste water treatment. Reclamation of soil. Current air pollution situation and trends. Factors responsible for air pollution. Air pollution assessment, monitoring and mitigation.

TOTAL PERIODS — **30**

Course Outcomes

At the end of the course, the student will be able to

CO1	Understand the ability to face the current challenges across globe with the aid of chemistry.
CO2	Identify the climatic challenges and to contribute for sustainable transformation.
CO3	Understand the safe design of products with the principles of green chemistry.
CO4	Understand to analyze the energy challenges for sustainable resource management.
CO5	Integrate chemistry with environmental science and public health.

TEXT BOOKS

1.Anubha Kaushik and C.P. Kaushik's "Perspectives in Environmental Studies",6th Edition, NewAge International Publishers ,2018.

2.BennyJoseph, 'Environmental Science and Engineering',TataMcGraw-Hill,NewDelhi,2016.

3.Gilbert M.Masters, 'Introduction to Environmental Engineering and Science',2ndedition,Pearson Education, 2004.

4.Allen, D.T and Shonnard.D.R, SustainabilityEngineering:Concepts,DesignandCaseStudies, Prentice Hall.

5.Bradley.A.S; Adebayo, A.O.,Maria, P.Engineering applications in sustainable design and development, Cengage learning.

6.Environment Impact Assessment Guidelines, Notification of Government of India,2006.7.Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES

1.M.Karpagam,Geetha Jaikumar,"Green Management Theory and Applications",ANE Publishers,First Edition,2010.

2.Matlack,A.S.Introduction to green chemistry,Marcel Dekker:Newyork,2001.

3.Anastas,P.T:Warner,J.C.Green chemistry:Theory and practice,Oxford univ press:oxford,1998.

4.Fankte,peter,et al."Exposure and toxicity characterization of chemical emissions and chemical in products:Global recommendations and implementation in USEtox"The international journal of life cycle assessment,26.5(2021):899-915.

5.Rajagopalan,R,'EnvironmentalStudies-FromCrisistoCure',Oxford University Press,2005.

6.ErachBharucha"Textbook of Environmental Studies for Undergraduate Courses"Orient BlackswanPvt. Ltd. 2013.

CO-PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs)andProgrammeSpecificOutcomesPSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	1	-	1	1	2	2	1	2	-	3	-	-	-
CO2	3	1	1	-	1	1	3	1	2	2	-	2	-	-	-
CO3	3	1	1	-	1	1	2	1	2	2	-	2	-	-	-
CO4	3	-	1	-	2	2	3	2	2	2	-	3	-	-	-
CO5	3	1	1	-	2	2	3	2	1	2	-	3	-	-	-
AVG	3	1	1	-	1.4	1.4	2.6	1.6	1.6	2	-	2.6	-	-	-

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24CS201	PYTHON PROGRAMMING	L	T	P	C
		3	-	3	4.5

Course Objectives

1	To understand the basics of python programming.
2	To define Python functions and strings.
3	To use Python data structures - lists, tuples, dictionaries to represent complex data.
4	To perform file operations in Python.
5	To learn & use python libraries.

UNIT 1 INTRODUCTION TO PYTHON — **9 + 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: circulate the values of n variables, distance between two points.

Practicals:

1.Implement a python program to print an Electricity Bill. (for domestic usage.)
2.Implement a Python program to exchange the values of two variables. (using simple statements and expressions)

UNIT 2 CONTROL FLOW, FUNCTIONS, STRINGS — **9 + 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,Lambda functions, recursion; Strings: string slices, immutability, string functions and methods, string module; Illustrative programs: square root, sum of individual digits of a number.

Practicals:

1.Implement a Python program to print a Number series & Number Patterns.(using Iterative loops).
2.Implement a Python program to find Factorial and largest number in a list(using Functions.).
3.Implement a Python program to perform operations on strings like string reverse,string concatenation & substring .(use switch case).

UNIT 3 LISTS, TUPLES, DICTIONARIES — **9 + 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:Students marks statement,Linear Search, Binary Search.

Practicals:

1.Implement a Python program using Lists & Tuples. (operations of list & tuples - Book Catalogue)
2.Implement a Python program using Sets, Dictionaries. (operations of Sets - Product Categories , operations on Dictionaries - Product Categories)

UNIT 4 FILES, EXCEPTIONS AND MODULES — **9 + 9**

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages, Python Itertools&functools modules, Illustrative programs: Marks range validation.

Practicals:

1.Implement a Python program to perform file operations (copy from one file to another, word count, longest word).
2.Implement a Python program to handle Exceptions.(voter's age validity).

UNIT 5 LIBRARIES, PACKAGES — **9 + 9**

Python libraries - NumPy -Array manipulations, numeric ranges, Slicing, indexing, Searching, Sorting, and splitting, Pandas - Data Analysis, Data-frame, Data selection, group-by, Series, sorting, searching, and

statistics, dask (pandas wrapper) ,Matplotlib- Data visualization , Line plot, Style properties, multi line plot, scatter plot

Practicals:

1.Implement a Python program to create a weather data chart using Python Standard Libraries (pandas, numpy. Matplotlib, scipy) .

TOTAL PERIODS	**90**

Course Outcomes

At the end of the course, the student will be able to

CO1	Develop and execute simple Python programs
CO2	Learn to handle strings and functions in python.
CO3	Represent compound data using Python lists, tuples, dictionaries
CO4	Read and write data from/to files in Python programs.
CO5	Perform basic operations using python Libraries

TEXT BOOKS

1. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016.

2.Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving and Programming”, 1st Edition, BCS

REFERENCES

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021

2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion

3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling

4.Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.

5.Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	2	-	-	-
CO3	2	-	2	2	-	-	-	-	-	-	-	2	-	-	-
CO4	2	3	2	2	-	-	-	-	2	1	1	2	-	-	-
CO5	2	3	2	2	2	1	1	1	2	1	1	2	-	-	-
AVG	2	3	2	2	2	1	1	1	2	1	1	2	-	-	-

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24CE204	ENGINEERING GRAPHICS FOR ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
		3	0	2	4

Course Objectives

CO1	To learn the construction of engineering curves and projection techniques for constructing conic curves, points, and lines.
CO2	To understand the techniques for projecting and visualizing surfaces and solids in various orientations.
CO3	To determine the true shape of sectioned solids and develop their lateral surfaces.
CO4	To develop skills in 3D projection and perspective projection techniques for simple solids.
CO5	To familiarize with standard electrical symbols, wiring diagrams, substation and earthing layouts, and basics of MATLAB/ORCAD.

UNIT 1 PLANE CURVES, PROJECTION OF POINTS AND STRAIGHT LINES — **6+9**

Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method. Orthographic projection- principles-Principal planes-First angle projection-projection of points and straight lines inclined to both the principal planes

UNIT 2 PROJECTION OF PLANES AND SOLIDS — **6+9**

Projection of planes inclined to both the principal planes -. Projection of simple solids like prisms, pyramids, cylinder, and cone. When the axis is inclined to one of the principal planes and parallel to the other by rotating object method.

UNIT 3 PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES — **6+9**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other —obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

UNIT 4 ISOMETRIC AND PERSPECTIVE PROJECTION — **6+9**

Principles of isometric projection — isometric scale —Isometric projections of simple solids - Freehand sketching of multiple views from pictorial views of objects. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

UNIT 5 ELECTRICAL DRAWING — **6+9**

Standard Electrical Signs and Symbols used in Electrical and Electronic Practices and trades – Sketch of various components – Wiring diagrams and Layout diagrams – Different Substation layouts from high voltage to domestic three phase distribution networks, Earthing – Plate earthing – pipe earthing, MATLAB – Simulink Basics – Schematic. ORCAD – Simple Schematic

TOTAL PERIODS — **75**

Course Outcomes

At the end of the course, the student will be able to

CO1	Construct engineering curves and apply projection techniques for conic curves, points, and lines.
CO2	Effectively project and visualize surfaces and solids in various orientations.
CO3	Determine true shapes and develop lateral surfaces of sectioned solids.
CO4	Apply 3D and perspective projection techniques to model simple solids in various views.
CO5	Explore standard electrical symbols, wiring diagrams, substation and earthing layouts, and basics of MATLAB/ORCAD.

TEXT BOOKS

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House,53 Edition, 2019.
2. Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.
3. Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015

4. Electrical Engineering Drawing By Kl Narang, Satya Prakashan Publication
5. Matlab And Simulink For Engineers by Agam Kumar Tyagi,Oxford University Press India

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1. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill, 2nd Edition, 2019
2. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3. Luzzader, Warren.J and Duff, John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson Education India, 2nd Edition, 2009
6. Venugopal K. and Prabhu Raja V., “Engineering Graphics", New Age International (P) Limited, 2008.
7. Electrical Design and Drawing by Surjit Singh, North Publication, Jalandhar.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	-	-	-	-	3	-	2			
CO2	3	1	2	-	2	-	-	-	-	3	-	2			
CO3	3	1	2	-	2	-	-	-	-	3	-	2			
CO4	3	1	2	-	2	-	-	-	-	3	-	2			
CO5	3	1	2	-	2	-	-	-	-	3	-	2			
AVG	3	1	2	-	2-	-	-	-	-	3	-	2			

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24ME101	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	4	2

Course Objectives	
The main learning objective of this course is to provide hands on training to the students in:	
1	Draw pipe line plan; layout and connect various pipe fittings used in common household plumbing work
2	To make wood joints commonly used in household wood.
3	To make various electrical connections in typical household electrical wiring installations.
4	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 equipment; Make a tray out of metal sheet using sheet metal work.
5	Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.
PART I CIVIL ENGINEERING PRACTICES	
PLUMBING WORK	
	Theory
1	Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in households.
2	Connecting pipes of different materials: Metal, plastic and flexible pipes
	Experiment
1	Preparing plumbing line sketches.
2	Laying pipe connection to the suction side of a pump
3	Laying pipe connection to the delivery side of a pump.
	Demo
1	**In-Campus -** - Water supply lines (RO plant) - Drainage systems - Water Harvesting
	Self-Study
1	Household Appliances- pipes of different materials: Metal, plastic and flexible pipes are utilized in various applications, such as: - Water supply lines - Drainage systems - Gas lines (if any) - Heating and cooling systems - Solar water heating (if any) - Chimney
WOOD WORK	
	Theory
1	Tools used in Carpentry & safety measures.
2	Studying common industrial trusses - https://www.youtube.com/watch?v=-1w4_4Sr2kg
	Experiment
1	Sawing,
2	Planing and
3	Making joints like T-Joint Mortise joint and Tenon joint and Dovetail joint.

	Demo
1	Studying joints in door panels and wooden furniture
2	Study of truss in workshop
	Self-study
1	In house- Types of joints used in window, door, chair, table, specific type of furniture or fixture
ELECTRICAL ENGINEERING PRACTICES 15	
	Theory
1	Electrical Installation tools, equipment & safety measures.
2	Introduction and application of switches, fuses, boards, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket.
	Demo
1	Hands-on session of basic electrical connections for Fuses, Miniature Circuit Breakers and Distribution Box,
2	Electrical wiring system from the Electricity Board (EB) to a classroom on a campus
3	Earth Pit & its maintenance in campus
4	Hands-on session of electrical connections for Motors & Uninterruptible Power Supply.
5	Bringing Renewable Energy to the Classroom: A Solar Smart Grid Demonstration
	Experiment
1	Fluorescent Lamp wiring with introduction to CFL and LED types.
2	Energy meter wiring and related calculations/ calibration
3	Iron Box wiring and assembly
4	Fan Regulator (Resistor type and Electronic type using DIAC/TRIAC/QUADRAC)
5	emergency lamp wiring/Water heater
	Self-Study
1	House - electrical wiring system from the Electricity Board (EB) to a dining Room
2	Building (Common area)- electrical wiring system from the Electricity Board (EB) to a staircase of the building & water pump
3	Types of fuse / MDB/ MCB/RCD/CU/Switchboard
4	Earth Pit at house
MECHANICAL ENGINEERING PRACTICES	
	Theory
1	Tools and its handling techniques & safety measures.
2	Welding Procedure, Selection & Safety Measures.
3	types of Welding joints Butt Joints, Lap Joints, and Tee Joints
4	Basic of foundry operations- Various types of casting processes Types of patterns used in casting processes Types of moulding sand and materials used for pattern making
5	Making of a cone using sheet metal
	Demo
1	Demonstrating basic foundry operations- Mold Cavity, Air Vents, Liquid Passages Gates, Runners, Sprues
2	Demonstrating components made out of casting at workshop

3	Demonstration of shaft in gearbox of lathe machine
4	Demonstration of screws RH, LH (Turning, Facing and Thread)
5	Demonstration of Bolted joint
6	Demonstration of sheet metal fabricated components
7	Making of a cone using sheet metal
	Experiment
1	Dis-assembly and assembly of a centrifugal pump.
2	Dis-assembly and assembly of a household mixer /Grinder Mixer
3	Dis-assembly and assembly of an air conditioner.
4	Dis-assembly and assembly of a Ceiling Fan/Table Fan
5	Simple Turning using Lathe machine
6	Drilling & Tapping in Plate (Simple Bolted joint)
7	Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
8	Making of a square tray
1 2 3 4	**Self-Study** List examples of sheet metal fabricated component used in house Application of shaft List examples of welded components commonly used in a house List components made by foundry - casting process
ELECTRONIC ENGINEERING PRACTICES 15	
	Theory
1	Electronic components, equipment & safety measures.
2	Soldering simple electronic circuits and checking continuity.
	Demo
1	Study an elements of smart phone
2	Assembly and dismantle of LED TV
	Experiment
1	Soldering simple electronic circuits and checking continuity.
2	Hands-on session of Soldering Practices in a Printed Circuit Breaker.
3	Assembling and testing electronic components on a small PCB
4	Assembly and dismantle of computer/ laptop
5	Hands-on session of integration of sensors and actuators with a Microcontroller.
6	Hands-on session of Bridge Rectifier, Op-Amp and Trans impedance amplifier.
	Self-Study (mini-Project)
1	Sensor-based projects: Create projects using sensors like temperature, humidity, or motion sensors
2	Automatic Fan Controller: Create a system that turns on a fan when the temperature exceeds a certain limit
3	Automatic Night Light: Design a circuit that turns on an LED light when it gets dark.
4	Water Level Indicator
5	Door Alarm: Create a simple alarm system that triggers when a refrigerator door is open for a more than a one minute

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Upon completion of this course, the students will be able to:	
CO1	To practice and experience the plumbing work
CO2	To gain practical experience in carpentry by crafting a variety of joints.
CO3	To acquire knowledge in the methodology and techniques of wiring for electrical connections.
CO4	To gain knowledge in welding, sheet metal fabrication, and lathe operations.
CO5	To learn about electronic components, equipment, and their functions—such as resistors, color coding, measuring AC signal parameters, gates, circuits, and more.

CO-PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Program Outcomes (POs) and Program Specific Outcomes PSOs'

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
CO2	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
CO3	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
CO4	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
CO5	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
AVG	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24TP210	COMMUNICATION SKILLS LABORATORY - II	L	T	P	C
		0	0	2	1

Course Objectives	
1	To enhance their ability to understand spoken English in various contexts and take part in effective discussions in a professional context.
2	To enhance speaking and presentation skills
3	To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
4	To develop students' critical thinking skills
5	To prepare for real-life communication situations and workplace discussions through the practice of mock interviews.

UNIT I	**6**
Listening: Listening to voicemail & messages, Audio texts, for writing short answers **Speaking:** Conversation between the interlocutor and each candidate	
UNIT II	**6**
Listening: Listening to podcasts, anecdotes and identifying topics, context etc.. **Speaking:** Presentation on any given topic (non-Technical)	
UNIT III	**6**
Listening: One extended conversation or monologue - interview, discussion, lectures and educational videos **Speaking:** Group Discussion.	
UNIT IV	**6**
Listening: Listening to presentation and 5 min informal talk **Speaking:** Presentation on any given topic (Technical)	
UNIT V	**6**
Listening: Listening to interview skills **Speaking:** Mock interview	
PERIODS	**30**

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Course Outcomes	
At the end of the course, the student will be able to	
CO1	To understand accurately and respond to a variety of spoken content to showcase their ability to capture both main ideas and supporting details.
CO2	To enhance the students to make effective presentations.
CO3	To speak effectively in group discussions held in a formal/semi-formal context.
CO4	Ability to interpret different genres of texts, infer implied meanings and evaluate it for ideas as well as for methods of presentation relevant in different situations
CO5	Motivate and prepare the students to attend job interviews and be successful in their pursuit.
List of experiments	
1	Conversation
2	Presentation on any given topic (non-Technical)
3	Group Discussion
4	Presentation on any given topic (Technical)
5	Mock interview

ASSESSMENT PATTERN

End Semester speaking & Writing will be conducted in the classroom

TEXT BOOKS

1. Debra Daise, CharlNorloff, and Paul Carne Reading and Writing (Level 4) Oxford University Press: Oxford, 2011

2. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University Press: Oxford, 2011

REFERENCES

1. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012

2. Withrow, Jeans and et al. Inspired to Write. Readings and Tasks to develop writing skills. Cambridge University Press: Cambridge, 2004

3. English and Soft Skills, Dr. S.P. Dhanavel, Orient Black Swan, 2013

4.Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015

5.Interact English Lab Manual for Undergraduate Students, Orient Balck Swan: Hyderabad, 2016

6 E. Suresh Kumar et al. Communication for Professional Success. Orient Black swan: Hyderabad, 2015

7.Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press, 2014

8.S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010.

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(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	2	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	2	-	-	-
AVG	-	-	-	-	-	-	-	-	1.8	3	-	2	-	-	-

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24ED211	DESIGN THINKING – DECODING INNOVATION OPPORTUNITY	L	T	P	C
		0	0	1	0.5

Course Objectives

1	Understand and apply the five phases of the Stanford Design Thinking Framework (Empathize, Define, Ideate, Prototype, and Test) to identify user needs and create innovative solutions.
2	Gain knowledge of the five stages of the IDEO Design Thinking Framework (Discover, Interpret, Ideate, Experiment, and Evolve) and explore how to iteratively refine solutions through a human-centered approach.
3	Learn the application of Design Thinking tools such as visualization, journey mapping, value chain analysis, brainstorming, and rapid prototyping to generate and refine ideas that meet customer needs.
4	Apply Design Thinking methodologies to identify opportunities for innovation, scope projects, conduct research, generate ideas, and create business case studies and prototypes for real-world problem-solving.
5	Analyze and clarify innovation opportunities by understanding the problem, stakeholders, and solution context through frameworks like Doblin's Ten Types of Innovation and RACI, focusing on the 'Who', 'What', 'How', and 'Why' aspects of problem-solving.

UNIT – 1: STANFORD DESIGN THINKING FRAMEWORK — **3**

- How To `Empathize'?
- How To `Define'
- How To `Ideate'?
- How To `Prototype'?
- How To `Test'?

UNIT – 2: IDEO DESIGN THINKING FRAMEWORK — **3**

- How To `Discover'?
- How To `Interpret'?
- How To `Ideate'?
- How To `Experiment'?
- How To `Evolve'?

UNIT – 3: DESIGN THINKING & DESIGN DOING — **2**

- `What Is'? - Overview About Visualization, Journey Mapping, Value Chain Analysis & Mind Mapping
- `What If'? - Overview About Brain Storming& Concept Development
- `What Wows'? - Overview About Assumption Testing & Rapid Prototyping
- `What Works'? - Overview About Customer Co-Creation & Learning Launch

UNIT – 4: DESIGN THINKING IN PRACTICE – Identify An Opportunity & Becoming Aware Of Next Steps For Innovation – Overview — **2**

- Before You Begin: Identify An Opportunity – Scope Your Project – Draft Your Design Brief – Make Your Plans
- `What Is' Focus: Do Your Research – Identify Insights – Establish Design Criteria
- What If' Focus: Brain Storm Ideas – Develop Concepts – Create Business Case Studies
- `What Wows' Focus: Surface Key Assumptions – Make Prototypes
- `What Works' Focus: Get Feedback from Stakeholders – Run Learning Launches – Design the On-Ramp

UNIT – 5: CLARIFYING PROBLEM STATEMENT & PRIORITIES BY IDENTIFYING & DECODING THE INNOVATION OPPORTUNITY — **5**

- Overview Of Doblin's Ten Types Of Innovation With Brief-Cases Towards Identifying Innovation Opportunity & Clarifying Problem Statement and Priorities
- Opportunity / Problem Clarity About `Who'? (Who're we solving the problem for?)
- Opportunity / Problem Clarity About `What'? (What is the Problem Or EGO – Expectation, Goal & Objective?)

- Opportunity / Problem Clarity About `HOW'? (How's the Overall Problem Solving Approach Help High-lighting RACI – Who's Responsible, Accountable, Consulted & Informed?)
- Opportunity / Problem Clarity About `WHY'? (Why's this Solution or Product or Service or Process ben-eficial to the stakeholders?)

TOTAL PERIODS	**15**

Course Outcomes

At the end of the course, the student will be able to

CO1	Apply Design Thinking frameworks, tools, and techniques to real-world problems, identifying opportunities for innovation and creating effective solutions.
CO2	Empathize with users, define problems, ideate solutions, prototype, and test, ensuring that solutions meet customer needs and are feasible, viable, and desirable.
CO3	Analyze problems, stakeholders, and solution contexts using frameworks like Doblin's Ten Types of Innovation and RACI, focusing on the 'Who', 'What', 'How', and 'Why' aspects of problem-solving.
CO4	Generate and refine ideas using Design Thinking tools like visualization, journey mapping, value chain analysis, brainstorming, and rapid prototyping, creating innovative solutions that meet customer needs.
CO5	Develop effective problem-solving skills, including the ability to scope projects, conduct research, generate ideas, and create business case studies and prototypes, preparing them to tackle complex real-world problems..

TEXT BOOKS

1	Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", Harper Publications, 2009
2	Don Norman, "The Design of Everyday Things", Basic Books, 2013
3	Tom Kelley, David Kelley, "Creative Confidence: Unleashing the Creative Potential Within Us All", Currency, 2013

REFERENCES

1	HassoPlattner, Christoph Meinel, Larry Leifer, "Design Thinking: Understand – Improve – Apply (Understanding Innovation)", Springer, 2011
2	Jakob Schneider, Marc Stickdorn, "This Is Service Design Thinking: Basics, Tools, Cases", John Wiley & Sons, 2011
3	Tom Kelley, The Art of Innovation: Lessons in Creativity from IDEO, America's Leading Design Firm, Currency, 2001

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Program Outcomes (POs) and Program Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	1	3	2	1	3	3	3	3	1	-	1
CO2	2	3	3	3	1	3	2	1	3	3	3	3	1	-	1
CO3	2	3	3	3	1	3	2	1	3	3	3	3	1	-	1
CO4	2	3	3	3	1	3	2	1	3	3	3	3	1	-	1
CO5	2	3	3	3	1	3	2	1	3	3	3	3	1	-	1
AVG	2	3	3	3	1	3	2	1	3	3	3	3	1	-	1

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24MA304	Transforms and Partial Differential Equations	L	T	P	C
		3	1	0	4

Course Objectives

1	To introduce the basic concepts of Partial differential equation and to find its solutions.
2	To introduce Fourier series analysis which is vital to many applications in engineering apart from its use in solving boundary value problems.
3	To acquaint the student with Fourier series techniques to solve heat and wave flow problems in engineering.
4	To familiarize the student with Fourier transform techniques used in solving various practical engineering problems.
5	To introduce the effective mathematical tools for the solutions of difference equations that model several physical processes and to develop transform techniques for discrete time systems

UNIT 1 PARTIAL DIFFERENTIAL EQUATIONS — **9+3**

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations (except $f(x^m z^k p, y^n z^k q) = 0$) – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous type.

Experiential Learning: Solving PDEs Using MATLAB's Built-in Functions (MATLAB PDE Toolbox))

Industrial Application: Heat Dissipation in Power Electronics (Heat Conduction)

Content Beyond Syllabus: Formation of PDE of all planes which are at different distance from the origin

UNIT 2 FOURIER SERIES — **9+3**

Dirichlet's conditions -Necessary and sufficient condition for existence of Fourier series –General Fourier series – Odd and even functions – Half range sine series –Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

Experiential Learning: Fourier Series Representation in MATLAB (Fourier Series Approximation of a Square Wave)

Industrial Application: Simplify complex periodic signals, enabling efficient design of circuits, signal processing, power systems, and control applications

Content Beyond Syllabus: Determine the first two harmonic of the Fourier series from the table which gives the different variations of a periodic function over the period T

UNIT 3 APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS — **9+3**

Classification of PDE – Method of separation of variables – Fourier Series Solutions of one-dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction.

Experiential Learning: Solving PDEs in MATLAB: Finite Element Method (FEM)

Industrial Application: Heat Transfer and Thermal Systems

Content Beyond Syllabus: Problems on finding solution of one dimensional wave equation using real world object (Guitar String Vibration)

UNIT 4 FOURIER TRANSFORMS — **9+3**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

Experiential Learning: Fourier Transform in MATLAB: Two-Dimensional Fourier Transform (2D)

Industrial Application: Signal Processing in Remote Sensing

Content Beyond Syllabus: Self reciprocal of exponential Function using Sine and Cosine transform

UNIT 5 Z – TRANSFORMS AND DIFFERENCE EQUATIONS	**9+3**

Z-transforms – Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems – Convolution theorem – Formation of difference equations – Solution of difference equations using Z – transform.
Experiential Learning: MATLAB Solving Higher-Order Difference Equations using Z Transforms
Industrial Application: Fourier Transform in Structural and Environmental Engineering AND Difference Equations in Transportation Engineering
Content Beyond Syllabus: Inverse Z-transforms by power series method

TOTAL PERIODS	**60**

Course Outcomes

At the end of the course, the student will be able to

CO1	Understand to formulate and solve partial differential equations.
CO2	Evaluate Fourier series of periodic functions.
CO3	Apply the method of separation of variables to find the solution of heat and wave equation.
CO4	Illustrate the Fourier transform techniques.
CO5	Examine Z transform techniques and solve difference equations.

TEXT BOOKS

1.Grewal B.S.,"Higher Engineering Mathematics",44th Edition, Khanna Publishers, New Delhi, 2017

2.Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016

3.Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.

4.Veerarajan.T,"Transforms and Partial Differential Equations", second Edition,Tata Mcgraw Hill Education , private Limited ,2014.

REFERENCES

1.Dass, H.K., and Er.RajnishVerma, "Higher Engineering Mathematics", S.Chand Private Ltd.,2011.

2.Peter V.O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012

3.James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2012.

4.Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	3	3	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	1	-	-

CO5	3	3	2	-	-	-	-	-	-	-	-	-	1	-	-
AVG	3	3	2.6	-	-	-	-	-	-	-	-	-	1	-	-

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE301	Electrical Machines - I	L	T	P	C
		3	0	0	3

Course Objectives

To evaluate, model, and apply electrical machines effectively in industrial and energy system

1	To understand techniques of Magnetic-circuit and to understand the concept of electromechanical energy conversion system.
2	To understand the working principle and characteristics of DC Generator using the concepts of electromechanical energy conversion principles and
3	To understand the working principle and characteristics and various tests performed on a DC Motor
4	To understand the working principle and various tests performed in a Transformer and understand the efficiency and regulation of the machine.
5	To analyze various applications of DC Generators and DC Motors and to evaluate the suitability of various motors for EV applications

UNIT 1 MAGNETIC CIRCUITS & ELECTROMECHANICAL ENERGY CONVERSION	**9**

Introduction – salient aspects of conversions - energy balance - magnetic field system: Energy & Co-energy – Linear system – A simple electromechanical system – in terms of field energy – in terms of field co-energy – energy in terms of electrical parameters – rotary motion – description of simple system – energy stored in the coils – different categories – one coil each on stator and rotor – vital role of air-gap – statically induced emf and dynamically induced emf.

UNIT 2 DC GENERATORS	**9**

Constructional features of a DC machine – Principle of Operation of DC generator – EMF equation – Methods of Excitation – Types of generator – No load and Load characteristics of DC generators – Commutation – Armature Reaction and its effects – Parallel operation of DC shunt generators – Applications

UNIT 3 DC MOTORS	**9**

Principle of operation, significance of back emf, torque equations and power developed by armature, types of DC motors — Electrical and Mechanical characteristics - Starting, speed control and braking of DC motors - Losses in DC machines, Efficiency, testing on dc machines- Brake test, Swinburne's and Hopkinson's test – Permanent magnet DC motors (PMDC) and its applications.

UNIT 4 TRANSFORMERS	**9**

Construction and principle of operation, equivalent circuit, phasor diagrams, testing - polarity test, open circuit and short circuit tests, voltage regulation, losses and efficiency, all day efficiency, Sumpner's test, separation of core losses, parallel operation of single-phase transformers, applications of single-phase transformer, Auto-Transformers – Construction, working, comparison with two winding transformers, Three phase Transformers – Construction and types of connections.

UNIT 5 APPLICATIONS OF DC MACHINES AND ELECTRIC VEHICLE	**9**

Applications of DC Generators – Series, Shunt and Compound Generators as Boosters, Exciters and small power supplies, Applications of DC Motors – Series, Shunt and Compound Motors in Traction, Lathes, drilling machines, Presses, Electric Vehicles – Effectiveness of DC motors in Electric Vehicles – torque characteristics, speed control.

TOTAL PERIODS	**45**
Course Outcomes	
At the end of the course, the student will be able to	
CO1	Apply the laws governing the electromechanical energy conversion for single and multiple excited systems.
CO2	Illustrate the construction and working principle of DC machines and interpret various characteristics of DC machines.
CO3	Conduct suitable performance tests on DC machines and compute parameters such as efficiency, losses, and speed regulation.
CO4	Explain the principle of transformer operation, draw the equivalent circuit, and determine its efficiency and voltage regulation through appropriate testing methods.
CO5	Analyze the industrial and transport applications of DC machines and evaluate the suitability of various DC motors for electric vehicle (EV) applications.
TEXT BOOKS	
1. Nagrath, I.J. and Kothari.D.P., Electric Machines', McGraw-Hill Education, 2004	
2.Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, 'Electric Machinery', Sixth edition, McGraw Hill Books Company, 2003.	
3. M.N. Bandyopadhyay, Electrical Machines Theory and Practice, PHI Learning PVT	
4. Er. R.K. Rajput " Electrical Machines." Sixth edition, Lakshmi Publications Pvt.Ltd 2015	
REFERENCES	
1. Stephen J. Chapman, 'Electric Machinery Fundamentals'4th edition, McGraw Hill Education Pvt. Ltd, 2010.	
2. B.R. Gupta ,'Fundamental of Electric Machines' New age International Publishers,3rd Edition ,Reprint 2015.	
3. B.L.Theraja and A.K.Theraja, 'A Textbook of Electrical Technology Vol II AC and DC Machines.	
4. P.C. Sen'Principles of Electric Machines and Power Electronics' John Wiley & Sons; 3rd Edition 2013.	
5. Theodore Wildi, ''Electrical Machines, Drives, and Power Systems'', Pearson Education., (5th Edition), 2002.	
CO/PO, PSO Mapping (3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'	

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	-	-	-	-	1	1	1	1	3	3	2
CO2	3	3	3	2	-	-	-	-	2	1	1	2	3	3	2
CO3	3	3	3	2	-	-	-	-	1	1	1	1	3	3	2
CO4	3	3	3	2	-	-	-	-	1	1	1	1	3	3	2
CO5	3	3	3	2	-	-	-	-	2	1	1	2	3	3	2
AVG	3	3	3	2	-	-	-	-	1.4	1	1	1.4	3	3	2

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE302	Electronic Devices and Circuits	L	T	P	C
		3	0	3	4.5

Course Objectives

Establish a solid Foundation in the principles, characteristics, and real-world applications of fundamental electronic devices and circuits, with emphasis on power regulation, signal processing, and industrial control systems.

1	To understand the structure of basic electronic devices
2	To be exposed to active and passive circuit elements
3	To familiarize the operation and applications of transistor like BJT and FET.
4	To explore the characteristics of amplifier gain and frequency response
5	To explain the required functionality of positive and negative feedback systems.

UNIT1 PN JUNCTION DEVICES — **9+12**

PN junction diode –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 characteristics- Zener diode Reverse characteristics – Zener diode as regulator.

Lab Components

1.VI characteristics of PN junction Diode and Zener diode
2.VI characteristics of Photo Diode and Phototransistors

UNIT 2 TRANSISTORS — **9+15**

BJT, JFET, MOSFET, UJT- structure, operation, characteristics and Biasing, Thyristors and IGBT Structure and Characteristics

Lab Components

1. Characteristics of BJT in CE, CB, CC configuration
2.Characterisitcs of JFET and UJT

UNIT 3 AMPLIFIERS — **9+3**

BJT small signal model – Analysis of CE amplifier- Gain and frequency response –MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

Lab Components

1.Frequency Response of CE amplifier

UNIT 4 MULTISTAGE AMPLIFERS AND DIFFERENTIAL AMPLIFIERS — **9+12**

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods

Lab Components

1.Differential Amplifier using BJT
2. Realization of Passive Filters
3.Characteristics of single phase half wave and full wave rectifiers with inductive and capacitive filters.

UNIT 5 FEEDBACK AMPLIFERS AND OSCILLATORS — **9+3**

Advantages of negative feedback – voltage / current, series, Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts oscillators.

Lab Components
1.Design OF RC Phase Shift Oscillator

TOTAL PERIODS	**90**

Course Outcomes

At the end of the course, the student will be able to

CO1	Explain the structure and operation of PN junction devices (diode, Zener diode, LED and Laser, Design clipper, clamper, half wave and full wave rectifier, regulator circuits using PN junction diodes
CO2	Analyze the structure and characteristics BJT, FET, MOSFET, UJT, Thyristor and IGBT
CO3	Analyze the performance of various configurations of BJT and MOSFET based amplifier
CO4	Explain the characteristics of MOS based cascade and differential amplifier C
CO5	Explain the operation of various feedback amplifiers and oscillators

TEXT BOOKS

1.David A. Bell , ”Electronic devices and circuits”, Oxford University higher education, 5th edition 2008.

2.Sedra and smith, “Microelectronic circuits”,7th Edition., Oxford University Press, 2017

REFERENCES

1. Balbir Kumar, Shail.B.Jain, “Electronic devices and circuits” PHI learning private limited, 2nd edition 2014.

.2. Thomas L.Floyd, “Electronic devices” Conventional current version, Pearson prentice hall, 10th Edition, 2017.

3.Robert B. Northrop, “Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation”, CRC Press, Second edition, 2012.

4.Donald A Neamen, “Electronic Circuit Analysis and Design” Tata McGraw Hill, 3rd Edition, reprinted in 2006

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	2	-	-	1	-	-	-	2	3	2	-
CO2	3	3	2	2	2	-	-	1	-	-	-	2	3	2	-
CO3	3	2	2	2	2	-	-	1	-	-	-	2	3	3	1
CO4	3	2	2	2	2	-	-	1	-	-	-	2	3	3	2
CO5	3	2	2	1	2	-	-	1	-	-	-	2	3	2	1
AVG	3	2..2	2	1.6	2	-	-	1	-	-	-	2	3	2.4	1.3

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24CS308	DATA STRUCTURES	L	T	P	C
		3	0	2	4

Course Objectives

1	To understand the concepts of ADTs.
2	To Learn linear data structures – lists, stacks, and queues.
3	To understand non-linear data structures – trees and graphs.
4	To apply Tree and Graph structures.
5	To understand sorting and searching

UNIT 1 LISTS — **9+6**

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists

Practical:
1. Array implementation of Stack, Queue and Circular Queue ADTs
2.Implementation of Singly Linked List

UNIT 2 STACKS AND QUEUES — **9+6**

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues.

Practical:
1.Linked list implementation of Stack and Linear Queue ADTs
2. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion

UNIT 3 TREES — **9+6**

Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.

Practical:
1.Linked list implementation of Stack and Linear Queue ADTs
2. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion

UNIT4 MULTIWAY SEARCH TREES AND GRAPHS — **9+6**

B-Tree – B+ Tree – Graph Definition – Representation of Graphs – Types of Graph - Breadth-first traversal – Depth-first traversal – Dijkstra's algorithm – Minimum Spanning Tree – Prim's

Practical:
1.Implementation of Dijkstra’s Algorithm
2. Implementation of Prim’s Algorithm

UNIT 5 SORTING AND SEARCHING TECHNIQUES — **9+6**

Insertion Sort – Quick Sort – Heap Sort – Merge Sort –Linear Search – Binary Search.

Practical:
1.Implementation of Linear Search and Binary Search
2.Implementation of Insertion Sort
3.Implementation of Merge Sort

TOTAL PERIODS	**75**

Course Outcomes

At the end of the course, the student will be able to

CO1	Define linear and non-linear data structures.
CO2	Implement linear and non–linear data structure operations.
CO3	Use appropriate linear/non–linear data structure operations for solving a given problem.
CO4	Analyze the various searching and sorting algorithms.
CO5	Apply appropriate graph algorithms for graph applications

TEXT BOOKS

1.Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005."

2.Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007

3.Ellis Horowitz and Sartaj Sahni, Anderson Freed “Fundamentals of Data Structures in C”, University Press, 2008.

4.Ellis Horowitz and Sartaj Sahni, Dinesh Mehta “Fundamentals of Data Structures in C++”, Silicon Press, 2007.

REFERENCES

1.Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.

2.Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022.

3.Alfred V. Aho, Jeffrey D. Ullman,John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002.

4.Kruse, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2006

5.Yashavant Kanetkar, “Data Structures Through C”, BPB press, 4th edition, 2022.

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	2	2	1	1	-	1	2	1	3	2	1	3
CO2	1	2	1	2	2	-	-	-	1	1	1	2	2	2	2
CO3	2	3	1	2	3	-	-	-	1	1	1	2	2	1	2
CO4	2	1	-	1	1	-	-	-	2	1	1	2	2	3	1
CO5	1	2	1	2	2	1	1	-	1	2	1	3	2	2	3
AVG	2	2	1	2	2	1	1	-	1	1	1	2	2	2	2

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE303	Circuit Analysis	L	T	P	C
		3	0	3	4.5

Course Objectives

Design a smart power distribution system for a small home and optimize energy usage.

1	To introduce Electric Circuits and its Analysis
2	To provide key concepts to analyze and understand electrical circuit
3	To impart knowledge on solving circuit equations using network theorems
4	To educate on obtaining the transient response of circuits
5	To introduce the phenomenon of resonance
6	To introduce Phasor diagrams and analysis of single & three phase circuits

UNIT 1 DC CIRCUITS — **9+9**

Electrical quantities, Ohm's Law, Resistors - Series and parallel combinations, Current Division rule, Voltage Division rule, Source transformation - Kirchhoff's laws, Nodal and Mesh Analysis, Star Delta Transformation

Lab Components

1. Simulation and experimental verification of series and parallel electrical circuit using fundamental laws.

UNIT 2 AC CIRCUITS — **9+3**

Sinusoidal Functions - RMS(effective) and Average Values - Phasor Representation – Sinusoidal Excitation Applied to Purely Resistive - Inductive and Capacitive Circuits - RL - RC and RLC Series and Parallel Circuits- Nodal and Mesh Analysis –Measurement of Power and Power Factor

Lab Components:

1. Experimental validation of frequency response of RLC electric circuit

UNIT 3 NETWORK THEOREMS (Both DC AND AC) — **9+18**

Superposition theorem, Thevenin's and Norton's theorem – Maximum power transfer theorem – Reciprocity theorem Statement: application to DC and AC Circuits

Lab Components

1. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem.
2. Simulation and experimental verification of electrical circuit problems using Norton's theorem.
3. Simulation and experimental verification of electrical circuit problems using Superposition theorem

UNIT 4 TRANSIENT ANALYSIS AND RESONANACE — **9+6**

Introduction –Laplace transforms and Inverse Laplace transforms- standard test signals - Transient response of RL, RC & RLC Networks using Laplace transform for source free, step input and Sinusoidal AC input. Series and Parallel resonance - Quality factor and Bandwidth

Lab Components:

1. Experimental validation of R-C, RLC electric circuit transients.

UNIT 5 THREE PHASE CIRCUITS — **9+9**

Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced and unbalanced – phasor diagram of voltages and currents – power measurement in three phase circuits– Power Factor Calculations

Lab Components:
1. Simulation of three phase balanced and unbalanced star, delta networks circuit.

TOTAL PERIODS	**90**

Course Outcomes

At the end of the course, the student will be able to

CO1	Categorize the circuit's behaviour and analysis of DC circuits
CO2	Categorize the circuit's behaviour and analysis of AC circuits
CO3	Apply network theorems to determine behaviour of the given DC and AC circuits
CO4	Compute the transient response for step and sinusoidal input and understand the concept of resonance circuits
CO5	Compute power, line/ phase voltage and currents of the given three phase circuits

TEXT BOOKS

1.William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, 9thedition, New Delhi, 2020.

2.Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Seventh Edition, McGraw Hill, 2022.

3.Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning India, 2013.

REFERENCES

1. Chakrabarti A, "Circuits Theory (Analysis and synthesis), Dhanpat Rai& Sons, New Delhi, 2020.

2. Joseph A. Edminister, Mahmood Nahvi, "Electric circuits",Schaum's series, McGraw-Hill, First Edition, 2019.

3. M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi, 2015.

4. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley Sons, Inc. 2018.

5. Sudhakar A and Shyam Mohan SP, "Circuits and Networks Analysis and Synthesis", McGraHill, 2015.

CO/PO, PSO Mapping
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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	2	1	-	-	-	2	3	3	2
CO2	3	3	3	3	2	-	2	1	-	-	-	2	3	3	2
CO3	3	3	3	3	2	-	2	1	-	-	-	2	3	3	2
CO4	3	3	3	3	2	-	2	1	-	-	-	2	3	3	2
CO5	3	3	3	3	2	-	2	1	-	-	-	2	3	3	2
AVG	**3**	**3**	**3**	**2.8**	**2**	**-**	**2**	**1**	**-**	**-**	**-**	2	**3**	**3**	**2**

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE304	ELECTRICAL MACHINES-1 LABORATORY	L	T	P	C
		0	0	3	1.5

Course Objectives	
1	To expose the students to determine the characteristics of DC machines and transformers by performing experiments on these machines.
2	To provide hands on experience to evaluate the performance parameters of DC machines and transformer by conducting suitable tests.

List of Experiments	**45**
1. Open circuit and load characteristics of DC shunt generator.	
2.Load test on DC shunt, series and compound motor.	
3. Swinburne's test and speed control of DC shunt motor.	
4. Hopkinson's test on DC motor – generator set.	
5.Load test on single-phase transformer.	
6. Open circuit and short circuit tests on single phase transformers.	
7.Sumpner's test on single phase transformers.	
8.Separation of no-load losses in single phase transformers.	

Course Outcomes	
At the end of the course, the student will be able to	
CO1	Construct the circuit with appropriate connections for the given DC machine/transformer.
CO2	Experimentally determine the characteristics of different types of DC machines.
CO3	Demonstrate the speed control techniques for a DC motor for industrial applications
CO4	Identify suitable methods for testing of transformer and DC machines.
CO5	Predetermine the performance parameters of transformers and DC motor.

CO/PO, PSO Mapping
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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	-	-	1	-	-	-	3	1	1
CO2	3	3	1	1	-	-	-	-	1	-	-	-	3	3	2
CO3	3	3	1	1	-	-	-	-	1	-	-	-	3	3	2
CO4	3	3	1	1	-	-	-	-	1	-	-	-	3	3	2
CO5	3	3	1	1	-	-	-	-	1	-	-	-	3	3	1
AVG	3	3	1	1	-	-	-	-	1	-	-	-	3	2.6	1.6

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24MA402	LINEAR ALGEBRA AND NUMERICAL METHODS	L	T	P	C
		3	1	-	4

Course Objectives

1	To introduce the basic notions of vector spaces which will then be used to solve related problems.
2	To understand the concepts of vector space, linear transformations, inner product spaces and orthogonalization.
3	To introduce the basic concepts of solving algebraic and transcendental equations.
4	To introduce the Interpolation operators and numerical techniques of interpolation in various intervals, numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
5	To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT 1 VECTOR SPACES — **9+3**

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT 2 LINEAR TRANSFORMATION AND INNER PRODUCT SPACES — **9+3**

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Inner product - Norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

UNIT 3 SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS — **9+3**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method.

UNIT 4 INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION — **9+3**

Interpolation operators (Forward, Backward, shifting operators and its Properties) -– Newton's forward and backward difference interpolation for equal intervals – Lagrange's and Newton's divided difference interpolations for unequal intervals - Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT 5 NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS — **9+3**

Single step methods: Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations - Multi step methods: Milne's and Adams- Bash forth predictor corrector methods for solving first order equations.

TOTAL HR — **60**

Course Outcomes

At the end of the course, the student will be able to

CO1	Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
CO2	Demonstrate accurate and efficient use of advanced algebraic techniques.
CO3	Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
CO4	Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.

CO5	Solve the ordinary differential equations with initial conditions by using certain techniques with engineering applications.

TEXT BOOKS

1.Friedberg. A.H., Insel. A.J. and Spence. L., “Linear Algebra”, Prentice Hall of India, New Delhi, 4 th Edition, 2004.

2.Grewal. B.S. and Grewal. J.S., “Numerical Methods in Engineering and Science ", 10th Edition, Khanna Publishers, New Delhi, 2015.

3.Johnson, R.A., Miller, I and Freund J., “Miller and Freund’s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCES

1.Kolman. B. Hill. D.R., “Introductory Linear Algebra”, Pearson Education, New Delhi, First Reprint, 2009.

2.Kumaresan. S., “Linear Algebra – A Geometric Approach”, Prentice – Hall of India, New Delhi, Reprint, 2010.

3.Burden, R.L and Faires, J.D, "Numerical Analysis”, 9th Edition, Cengage Learning, 2016.

4.Devore. J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning, New Delhi, 8th Edition, 2014.

5.Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis” Pearson Education, Asia, New Delhi, 2006.

6.Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi, 2007.

7.Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., “Probability and Statistics for Engineers and scientists” 8th edition, Pearson Education, Asia, 2007.

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Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	1	-	-	1	1	-	-
CO2	3	2	2	1	1	-	-	-	1	-	-	1	1	-	-
CO3	3	2	2	1	1	-	-	-	1	-	-	1	1	-	-
CO4	3	2	2	1	1	-	-	-	1	-	-	1	1	-	-
CO5	3	2	2	1	1	-	-	-	1	-	-	1	1	-	-

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE401	ELECTROMAGNETIC THEORY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	Understand electric field concepts using vector calculus and Gauss's law.
2	Analyze potential, boundary conditions, and capacitance in dielectric systems.
3	Evaluate magnetic fields, magnetization, and energy in magnetic systems.
4	Develop understanding of time-varying fields and Maxwell's equations.
5	Examine electromagnetic wave propagation and associated phenomena.

UNIT 1 ELECTROSTATICS – I	**9**

Sources and effects of electromagnetic fields - Coordinate Systems - Vector fields –Gradient - Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity - Electric Field Intensity due to Line Charge - E due to Line Charge and Surface Charge Distribution - Gauss's law and applications.

UNIT 2 ELECTROSTATICS – II	**9**

Electric potential – Electric fields and equipotential plots, Uniform and Non-Uniform fields, Utilization factor – Electric field in free space, conductors, dielectric -Dielectric polarization – Dielectric strength, Electric fields in multiple dielectrics – Boundary conditions, capacitance, Energy density, Poisson's and Laplace's equations – solutions by Direct Integration method, Applications.

UNIT 3 MAGNETOSTATICS	**9**

Lorentz force, magnetic field intensity (H) – Biot– Savart's Law - Ampere's Circuit Law and practical applications– 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 and mutual inductance, Energy density, Applications.

UNIT 4 ELECTRODYNAMIC FIELDS	**9**

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Time varying potential – Relation between field theory and circuit theory, Applications.

UNIT 5 ELECTROMAGNETIC WAVES	**9**

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

TOTAL: 45

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

COURSE OUTCOMES

At the end of the course, the student will be able to	
CO1	Apply vector calculus and analyze electrostatic field intensity due to different charge configurations.
CO2	Determine electric potential and solve electrostatic problems using Laplace/Poisson equations.
CO3	Calculate magnetic fields using Biot–Savart and Ampere's laws; evaluate magnetic forces and inductance.
CO4	Explain electromagnetic induction and formulate complete Maxwell's equations for time-varying situations.
CO5	Analyze EM wave propagation and compute relevant wave parameters in different media using wave equations and Poynting vector.
TEXT BOOKS	
1	Mathew N. O. Sadiku, S.V. Kulkarni 'Principles of Electromagnetics', 6th Edition, Oxford University Press Inc. Asian edition, 2015.
2	William H. Hayt and John A. Buck, 'Engineering Electromagnetics', McGraw Hill Special Indian edition, 2014.
3	Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.
4	K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; Sixteenth Edition Eighth Reprint :2015
REFERENCES	
1	V.V.Sarwate, 'Electromagnetic fields and waves', Second Edition, Newage Publishers, 2018.
2	J.P.Tewari, 'Engineering Electromagnetics - Theory, Problems and Applications', Second Edition, Khanna Publishers 2013.
3	Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Fifth Edition (Schaum's Outline Series), McGraw Hill, 2018.
4	S.P.Ghosh, Lipika Datta, 'Electromagnetic Field Theory', First Edition, McGraw Hill Education(India) Private Limited, 2017.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	3	1	-	-	-	1	3	3	-
CO2	3	2	1	2	-	-	1	1	-	-	-	1	3	3	-
CO3	3	2	1	2	-	-	1	1	-	-	-	1	3	3	2
CO4	3	2	1	2	-	-	1	1	-	-	-	1	3	3	2
CO5	3	2	1	2	-	-	1	1	-	-	-	1	3	3	2
AVG	3	2	1	2	-	-	1.4	1	-	-	-	1	3	3	2

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE402	Digital Logic Circuits	L	T	P	C
		3	0	0	3

Course Objectives

To develop digital simulation techniques to support the development of innovative, application- oriented logic circuits used in industries like automotive electronics, artificial intelligence, and consumer electronics.

1	Analyze various number systems and simplify logical expressions using Boolean laws to optimize digital circuit design.
2	Design combinational circuits using logic gates and MSI devices for real-world applications.
3	To design synchronous logic circuits, FSMs and introduce ASMs.
4	To analyze and study asynchronous sequential circuits and Programmable Logic Devices.
5	To introduce digital simulation techniques for development of application-oriented logic circuit

UNIT 1 NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES	**9**

Review of number system- error detection, corrections & codes conversions - Boolean algebra: De Morgan's theorem - switching functions and minimization using K-maps & Quine McCluskey method - Digital Logic Families -comparison of RTL, DTL, TTL, ECL and MOS families - Operation characteristics of digital logic family.

UNIT 2 COMBINATIONAL LOGIC CIRCUITS	**9**

Representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps - simplification and implementation of combinational logic – multiplexers and de multiplexers - code converters, adders, subtractors, Encoders and Decoders.

UNIT 3 SYNCHRONOUS SEQUENTIAL CIRCUITS	**9**

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

UNIT 4 ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PLD	**9**

Asynchronous sequential logic Circuits-Transition stability, flow stability-race conditions, hazards & errors in digital circuits; analysis of asynchronous sequential logic circuits introduction to Programmability Logic Devices: PROM – PLA –PAL, CPLD-FPGA.

UNIT5 VHDL	**9**

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages – Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flip flops, Multiplexers & De multiplexers).

TOTAL Periods	**45**

Course Outcomes

At the end of the course, the student will be able to

CO1	Simplify the logical expressions using reduction techniques.
CO2	Design and implement combinational circuits using basic gates(basic digital ICs)

CO3	Design and implement various synchronous circuits.
CO4	Design various synchronous and asynchronous circuits using Flip Flops
CO5	Use HDL for simulating and testing RTL, combinatorial and sequential circuits
TEXT BOOKS	
1	Morris Mano.M, 'Digital Logic and Computer Design', Prentice Hall of India, 3rd Edition, 2005.
2	Donald D. Givone, 'Digital Principles and Design', Tata McGraw Hill, 1st Edition, 2003
3	William Keitz, "Digital Electronics-A Practical Approach with VHDL", Pearson, 2013.
REFERENCES	
1	Donald P Leach, Albert Paul Malvino, Goutam Sha, 'Digital Principles and Applications', Tata McGraw Hill, 7th Edition, 2010
2	Charles H. Roth, Jr., Fundamentals of Logic Design, 7th Edition Reprint, Brooks/Cole, Pacific Grove, US,2014.
3	Botros, "HDL Programming Fundamentals, VHDL & Verilog", Cengage, 2013.
4	Gaganpreet Kaur, "VHDL Basics to Programming", Pearson, 2013.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	1		2	2	1	1	2	3	2	2
CO2	3	3	3	2	3	1		2	2	1	1	2	3	2	2
CO3	3	3	3	3	3	1		1	2	2	2	2	3	2	3
CO4	3	3	3	3	3	1	2	1	2	2	2	3	3	3	3
CO5	3	3	3	3	3	1	2	1	2	1	2	3	3	3	3
AVG	3	3	2.8	2.6	3	1	2	1.4	2	1.4	1.6	2.4	3	2.4	2.6

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE403	ELECTRICAL MACHINES II	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	**To control the speed of various types of AC motors.**
2	To provide knowledge on construction, theory of operation and performance of synchronous generators.
3	To impart knowledge on the operation, starting methods and current Loci of synchronous motors.
4	To explain the details of the construction, principle of operation and performance of three-phase induction motors.
5	To provide exposure on the starting and speed control of three-phase induction motors.
6	To explain the details of the construction, principle of operation and performance of single-phase induction motors and special machines

UNIT 1 SYNCHRONOUS GENERATOR	**9**

Construction-Stator & Rotor, Armature Windings-coil span factor, distribution factor - EMF Equation, Efficiency - Voltage Regulation-EMF, MMF, PSA, ASA methods - Salient and Non-Salient Pole Machines-Slip Test - Two reaction theory - Active and Reactive Power Generation from Alternators Parallel Operation, Effects in load distribution with change in excitation and mechanical input - Characteristics-capability curves.

UNIT 2 SYNCHRONOUS MOTOR	**9**

Principle of Operation, starting methods, Power input and Power developed equations, Operation on infinite bus bars, Current loci for constant power input, constant excitation and constant power developed, O-curves, V-curves, inverted V-curves - Hunting-Damper windings - Synchronous condensers.

UNIT 3 THREE PHASE INDUCTION MOTOR	**9**

Constructional details-Types of rotors - Principle of operation-Slip - Torque-Speed characteristics - Power Stages-Losses and Efficiency - No-load and Blocked-rotor Test-Circle Diagram - Equivalent circuit - Induction Generators.

UNIT 4 STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTORS	**9**

Need for Starting - Types of starters - DOL, Rotor Resistance, Auto Transformer - Star-Delta Starters - Speed Control-Stator side - Voltage control, frequency control, pole changing - From Rotor side-cascaded connection, slip power recovery scheme, Braking-dynamic braking, regenerative braking – plugging.

UNIT 5 SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES	**9**

Single phase Induction Motor-Construction, Principle of operation - Double field revolving theory - Starting - Equivalent circuit-No-load & Blocked Rotor test - Performance analysis - Special machines-Shaded pole induction motor, Repulsion motor - Hysteresis motor, Servo motor, Stepper motor - Linear Induction motor-introduction to magnetic levitation systems.

TOTAL: 45

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

COURSE OUTCOMES

At the end of the course, the student will be able to	
CO1	Understand the theory of synchronous generators and the calculation of the regulation of non- salient pole and salient pole alternators by various methods.
CO2	Describe the complete operation of synchronous motors including its starting methods.
CO3	Comprehend the various features of three phase induction motors, starting from their principle of operation.
CO4	Choose the appropriate method of starting of three-phase induction motors
CO5	Comprehend the various features of single-phase induction motors, and special machines
TEXT BOOKS	
1	P.S. Bhimbhra, 'Electrical Machinery', Khanna Publishers, edition 2, 2021.
2	D.P. Kothari and I.J. Nagrath, 'Electric Machines', McGraw Hill Publishing Company Ltd, 5th Edition 2017
3	M.N. Bandyo padhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2011.
4	J.B. Gupta, "Theory and Performance of Electrical Machines", S.K.Kataria and Sons, 2009
REFERENCES	
1	B. L. Theraja and AK Theraja, "A Text book of Electrical Technology", Volume 2, S. Chand Publications, 2015
2	B.R.Gupta, 'Fundamental of Electric Machines' New age International Publishers,3rd Edition, Reprint 2015.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	2	-	3	1	2	3	3	2	3	3
CO2	3	3	3	3	1	2	-	3	1	2	3	3	2	3	3
CO3	3	3	3	3	1	2	-	3	1	2	3	3	2	3	3
CO4	3	3	3	3	1	2	-	3	1	2	3	3	2	3	3
CO5	3	3	3	3	1	2	-	3	1	2	3	3	2	3	3
AVG	3	3	3	3	1	2	-	3	1	2	3	3	2	3	3

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE404	INTEGRATED CIRCUITS	L	T	P	C
		3	0	3	4.5

COURSE OBJECTIVES

Students develop analytical skills and gain practical expertise in the design, evaluation, and application of analog integrated circuits, including operational amplifiers and specialized ICs, across various real-world systems.

1	Bridge theoretical knowledge with industry practices
2	Evaluate frequency response and feedback mechanisms
3	Design and implement analog circuits
4	Design timing and waveform generation circuits
5	Incorporate switching regulators and decoupling techniques

UNIT - I IC FABRICATION — **9**

IC classification - Fundamental of monolithic IC technology- Epitaxial growth - Masking and etching - Diffusion of impurities - Realisation of monolithic ICs and packaging - Fabrication of diodes, capacitance, resistance, FETs and PV cell.

UNIT - II CHARACTERISTICS OF OPAMP — **9+18**

Ideal OP-AMP characteristics - DC characteristics- AC characteristics - Differential amplifier - Frequency response of OP-AMP - Non-Inverting Amplifier – Basic applications of op-amp - Summer, differentiator - V/I & I/V converters - Voltage-shunt feedback and inverting amplifier - Voltage series feedback

Lab Components

1. Application of inverting amplifier
2. Application of non-inverting amplifier
3. Application of Op Amp- comparator circuits
4. Application of Op Amp- integrator circuits
5. Op amp differentiator circuits
6. Instrumentation Amplifier

UNIT - III APPLICATIONS OF OPAMP — **9+9**

Instrumentation amplifier and its applications for transducer Bridge – Comparators - Multi vibrators - Waveform generators, clippers, clampers, peak detector - S/H circuit - D/A converter (R- 2R ladder and weighted resistor types) - A/D converters using OP-AMPs - Log and antilog filters.

Lab Components

1. A/D converter using Op Amp
2. D/A converter using Op Amp
3. Clipper using Op Amp

Clamper using Op Amp

UNIT - IV SPECIAL ICs — **9+9**

Functional block - characteristics of 555 Timer and its PWM application - IC-566 voltage-controlled oscillator IC - AD633 Analog multiplier ICs - 565-phase locked loop IC - Multiplexer and Demultiplexer **Lab Components** **1.** Voltage to frequency characteristics of NE/SE 566 IC 2. Multiplexer and De Multiplexer	
UNIT - V APPLICATION ICs	**9+9**
AD623 Instrumentation Amplifier and its application as load cell weight measurement IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variability voltage regulators, switching regulator - AI tool SnapEDA - Decoupling capacitors - optimize bills of materials for cost or power reduction. **Lab Components** **1.**Variability voltage regulator using LM317 IC 2, Mini Project on Design and implementation of audio volume control using differential amplifier 3.Mini Project on Design and implementation of light detector using Operational amplifier.	
	TOTAL PERIODS: 45+45 = 90

COURSE OUTCOME	
At the end of the course, the student will be able to	
CO1	Explain monolithic IC fabrication process
CO2	Explain the fabrication of diodes, capacitance, resistance, FETs and PV Cell
CO3	Analyze the characteristics and basic applications (inverting/non-inverting amplifier, summer differentiator, integrator, V/I and I/V converter) of Op-Amp
CO4	Real Time applications of op-amp based instrumentation amplifier, log/antilog amplifier analog multiplier /divider, active filters, comparators, waveform generators, A/D and D/A converters
CO5	Do projects using different ICs.

TEXT BOOKS	
1	David A. Bell, ‘Op-amp & Linear ICs’, Oxford, Third Edition, 2011
2	D. Roy Choudhary, Sheil B. Jani, ‘Linear Integrated Circuits’, , New Age, Fourth Edition, 2018
3	Ramakant A.Gayakward, ‘Op-amps and Linear Integrated Circuits’, IV edition, Pearson Education, PHI 2021.
REFERENCES	
1	Fiore,”Opamps& Linear Integrated Circuits Concepts & applications”, Cengage, 2010
2	Floyd ,Buchla,”Fundamentals of Analog Circuits, Pearson, 2013.

3	Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', McGraw Hill, 2nd Edition, 2017.
4	Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', Pearson, 6th edition,2012.
5	Sergio Franco, 'Design with Operational Amplifiers and Analog Integrated Circuits', McGraw Hill, 2016 – Fourth Edition.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	2	_	_	1	_	_	_	1	3	2	2
CO2	2	2	3	2	2	_	_	1	_	_	_	1	3	1	2
CO3	2	2	3	2	2	_	_	1	_	_	_	1	3	2	2
CO4	2	2	3	2	2	_	_	1	_	_	_	1	3	2	2
CO5	2	2	3	2	2	_	_	1	_	_	_	1	3	1	2
AVG	2	2	3	2	2	_	_	1	_	_	_	1	3	1.6	2

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE405	ELECTRICAL MACHINES II LABORATORY	L	T	P	C
		0	0	3	1.5

COURSE OBJECTIVES	
1	Build a generator using magnets and coils.
2	To impart the necessary knowledge in predetermining the regulation of an Alternator
3	To conduct experiments to determine the negative and zero sequence impedances of an alternator
4	To teach the synchronization procedure for an alternator and to draw the V and inverted V curves
5	To conduct load test to determine the performance characteristics of 3 phase and 1 phase Induction Motors
6	To conduct no load and blocked rotor tests on 3 phase and 1 phase induction motors
LIST OF EXPERIMENTS	
1	Regulation of three phase alternators by EMF and MMF methods.
2	Regulation of three phase alternators by ZPF and ASA methods.
3	Regulation of three phase salient pole alternator by slip test.
4	Measurements of negative sequence and zero sequence impedance of alternators.
5	V and Inverted V curves of Three Phase Synchronous Motor.
6	Load test on three-phase induction motor.
7	No load and blocked rotor tests on three-phase induction motor (Determination of equivalent circuit parameters).
8	Separation of No-load losses of three-phase induction motor.
9	Load test on single-phase induction motor.
10	No load and blocked rotor test on single-phase induction motor.
	Case Study
	Efficiency and Health Check for a Workshop Motor
	TOTAL:45

COURSE OUTCOMES

At the end of the course, the student will be able to	
CO1	Find the performance characteristics of AC machines using direct and indirect methods
CO2	Compute the regulation of three phase alternators using the predetermination methods.
CO3	Study the saliency nature of synchronous machines.
CO4	Check the performance of the single-phase induction motor.
CO5	Study the starting and speed control of AC machines.
TEXT BOOKS	
1	Dr. PS Bhimbra, "Electrical Machinery," Khanna Publishers, 2nd edition, 2001

2	O Elgerd, "Electrical Energy System Theory - An Introduction," McGraw Hill Education
3	BL Theraja, AK Theraja, "A Text Book of Electrical Technology," Vol. 2, S Chand Publishers, 2015
REFERENCES	
1	D.P. Kothari and I.J. Nagrath, 'Electric Machines', McGraw Hill Publishing Company Ltd, 5th Edition 2017
2	M.N. Bandyo padhyay, Electrical Machines Theory and Practice, PHI Learning PVT LTD., New Delhi, 2011.
3	J.B. Gupta, "Theory and Performance of Electrical Machines", S.K.Kataria and Sons, 2009

CO-PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	3	-	-	-	-	-	-	-	-	1	2	-
CO2	3	-	3	3	-	-	-	-	-	-	-	-	1	2	3
CO3	3	3	2	1	2	-	-	-	-	-	-	-	2	3	2
CO4	3	3	2	2	3	-	-	-	-	-		-	1	3	2
CO5	3	-	-	-	-	-	-	-	-	-	-		-	-	
AVG	3	3	2.3	2.25	2.5	-	-	-	-	-	-	-	1.25	2.5	2.3

Meenakshi Sundararajan Engineering College

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Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE501	TRANSMISSION & DISTRIBUTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1	To model the electric power transmission and distribution systems along with the line parameters and their performance-mechanical design of transmission lines and voltage distribution in insulator strings and cables.
2	To impart knowledge on the structure of electric power system and various distribution schemes.
3	To study the line parameters and interference with neighboring circuits.
4	To understand the mechanical design and performance analysis of transmission lines.
5	To familiarize the voltage distribution in insulator strings and cables.
6	To inculcate knowledge on the mechanical design of transmission line, sag calculations and substation layout.

UNIT 1 STRUCTURE OF POWER SYSTEM	**9**

Structure of electric power system: generation, transmission and distribution; Choice of transmission voltage, overhead and underground systems, Types of AC and DC distributors– distributed and concentrated loads– voltage tolerances, interconnection- advantages and limitations– EHVAC and HVDC transmission -Introduction to FACTS devices.

UNIT 2 TRANSMISSION LINE PARAMETERS	**9**

Parameters of single and three phase transmission lines with single and double circuits - Resistance, inductance and capacitance of solid, stranded and bundled conductors, conductor types - Symmetrical and unsymmetrical spacing and transposition-application of self and mutual GMD; skin and proximity effects-Effects of earth on capacitance of transmission line - interference with neighboring communication circuits, corona discharge, factors affecting corona-advantages and disadvantages.

UNIT 3 MODELLING AND PERFORMANCE OF TRANSMISSION LINES	**9**

Classification of lines–short line medium line and long line - equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance and surge impedance loading - transmission efficiency and voltage regulation, Evaluation of A, B, C, D constants, real and reactive power flow in lines methods of voltage control, Ferranti effect, Charging current and losses in an open circuited line

UNIT 4 INSULATORS AND CABLES	**9**

Insulators-Types, voltage distribution in insulator string, improvement of string efficiency Underground Cables-Types of cables, insulation materials, Parameters of cable, Grading of cables. Capacitance of 3-core cable, heating, thermal resistance of cables.

UNIT 5 MECHANICAL DESIGN OF LINES AND GROUNDING	**9**

Mechanical design of transmission line, sag and tension calculations for different weather conditions - Tower spotting, Types of towers, Stringing chart, String failures, Sub-station Layout (AIS, GIS), Methods of grounding.

TOTAL: 45

At the end of the course, the student will be able to	
CO1	Understand structure of power system, distribution schemes, HVDC system and FACTS devices.
CO2	Compute line parameters for different configurations.
CO3	Model the transmission lines to determine the line performance and to understand the impact of Ferranti effect and corona.
CO4	Evaluate the different types of insulators and cables.
CO5	Understand the mechanical design of transmission line, sag calculations and substation layout.

TEXT BOOKS	
1	D.P.Kothari, I.J. Nagarath, 'Power System Engineering', Mc Graw-Hill Publishing Company limited, New Delhi, Third Edition, 2019.
2	C.L.Wadhwa, 'Electrical Power Systems', New Age International Ltd, seventh edition 2022.
3	S.N. Singh, 'Electric Power Generation, Transmission and Distribution', Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition, 2008.
4	V.K.Mehta, Rohit Mehta, 'Principles of power system', S. Chand & Company Ltd, New Delhi, 842013

REFERENCES	
1	B.R.Gupta, 'Power System Analysis and Design' S. Chand, New Delhi, Sixth Edition, 2011.
2	Luces M.Faulkenberry, Walter Coffer, 'Electrical Power Distribution and Transmission', Pearson Education, 2007.
3	Arun Ingole, "Power transmission and distribution" Pearson Education, first edition, 2018
4	J.Brian Hardy and Colin R.Bayliss 'Transmission and Distribution in Electrical Engineering', Newnes; Fourth Edition, 2011.
5	G.Ramamurthy, "Handbook of Electrical power Distribution," Universities Press, 2013.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	3	3	3	2	2	-	2	1	3	3	3	2	3
CO2	3	3	2	3	2	2	2	-	2	1	3	3	3	2	3
CO3	3	3	2	3	2	2	2	-	2	1	3	3	3	2	3
CO4	3	3	2	2	3	2	2	-	2	1	3	3	2	2	3
CO5	3	3	3	2	2	2	2	-	2	1	3	3	2	2	3
AVG	3	3	2.4	2.6	2.4	2	2	-	2	1	3	3	2.6	2	3

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE502	MEASUREMENT AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course Objectives

1	Analyze measurement systems and errors using statistical methods to improve accuracy.
2	To Evaluate and apply electrical measuring instruments and transformers for accurate power and energy measurement.
3	Design and analyze bridge circuits and instrumentation amplifiers for precise electrical parameter measurement.
4	Select and integrate appropriate transducers and smart sensors for real-time monitoring of physical quantities.
5	Implement digital measurement systems using A/D, D/A converters, DSOs, and PLCs for industrial automation.

UNIT 1 CONCEPTS OF MEASUREMENTS	**9**
Instruments: classification, applications instruments: classification, applications Elements of a generalized measurement system Static and dynamic characteristics - Errors in measurement Statistical evaluation of measurement data.	
UNIT 2 MEASUREMENT OF PARAMETERS IN ELECTRICAL SYSTEMS	**9**
Classification of instruments -- moving coil and moving iron meters - Induction type, dynamometer type watt meters - Energy meter - Megger -- Instrument transformers (CT & PT)	
UNIT 3 AC/DC BRIDGES AND INSTRUMENTATION AMPLIFIERS	**9**
Wheatstone bridge, Kelvin double bridge - Maxwell's bridge-, Hay's bridge - Wien bridge- and Schering bridge – Errors and compensation in A.C. bridges -Instrumentation Amplifiers.	
UNIT 4 TRANSDUCERS FOR MEASUREMENT OF NON-ELECTRICAL PARAMETERS	**9**
Classification of transducers -- Measurement of pressure, temperature. , displacement, flow, angular velocity. - Digital transducers- - Smart sensors.	
UNIT 5 DIGITAL INSTRUMENTATION	**9**
Experiential Learning:A/D converters- : types and characteristics - sampling - Errors - Measurement of voltage, current, frequency and phase,-D/A converters: types and characteristics - DSO- Data loggers- Basics of PLC programming and introduction to virtual instrumentation -Instrument standards.	
TOTAL Periods	**45**

Course Outcomes

At the end of the course, the student will be able to

CO1	Ability to understand the fundamental art of measurement in engineering and apply the same to suit industrial application.
CO2	Ability to correlate the structural elements of various instruments, in practical applications
CO3	Ability to understand the importance of bridge circuits, in determination of various electrical parameters

CO4	Ability to utilize various transducers and their characteristics, in different electrical applications.
CO5	Ability to apply the concept of digital instrumentation and virtual instrumentation, in advanced measurements.
TEXT BOOKS	
1	A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, New Delhi, Edition 2011.
2	H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010
REFERENCES	
1	M.M.S. Anand, 'Electronics Instruments and Instrumentation Technology', Prentice Hall India, New Delhi, 2009 J.J.
2	J.J . Carr, 'Elements of Electronic Instrumentation and Measurement', Pearson Education India, New Delhi, 2011
3	W.Bolton, Programmable Logic Controllers, 6th Edition, Elseiver, 2015
4	R.B. Northrop, 'Introduction to Instrumentation and Measurements', Taylor & Francis, New Delhi, 2008
5	E. O. Doebelin and D. N. Manik, "Measurement Systems – Application and Design", Tata McGraw-Hill, New Delhi, 2007

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	_	2	_	2	_	_	_	3	3	2	3
CO2	3	2	3	2	2	_	_	_	_	3	_	3	3	3	3
CO3	3	2	3	3	_	2	_	_	_	_	_	3	3	3	2
CO4	3	2	3	3	_	_	_	2	_	_	_	_	2	2	3
CO5	3	2	3	3	2	_	_	_	_	3	_	3	3	3	2
AVG	3	2	3	2.6	2	2	_	2	_	3	_	3	2.8	2.6	2.6

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE503	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	2	4

Course Objectives

1	To understand the 8-bit 8085 microprocessor internal architecture and get familiarized with assembly language programming for simple arithmetic, logical and control applications.
2	To understand the 8-bit 8081 microcontroller internal architecture and get familiarized with assembly language programming for simple arithmetic, logical and control applications.
3	To understand the 8-bit 8051 microcontroller internal architecture and get familiarized with C programming for simple arithmetic, logical and control applications.
4	To understand the PIC microcontroller internal architecture and get familiarized with assembly language programming for simple arithmetic, logical and control applications.
5	To understand the STM32 microcontroller internal architecture and get familiarized with assembly language programming for simple arithmetic, logical and control applications.

UNIT 1: Introduction to 8085 Microprocessor Architecture and Instruction sets	**9+6**

Overview and comparison of microprocessors and microcontrollers - Architectures of 8 bit processor (8085) - Instruction set of 8085: Data Transfer instructions, Arithmetic instructions Instruction set of 8085: Logical & Machine control instructions. Timing diagram of 8085 processor, Handling of interrupt systems, Simple programs to understand the usage of instruction set.

Lab Components
1. Programs for 8-bit Arithmetic, Logical & Control instructions using 8085.
2. Speed control of Stepper motor using 8085.

UNIT 2: Introduction to 8051 Microcontroller Architecture and Instruction sets	**9 + 6**

Architecture & Pin diagrams Addressing modes & instruction set IO ports, Timers and counters serial data communication & interrupts Simple programs for understanding the flow of Assembly language programming.

Lab Components
1. Programs for 8-bit arithmetic, logical & control instructions using 8051 microcontroller.
2. Traffic light control using 8051 microcontroller.

UNIT 3: 8051 Programming Using Embedded 'C'	**9 + 6**

Role of Microcontroller and Microprocessor in Embedded systems, Introduction to Embedded 'C ' . Port initialization, Data types, Time delay & logic operations, Data conversion & data serialization- , Simple programs to understand the C programming technique

Lab Components
1.Controlling the switching activities of Relays using 8051
2. Realization of serial communication technique.
3. Realization of LCD interfacing technique

UNIT 4: INTRODUCTION TO RISC BASED ARCHITECTURE- PIC Controller	**9 + 6**

PIC16 /18 architecture, Memory organization – Addressing modes – Instruction set – Programming techniques– Timers – I/O ports– Interrupt programming.

Lab Components
1. Controlling the Seven segment display unit.
2. PWM based Light intensity control using PIC.

UNIT 5: INTRODUCTION TO STM 32 MICROCONTROLLER ARCHITECTURE	**9 + 6**

Architecture of STM 32 controller, Memory organization – Addressing modes – Programming techniques – Timers – I/O ports – Interrupt programming. Real time applications of ARM: Autonomous vehicle.

Lab Components I /O Interfacing Experiments
1. Speed control of Stepper Motor using STM 32 controller.
2. Temperature Control using STM 32.
3. Decoration light control using STM 32.

Contact Periods	**75**

Course Outcomes

At the end of the course, the student will be able to

CO1	Write assembly language program for microprocessor and experience I/O interfacing technique.
CO2	Write assembly language program for microcontroller and experience I/O interfacing technique.
CO3	Write embedded 'C ' program for microcontroller and experience the interfacing techniques to demonstrate the working of various peripherals with 8051 controllers
CO4	Understand and appreciate RISC architecture evolving microprocessor architecture.
CO5	Analyse, comprehend and simulate the advanced processor-based system control.

TEXT BOOKS

1	Ramesh S. Gaonkar, 'Microprocessor Architecture Programming and Application', Penram International (P) ltd., Mumbai, 5 th edition, 2008.
2	Muhammad Ali Mazidi & Janice Gilli Mazidi, 'The 8051 Micro Controller and Embedded Systems', Pearson Education, 2007.
3	Joseph Yiu , 'The Definitive Guide to the ARM Cortex-M0' Newnes – Elsevier, 2011.
4	Kenneth Ayala, "The 8051 Microcontroller", Cengage Learning India, 2007, 3rd Edition.
5	Programming With STM32: Getting Started With the Nucleo Board and C/C++

REFERENCES

1	Douglas V. Hall, "Micro-processors & Interfacing". Tata McGraw Hill 2nd edition, 2009
2	Krishna Kant, "Micro-processors & Micro-controllers", Prentice Hall of India, 2007.
3	Embedded Systems: Architecture, Programming & Design, Raj Kamal, 2008, Tata McGraw Hill
4	Mike Predko, " 8051 Micro-controller", McGraw Hill,2009
5	Muhammad Tahir and Kashif Javed, 'ARM Microprocessor Systems - Cortex-M Architecture, Programming, and Interfacing', CRC Press, 2011.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	3	3	1	-	-	2	-	-	1	3	-	1
CO2	2	1	2	3	3	1	-	-	2	-	-	1	3	-	1
CO3	2	1	2	3	3	1	-	-	2	-	-	1	3	-	1
CO4	2	1	2	3	3	1	-	-	2	-	-	1	3	-	1
CO5	2	1	2	3	3	1	-	-	2	-	-	1	3	-	1
AVG	2	1	2	3	3	1	-	-	2	-	-	1	3	-	1

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE504	CONTROL SYSTEMS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

Simulate, design, and model system dynamics, automation, and feedback mechanisms to improve efficiency in engineering fields such as power systems, medical technology, robotics, and automation

1	To derive the transfer function models of mechanical and electrical systems.
2	To develop adequate knowledge in the time response of systems and steady stat error analysis
3	To analyse the open loop and closed loop frequency response of linear systems.
4	To analyse stability and design of compensators and controller of linear systems.
5	To derive state variable representation of physical systems.

UNIT 1 MODELING OF LINEAR TIME INVARIANT (LTIV) SYSTEMS — **9 + 3**

Basic elements in control systems - Open loop and Closed loop systems – First principle modeling: Mechanical, Electrical and Electromechanical systems – Electrical analogy of mechanical systems - Transfer function representations: Block diagram and Signal flow graph.

Practical:

1. Mathematical modelling and simulation of Mechanical and Electrical systems using transfer function approach

UNIT 2 TIME DOMAIN ANALYSIS — **9 + 6**

Standard test inputs –Time responses I and II order system – Time domain specifications– Error coefficients – Generalized error series - Steady state error - Root locus: Construction and Interpretation. Effect of adding poles and zeros.

Practical:

1. Time domain analysis of second order systems in simulation platforms.
2. Root locus technique based stability analysis in simulation platform.

UNIT 3 FREQUENCY RESPONSE ANALYSIS — **9 + 6**

Frequency domain specifications, Bode plot, Polar plot and Nyquist plot - Correlation between frequency domain and time domain specifications. Introduction to closed loop Frequency Response

Practical:

1. Frequency response and stability analysis using Bode plot in simulation platform.
2. Frequency response and stability analysis using Polar plot in simulation platform.

UNIT 4 STABILITY ANALYSIS AND DESIGN OF COMPENSATOR AND CONTROLLER — **9 + 9**

Concept of stability –Routh Hurwitz stability criterion - Design specifications – Lead, Lag and Lag-lead compensators using Bode plot –Effect of adding lag and lead compensators.- PID controller-Design using reaction curve and Ziegler-Nichols technique -Effects of P,PI and PID modes of feedback control.

Practical:

1. Stability analysis using Pole zero maps and Routh Hurwitz Criterion in simulation platform.
2. Design of compensators using Bode plot in simulation platform.
3. Design and simulation of P, PI, PD and PID controllers and evaluation of closed loop system performance for a second order system

UNIT 5 STATE VARIABLE ANALYSIS AND STATE SPACE MODELLING	**9 + 6**

State variable formulation – Non uniqueness of state space model – State transition matrix – solution of state equation and output equation -Eigen values – Eigen vectors –Controllability – Observability.

Practical:

1. State feedback and state observer design and evaluation of closed loop performance in simulation platform.
2. Test of controllability and observability in continuous and discrete domain in simulation platform.

TOTAL PERIODS: 45+30 = 75

COURSE OUTCOME

At the end of the course, the student will be able to	
CO1	Represent the physical systems using transfer function approach.
CO2	Analyse and evaluate the performance of systems in time domain.
CO3	Analyse and evaluate the performance of systems in frequency domain.
CO4	Design and evaluate the performance of closed loop systems with compensators
CO5	Analyse the simple systems using state space approach.

TEXT BOOKS	
1	Nagrath.I.J & Gopal.M, “Control Systems Engineering”, New Age International Pvt. Ltd., 7th Edition, 2021.
2	Katsuhiko Ogata, “Modern Control Engineering”, Pearson, 5th Edition, 2015.
3	Nise, N.S., Control Systems Engineering, Wiley, 7th Edition, 2015.

REFERENCES	
1	Richard C.Dorf and Bishop, R.H., “Modern Control Systems”, Education Pearson, 13th Edition, 2017.
2	John J.D., Azzo Constantine, H. and Houpis Sttuart, N Sheldon, “Linear Control System Analysis and Design with MATLAB”, CRC Taylor & Francis Reprint 2009.
3	Farid Golnaraghi & Benjamin C. Kuo, “Automatic Control System”, Wiley, 9th Edition, 2010.

4	M.Gopal, “Control System: Principle and design”, McGraw Hill Education, 2012.
5	NPTEL Video Lecture Notes on “Control Engineering” by Prof.S.D.Agashe, IIT Bombay.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	3	-	-	-	3	-	-	1	2	2	2
CO2	3	3	2	-	3	-	-	-	3	-	-	1	2	2	2
CO3	3	3	2	-	3	-	-	-	3	-	-	1	2	2	2
CO4	3	3	2	-	3	-	-	-	3	-	-	1	2	2	2
CO5	3	3	3	-	3	-	-	-	3	-	-	1	2	2	2
AVG	3	2.8	2.2	-	3	-	-	-	3	-	-	1	2	2	2

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE601	POWER SYSTEM ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives

1	To enable students to model and represent complex power system networks using matrices and single-line diagrams, forming the basis for system-wide simulations and intelligent analysis.
2	To solve power flow problems using numerical and AI-based techniques, supporting efficient and real-time grid operation.
3	To provide analytical tools for identifying and evaluating symmetrical faults using system matrices, and to develop fault management systems enhanced by AI.
4	To rectify unsymmetrical faults and develop real-time diagnosis systems using sequence networks and intelligent classifiers.
5	To model and analyze system stability under various disturbances and design AI-driven systems for improving dynamic performance.

UNIT 1 POWER SYSTEM OVERVIEW	**9**
Need for system planning and operational studies - Power scenario in India - Power system components, Representation - Single line diagram - per unit quantities - p.u. impedance diagram - p.u. reactance diagram, Network graph Theory -Bus incidence matrices, Primitive parameters - Formation of bus admittance matrix - Direct inspection method - Singular Transformation method.	
UNIT 2 POWER FLOW ANALYSIS	**9**
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 - Flow charts -Comparison of methods.	
UNIT 3 SYMMETRICAL FAULT ANALYSIS	**9**
Assumptions in short circuit analysis - 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 - Current limiting reactors.	
UNIT 4 UNSYMMETRICAL FAULT ANALYSIS	**9**
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.	
UNIT 5 POWER SYSTEM STABILITY	**9**
Classification of power system stability - Rotor angle stability - Power-Angle equation - Steady state stability - Swing equation - Swing curve, Equal area criterion -Critical clearing angle and time, solution of Swing equation (Runge – Kutta Method)- modified Euler method - Multi-machine stability analysis.	
TOTAL Periods	**45**

Course Outcomes

At the end of the course, the student will be able to

CO1	Ability to model the power system under steady state operating conditions.
CO2	Ability to carry out power flow analysis using.
CO3	Ability to infer the significance of short circuit studies in designing circuit breakers
CO4	Ability to analyze the state of the power system for various unsymmetrical faults.
CO5	Ability to analyze the stability of the power system using different methods.

TEXT BOOKS

1	John J. Grainger, William D. Stevenson, Jr, 'Power System Analysis', Mc Graw Hill Education (India) Private Limited, New Delhi, 2017.
2	Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw-Hill Education, Second Edition, 2019.
3	Hadi Saadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21st reprint, 2010.

REFERENCES

1	Pai M A, 'Computer Techniques in Power System Analysis', Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, Second Edition, 2007
2	P. Venkatesh, B. V. Manikandan, A. Srinivasan, S. Charles Raja, "Electrical Power Systems: Analysis, Security and Deregulation" Prentice Hall India (PHI), second edition - 2017
3	J. Duncan Glover, Mulukutla S.Sarma, Thomas J. Overbye, 'Power System Analysis & Design', Cengage Learning, Fifth Edition, 2012.
4	Gupta B.R., 'Power System - Analysis and Design', S. Chand Publishing, Reissue edition 2005.
5	Kundur P., 'Power System Stability and Control', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	_	_	1	_	_	_	1	-	2
CO2	3	3	3	2	1	-	_	_	1	_	_	_	1	1	1
CO3	3	3	3	2	1	-	_	_	1	_	_	1	1	1	1
CO4	3	2	2	2	2	-	_	_	1	_	_	1	1	1	2
CO5	3	3	2	2	2	-	_	_	1	_	_	1	1	1	1
AVG	3	2.6	2.4	1.8	1.4	-	_	_	1	_	_	1	1	1	1.4

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE602	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

Students are able to develop solutions for real-world applications such as signal processing, Audio & Image Processing, Digital Communication Systems, Biomedical Signal Processing and Control & Automation.

1	To develop a mathematical representation of a signal and system in time/frequency domain.
2	To develop discrete time systems using Z-transform and Inverse Z-transform.
3	To implement the discrete time systems in Discrete Fourier Transform using Fast Fourier Transform algorithm.
4	To design FIR & filters with its response and obtaining its realization structure.
5	To implement real-time signal processing applications using Digital Signal Processors.

UNIT I SIGNALS AND SYSTEMS	**9**

classification of signals: Discrete - energy and power; Classification of Systems: Discrete- Linear, Causal, Stability, Dynamic, Recursive, Time Variance Systems Sampling Theorem, Sampling techniques Quantization - quantization error Nyquist rate - aliasing effect.

UNIT II DISCRETE TIME SYSTEM ANALYSIS	**9**

Z-transform and its properties, ROC, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, Frequency response - Convolution Discrete Time Fourier transform - Magnitude and Phase representation.

UNIT III DISCRETE FOURIER TRANSFORM	**9**

Discrete Fourier Transform- properties, magnitude and phase representation, Computation of DFT using FFT algorithm using radix 2 – Butterfly structure - DIT and DIF.

UNIT IV DESIGN OF DIGITAL FILTERS	**9**

Realization of FIR & IIR filter using direct & Cascade structure, Finite Impulse Response (FIR) design - Need and choice of windows, Windowing Techniques: Rectangular, Hamming and Hanning; Linear phase characteristics - IIR design: Analog filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation, Warping, pre-warping.

UNIT V DIGITAL SIGNAL PROCESSORS	**9**

Introduction – Architecture of one DSP processor for motor control -Features- Addressing Formats - Functional modes. Introduction to Commercial Processors.

TOTAL PERIODS:45

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

COURSE OUTCOME

At the end of the course, the student will be able to	
CO1	Analyze different types of Signals and Systems with its performance.
CO2	Analyze the given discrete time system using Z-transform.
CO3	Apply DFT for a given discrete time system for finding its system characteristics.
CO4	Design suitable digital FIR, IIR algorithm for the given specification and construct its realization structure.
CO5	Develop real-time signal processing applications for motor control.

TEXT BOOKS

1	John G. Proakis Northeastern University & Dimitris G Manolakis Massachusetts Institute of Technology "Digital Signal Processing: Principles, Algorithms and Applications", 5th edition Published by Pearson (July 23, 2021) © 2022
2	Robert J. Schilling, Sandra L Harris "Digital Signal Processing using MATLAB" Cengage Learning, 3 Edition 1 Jan 2016

REFERENCES

1	S.K. Mitra, 'Digital Signal Processing - A Computer Based Approach', McGraw Hill Edu, 2011.
2	S. Salivahanan, A.Vallavaraj, Gnanapriya, Digital Signal Processing, McGraw-Hill, 2nd Edition, 2011. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, Discrete - Time Signal Processing, Pearson Education, New Delhi, 2015.
3	Tarun Kumar Rawat, Digital Signal Processing, Oxford University Press, Dec 19, 2022.
4	Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, 'Discrete – Time Signal Processing', Pearson Education, New Delhi, 2nd Edition 2012.
5.	Emmanuel C Ifeachor and Barrie W Jervis ,"Digital Signal Processing – A Practical approach" Pearson E.
6.	B. Venkataramani, M. Bhaskar, 'Digital Signal Processors, Architecture, Programming and Applications', Tata McGraw Hill, New Delhi, 2003, 1st Edition.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	-	-	-	-	-	-	-	-	2	2	1
CO2	3	3	2	2	-	-	-	-	-	-	-	-	2	2	1
CO3	3	2	2	2	-	-	-	-	-	-	-	-	2	2	1
CO4	3	3	3	3	-	-	-	-	-	-	-	-	2	2	1
CO5	3	2	3	2	2	-	-	-	-	-	-	-	2	2	2
AVG	3	2.4	2.4	2.2	2	-	-	-	-	-	-	-	2	2	1.2

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE603	POWER ELECTRONICS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

1	To introduce the operation and characteristics of single-phase rectifiers and controlled converters using SCR.
2	To impart knowledge on three-phase rectifiers and analyze their performance parameters and power quality.
3	To provide understanding of high-frequency switching power supplies and thermal management of converters.
4	To study the working principles and control strategies of voltage and current source inverters.
5	To familiarize students with the operation of AC phase controllers using SCR and TRIAC for power control.

UNIT 1 SINGLE PHASE RECTIFIERS — **9 + 6**

Power Diode – half wave rectifier – mid-point secondary transformer based full wave rectifier – bridge rectifier - distortion factor - LC filters – SCR-Two transistor analogy based turn- ON, Controlled converters (1 pulse, 2 pulse) displacement factor – ripple and harmonic factor effect of source inductance, inverter angle limit.

Lab Components:

1. Characteristics of SCR.
2. Simulation of Single-Phase Rectifiers.

UNIT 2 THREE PHASE RECTIFIERS — **9 + 6**

Three phase diode rectifiers – Concern for power quality, Controlled converters (3 pulse, 6 pulse) Computation of performance parameters

Lab Components:

1. Simulation of Three Phase Rectifier.
2. Experimental verification of transfer characteristic of AC to DC fully controlled Converter.

UNIT 3 SWITCHING POWER SUPPLIES — **9 + 6**

IGBT, MOSFET: dynamic behavior - driver and snubber circuits -low power high switching frequency switching Power supplies, buck, boost, buck-boost converters – Isolated topologies – resonant converters switching loss calculations and thermal design.

Lab Components:

1. Characteristics of MOSFET.
2. Simulation of Switching Power Supplies.

UNIT 4 INVERTERS — **9 + 6**

Single phase half bridge and full bridge inverters - VSI :(1phase and three phase inverters square wave operation) - Voltage control of inverters single, multi pulse, sinusoidal, space vector modulation techniques– various harmonic elimination techniques-CSI.

Lab Components:

1. Characteristics of IGBT. 2. Simulation of Inverters.	
UNIT 5 AC PHASE CONTROLLERS	**9 + 6**
TRIAC triggering concept with positive and negative gate pulse triggering, TRIAC based phase controllers various configurations for SCR based single and three phase controllers **Lab Components:** 1. Characteristics of TRIAC. 2. Experimental verification of transfer characteristics of AC Phase Controllers.	
	TOTAL: 45+30

COURSE OUTCOME

At the end of the course, the student will be able to	
CO1	Explain the operation of various rectifiers and power semiconductor devices.
CO2	Evaluate the performance of three-phase diode and controlled rectifiers with respect to ripple, displacement factor, and power quality.
CO3	Design and analyze switching power supplies such as buck, boost, and isolated topologies, including switching loss calculations.
CO4	Apply various voltage control and modulation techniques for single-phase and three-phase inverters and simulate inverter circuits.
CO5	Demonstrate the triggering and operation of AC phase controllers using SCR and TRIAC under different configurations.

TEXT BOOKS

1	Muhammad H.Rashid, ‘Power Electronics Circuits, Devices & Applications’, 4th Edition, Pearson India, 2018.
2	Ned Mohan, Tore. M. Undeland, William. P. Robbins, ‘Power Electronics: Converters, Applications and Design’, 3rd Edition Wiley India, NewDelhi, 2012.
3	M.D.Singh & K.B Khanchandani, ‘Power Electronics’, 2nd Edition, Tata Mc Graw Hill Publishing Co.Ltd., New Delhi, 2017.

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1	Cyril. W.Lander, Power Electronics, McGraw Hill International, Third Edition, 1993
2	P.S.Bimbhra, Power Electronics, Khanna Publishers, Third Edition 2003
3	Philip T.Krein, Elements of Power Electronics, Oxford University Press, 2013
4	P.C.Sen, Power Electronics, Tata McGraw-Hill, 30th reprint, 2008.
5	L. Umanand, Power Electronics Essentials and Applications Ⅱ, Wiley, 2009.
6	R. W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science & Business Media, 2007.
7	José Rodríguez, Jih-Sheng Lai, and Fang Zheng Peng, ‘Multilevel Inverters: A Survey of Topologies, Controls, and Applications’, IEEE Trans. Ind. Electron., Vol. 49, No. 4, August 2002.

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

Programme Outcomes (POs) and Programme Specific Outcomes PSOs'															
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	0	2	2	-	-	-	2	2	-	-	2	1	2
CO2	3	2	1	2	2	-	-	-	2	2	-	-	2	1	2
CO3	3	2	1	2	2	-	-	-	2	2	-	-	2	1	2
CO4	3	2	1	2	2	-	-	-	2	2	-	-	2	1	2
CO5	3	2	0	2	2	-	-	-	2	2	-	-	2	1	2
AVG	3	1.8	0.6	2	2	-	-	-	2	2	-	-	2	1	2

Meenakshi Sundararajan Engineering College

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Department: Electrical and Electronics Engineering, R2024, CBCS

U24EE701	Renewable Energy Systems	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

Students are able to critically analyze, innovate, and apply renewable energy solutions in industrial and research settings.

1	Identify different renewable energy sources and compare them with conventional sources for sustainable development.
2	Explain the working of wind power plants and analyze the issues related to their grid integration.
3	Describe the principles of solar thermal and PV systems and evaluate their performance characteristics.
4	Classify various biomass and hydro energy systems and illustrate their energy conversion methods.
5	Explore emerging technologies like tidal, wave, and fuel cells and assess their potential for hybrid energy systems.

UNIT 1 RENEWABLE ENERGY SOURCES — **9 + 6**

Types of RE sources - Concept of co-generation and distributed generation - Environmental consequences of fossil fuel use - Importance of renewable sources of energy- Sustainable Design and development - Limitations of RE sources - Present Indian and international energy scenario of conventional and RE sources.

Lab Components

1. Simulation study on solar PV energy system.
2. Experiment on VI characteristics & Efficiency of 1 Kwp solar PV system.

UNIT 2 WIND ENERGY — **9 + 6**

Power in the Wind – Types of Wind Power Plants (WPPs) – Components of WPPs - Working of WPPs - Siting of WPPs-Grid integration issues of WPPs.

Lab Components

1. Simulation study on wind generator.

Experiment on performance assessment of micro wind energy generator.

UNIT 3 SOLAR PV AND THERMAL SYSTEMS — **9 + 6**

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- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array, PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications

Lab Components

1. Experiment on shadowing effect & diode-based solution in 1 Kwp solar PV system.
2. Experiment on performance assessment of grid connected and standalone 1 Kwp solar power system.

UNIT 4 BIOMASS ENERGY AND HYDEL ENERGY — **9 + 6**

Introduction-Biomass 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.

Lab Components

1. Simulation study on hydel power plant
2. Simulation study on hybrid (solar + wind) power system

UNIT 5 OTHER ENERGY SOURCES	**9 + 6**

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.

Lab Components:

1. Experiment on performance assessment of 100 W fuel cell.
2. Experiment on performance assessment hybrid (solar + wind) power system

TOTAL PERIODS: 45+30=75

COURSE OUTCOME	
At the end of the course, the student will be able to	
CO1	Analyze the feasibility and environmental impact of various renewable energy sources for sustainable development.
CO2	Evaluate the operation, siting, and grid integration challenges of wind power plants.
CO3	Assess the performance and efficiency of solar thermal and photovoltaic energy systems.
CO4	Develop good understanding of biomass geothermal and Hydel energy principles and operation.
CO5	Propose an appropriate renewable energy system for a given application.

TEXT BOOKS

1	Joshua Earnest, Tore Wizeliu, ‘Wind Power Plants and Project Development’, PHI Learning Pvt.Ltd, New Delhi, second Edition 2017.
2	D.P.Kothari, K.C Singal, Rakesh Ranjan “Renewable Energy Sources and Emerging technologies”, PHI Learning Pvt.Ltd, New Delhi, 2013.
3	Scott Grinnell, “Renewable Energy & Sustainable Design”, CENGAGE Learning, USA,2016.
4	Gupta, B.R., Generation of Electrical Energy, S. Chand (2017).
5	Frede Blasbjerg and Dan M. Ionel, "Renewable Energy Devices and Systems with Simulation in MATLAB and ANSYS" CRC Press,2017

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1	A.K.Mukerjee and Nivedita Thakur," Photovoltaic Systems: Analysis and Design", PHI Learning Private Limited, New Delhi, 2011
2	Richard A. Dunlap," Sustainable Energy" Cengage Learning India Private Limited, Delhi, 2015.
3	Chetan Singh Solanki, "Solar Photovoltaics: Fundamentals, Technologies and Applications", PHI Learning Private Limited, New Delhi, third Edition 2015
4	Bradley A. Striebig, Adebayo A.Ogundipe and Maria Papadakis," Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, Delhi, 2016.
5	Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
6	Shobh Nath Singh, 'Non-conventional Energy resources' Pearson Education ,2015.
7	Wood, A.J. and Wollenberg, B.F., Power Generation and Control, John Wiley (2004).

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1-Weak Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	3	-	-	-	-	2	2	2	2
CO2	3	2	1	1	2	1	3	-	-	-	-	2	2	2	2
CO3	3	2	1	1	2	1	3	-	-	-	-	2	2	2	2
CO4	3	2	1	1	2	1	3	-	-	-	-	2	2	2	2
CO5	3	2	1	1	2	1	3	-	-	-	-	2	2	2	2
AVG	3	2	1	1	2	1	3	-	-	-	-	2	2	2	2

U24EE702	Power System Operation and Control	L	T	P	C
		3	0	0	4

Course Objectives

1	To investigate the fundamental structure and operational goals of modern power systems and design a system that monitors and manages grid performance using real-time data.
2	To analyse real power and frequency dynamics of a power system and develop control strategies for maintaining system stability.
3	To evaluate reactive power control techniques and create systems for voltage regulation in smart grids.
4	To study economic aspects of power generation and implement optimization algorithms to minimize generation costs while meeting demand.
5	To explore computer-aided techniques in power system control.

UNIT 1 INTRODUCTION	**9 + 6**

Power scenario in Indian grid - National and Regional load dispatching centres - Requirements of good power system -Necessity of voltage and frequency regulation - real power vs frequency and reactive power vs voltage control loops - System load variation, load curves -Load forecasting - Computational methods in load forecasting -Load shedding and Islanding - Basics of electrical energy tariff

Lab components:
1. Load forecasting using curve fitting techniques
2. Determination of MCP in deregulated power system.

UNIT 2 REAL POWER FREQUENCY CONTROL	**9 + 6**

Basics of speed governing mechanisms and modelling - Speed regulation of two generators in parallel Load Frequency Control (LFC) of single area system- Static and dynamic analysis - LFC of two area system --Tie line modelling – Block diagram representation of two area system - Static and dynamic analysis - Tie line with frequency bias control - State variable model - Integration of economic dispatch control with LFC

Lab components:
1. Load Frequency Control of single area system.
2. Load Frequency Control of Two area system.

UNIT 3 REACTIVE POWER – VOLTAGE CONTROL	**9 + 6**

Generation and absorption of reactive power – Basics of reactive power control-Automatic Voltage Regulator (AVR) – Brushless AC 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 and STATCOM for voltage control

Lab components:

Simulation / Development of source code for 1. Stability analysis of AVR. 2. Sizing of SVC/STATCOM for voltage control of a HVAC bus.	
UNIT 4 ECONOMIC OPERATION OF POWER SYSTEM	**9 + 6**
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) - Lambda–iteration method - Base point and participation factors method Statement of Unit Commitment (UC) problem – Constraints on UC problem - Solution of UC problem using priority list - Special aspects of short term and long-term hydrothermal scheduling problems. **Lab components:** Simulation / Development of source code for 1. Economic Dispatch problem 2. Unit Commitment problem	
UNIT 5 COMPUTER AIDED CONTROL OF POWER SYSTEM	**9 + 6**
Need of computer control of power system - Concept of energy control centers and functions – PMU system monitoring - Data acquisition and controls – System hardware configurations - SCADA and EMS functions - State estimation - Measurements and errors - Weighted least square estimation - Various operating states – State transition diagram **Lab components:** Simulation / Development of source code for 1. State estimation using weighted least square estimation technique. 2. Energy management in power system.	
TOTAL Periods	**45+30 = 75**

Course Outcomes

At the end of the course, the student will be able to

CO1	Explain the structure and daily operation of modern power systems including load forecasting, dispatching, and energy tariff analysis.
CO2	Model the load frequency control (LFC) mechanisms and analyze the dynamic behavior of single and multi-area systems for real power regulation.
CO3	Design and analyze reactive power compensators and voltage control devices such as AVR, SVC, and STATCOM to regulate system voltage.
CO4	Apply optimization techniques to solve economic dispatch and unit commitment problems for cost-effective power generation scheduling.
CO5	Implement computer-aided control systems such as SCADA and EMS, and evaluate their role in power system monitoring, state estimation, and control.

TEXT BOOKS

1	Olle. I. Elgerd, 'Electric Energy Systems theory – An introduction', McGraw Hill Education Pvt. Ltd., New Delhi, 2nd edition, 2017.
2	Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 3rd edition, 2013.
3	Abhijit Chakrabarti and Sunita Halder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Fourth Edition, 2018.
REFERENCES	
1	Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw– Hill Education, Second Edition, Reprint 2018.
2	Hadi Saadat, 'Power System Analysis', McGraw Hill Education Pvt. Ltd., New Delhi, 23rd reprint, 2015.
3	Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi, 12th reprint, 2015
4	B.M. Weedy, B.J. Cory et al, 'Electric Power systems', Wiley, Fifth Edition, 2012.

CO/PO, PSO Mapping
(3/2/1 indicates the strength of correlation) 3-Strong 2-Medium, 1- Weak
Programme Outcomes (POs) and Programme Specific Outcomes PSOs'

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	_	1	_	_	_	2	3	3	3
CO2	3	2	1	1	-	1	_	2	_	2	_	2	3	3	3
CO3	3	2	1	1	-	1	_	2	_	2	_	2	3	3	3
CO4	3	2	1	1	-	1	_	2	-	2	_	2	3	1	2.33
CO5	2	1	-	-	-	-	_	1	-	2	_	2	3	3	3
AVG	2	1.6	1	1	_	1	_	1.6	-	2	-	2	3	2.2	2.86

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