SHIV NADAR UNIVERSITY
CHENNAI

Rajiv Gandhi Salai, Kalavakkam – 603 110

SSN School of Engineering

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

B.TECH. ELECTRICAL AND ELECTRONICS ENGINEERING

CURRICULUM & SYLLABUS

REGULATIONS 2025

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1: Graduates of the programme will have successful career by their ability to contribute in electrical and electronics engineering or related professional fields.

PEO2: Graduates of the programme can work in teams with technical competencies, discharging their professional and social responsibilities.

PEO3: Graduates of the programme will exhibit demonstrable attributes in lifelong learning to contribute to their chosen professional field.

PROGRAM OUTCOMES (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to develop to the solution of complex engineering problems. (WK1 to WK4)

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OBJECTIVES (PSOs)

PSO1 To apply advanced science and engineering knowledge to analyze and design complex electrical and electronic devices, software and systems containing hardware and software components.

PSO2 To design and analyze systems used in advanced power applications, renewable energy, electrical drives for the transportation, manufacturing industries and in allied technical fields.

CURRICULUM

SEMESTER – I

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Matrices and Calculus	MD	4	3	1	0	4
2	Engineering Physics	MD	3	3	0	0	3
3	Communicative English	AEC	4	2	0	2	3
4	Circuit theory	MC	3	3	0	0	3
5	Electromagnetic Theory	MC	3	3	0	0	3
6	Professional Ethics and Human Values	VAC	2	2	0	0	2
7	Engineering Physics Laboratory	MD	4	0	0	4	2
8	Makers Space Laboratory	SEC	4	0	0	4	2
9	Extra Academic Activity*	VAC	2	0	0	2	1*
Total			**29**	**16**	**1**	**12**	**22+1***

SEMESTER – II

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Differential Equations and Complex Functions	MC	3	3	0	0	3
2	Technical Writing	AEC	4	2	0	2	3
3	Programming in Python for Data Science	VAC	3	1	0	2	2
4	Environmental Science	VAC	2	2	0	0	2
5	Electronic Devices and Circuits	MC	5	3	0	2	4
6	Digital Logic circuits	MC	5	3	0	2	4
7	Circuit and EMT Lab	SEC	4	0	0	4	2
8	Extra Academic Activity*	VAC	2	0	0	2	1*
Total			**28**	**14**	**0**	**14**	**20+1***

***Note at a later page on Extra Academic Activity.**

SEMESTER – III

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Numerical Computation and Probability Models	MS	3	3	0	0	3
2	Material Sciences	MS	2	2	0	0	2
3	Electrical Machines - I	MC	3	3	0	0	3
4	Analog Circuits	MC	3	3	0	0	3
5	Design Thinking, Innovation and Entrepreneurship	SEC	4	2	0	2	3
6	Control Systems	MC	3	3	0	0	3
7	Electrical Machines – I Laboratory	MC	4	0	0	4	2
8	Analog Circuits Laboratory	MC	4	0	0	4	2
9	Engineering Graphics and CAD for EEE	SEC	2	0	0	2	1
Total			**28**	**16**	**0**	**12**	**22**

SEMESTER – IV

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Microprocessor and Microcontroller	MC	6	2	0	4	4
2	Power Plant Mechanics	MC	3	3	0	0	3
3	Electrical Machines – II	MC	3	3	0	0	3
4	Electrical Measurement and Instrumentation	MC	3	3	0	0	3
5	Electrical Energy Utilization	MS	3	3	0	0	3
6	Transmission and Distribution	MC	3	3	0	0	3
7	Electrical Machines – II Laboratory	MC	4	0	0	4	2
8	Practical Aspects of Control Systems and Instrumentation	SEC	2	0	0	2	1
9	Semiconductor Fabrication Technology	VAC	2	0	0	2	1
Total			**29**	**17**	**0**	**12**	**23**

SEMESTER – V

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Embedded System Design	MC	3	3	0	0	3
2	Power System Analysis	MC	5	3	0	2	4
3	Power Electronics	MC	5	3	0	2	4
4	Digital Signal Processing	MC	3	3	0	0	3
5	Industrial Automation	MS	3	3	0	0	3
6	Introduction to Robotics	MS	2	2	0	0	2
7	Electrical Machine Design	MC	2	2	0	0	2
Total			**23**	**19**	**0**	**4**	**21**

SEMESTER – VI

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Protection and Switchgear	MC	3	3	0	0	3
2	Power System Operation and Control	MC	5	3	0	2	4
3	Computational Data Structures in Electrical Systems	MC	5	3	0	2	4
4	Program Minor 1	MS	3	3	0	0	3
5	Program Minor 2	MS	3	3	0	0	3
6	Capstone Project Phase 1	PD	8	0	0	8	4
Total			**27**	**15**	**0**	**12**	**21**

SEMESTER – VII

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Modern Electric Drives	MC	5	3	0	2	4
2	Flexible AC Transmission Systems	MC	3	3	0	0	3
3	Program Minor 3	MS	3	3	0	0	3
4	Program Minor 4	MS	3	3	0	0	3
5	Program Minor 5	MS	2	2	0	0	2
6	Ability Enhancement Course[#]	AEC	2	2	0	0	2
7	Capstone Project Phase 2	PD	12	0	0	12	6
8	Internship	SI	4	0	0	4	2
Total			**34**	**16**	**0**	**18**	**25**

[#]The following is a list of courses that are offered under the Ability Enhancement Course:

1. Writing for Research
2. Creative Writing
3. Psychology and Communication
4. Professional Communication

SEMESTER – VIII

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Program Minor 6	MS	2	2	0	0	2
2	Program Minor 7	MS	3	3	0	0	3
3	Capstone Project Phase 3	PD	4	0	0	4	2
Total			**9**	**5**	**0**	**4**	**7**

COURSE SUMMARY

The listed courses are broadly classified as per the recommendations from the UGC.

Sl. No.	Broad Category of Course	Minimum Credit Requirement	Actual Credits
1	Major Core (MC)	80	82
2	Minor Stream (MS)	32	32
3	Multidisciplinary (MD)	09	09
4	Ability Enhancement Course (AEC)	08	08
5	Skill Enhancement Course (SEC)	09	09
6	Value Added Courses (VAC)	06-08	07+2*
7	Summer Internship (SI)	02-04	2
8	Project Dissertation (PD)	12	12
Total		**160**	**161+2***

The semester wise credit breakup of the Curriculum based on the above credit breakup proposed by the UGC is as follows:

Semester / Category	MC	MS	MD	AEC	SEC	VAC	SI	PD	TOTAL
1	6		9	3	2	2+1*			**22+1***
2	11			3	2	4+1*			**20+1***
3	13	5			4				**22**
4	18	3			1	1			**23**
5	16	5							**21**
6	11	6						4	**21**
7	7	8		2			2	6	**25**
8		5						2	**7**
Total	**82**	**32**	**9**	**8**	9	**7**+2*	**2**	**12**	**161+2***

* The credits earned through the Extra Academic Activities in Value Added Courses (VAC) are not included in the calculation of Cumulative Grade Point Average (CGPA).

MINOR STREAMS

The Department of Electrical and Electronics Engineering offers the following list of Minor Streams.

1. Electrical System (Foundation Minor)
2. Sustainable Energy Systems
3. Electric Drives and Mobility

Each Minor Stream has seven courses worth 19 credits. The student must enroll in any one of the above three Minor Streams. Minor Streams tagged with Foundations must not be enrolled by students whose Major Core courses overlap with the listed courses in the Minor Stream.

MINOR STREAM 1 – Electrical Systems (Offered to Other Department)

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Electrical Machines*	VI	3	3	0	0	3
2	Electrical and Electronic Measurements*	VI	3	3	0	0	3
3	Introduction to Power Electronics*	VII	3	3	0	0	3
4	MINOR STREAM BASKET 1	VII	3	3	0	0	3
5	MINOR STREAM BASKET 2	VII	2	3	0	0	2
6	MINOR STREAM BASKET 3	VIII	2	3	0	0	2
7	MINOR STREAM BASKET 4	VIII	3	3	0	0	3

*Mandatory Course for the Minor Stream

The following is the tentative list of courses that may be offered under the ***Minor Stream Basket*** in Minor Stream 1 – Electrical Systems:

Minor Stream Basket 1 (3 Credit courses)	***Minor Stream Basket 2 (3 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (2 Credit courses)***
Power Plant Engineering	Power System Operation	Power System Protection	Energy Auditing
Special Electrical Machines	Design of Electrical Machine	Introduction to Motor Drive Technology	E - Mobility
Control Engineering	Digital Control System	Intelligent Controllers	Industrial IoT and Cyber physical systems
Solar Energy System	Wind Energy System	Introduction to Hydrogen Energy Systems	Smart Grid Technology

Note: Students from B. Tech Electrical and Electronics Engineering must not opt this Minor Stream

MINOR STREAM 2 – Sustainable Energy Systems

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Power System Transients*	VI	3	3	0	0	3
2	Deregulated Power Systems*	VI	3	3	0	0	3
3	Computer Relaying and Wide Area Measurement Systems*	VII	3	3	0	0	3
4	MINOR STREAM BASKET 1	VII	3	3	0	0	3
5	MINOR STREAM BASKET 2	VII	2	3	0	0	2
6	MINOR STREAM BASKET 3	VIII	2	3	0	0	2
7	MINOR STREAM BASKET 4	VIII	3	3	0	0	3

*Mandatory Course for the Minor Stream

The following is the tentative list of courses that may be offered under the ***Minor Stream Basket*** in Minor Stream 1 – Electrical Systems:

Minor Stream Basket 1 (3 Credit courses)	***Minor Stream Basket 2 (3 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (2 Credit courses)***
High Voltage DC Transmission	Wind energy conversion systems	IOT and data analytics for smart energy systems	Power Quality
Power system stability	Power system economics	Energy management and auditing	High Voltage Engineering
Power system optimization	Microgrid and distributed energy resources	Renewable energy integration	Smart grid
Power system reliability	Design of solar energy systems	Cyber security in power systems	Power system dynamics

Minor Stream 3 – Electric Drives and Mobility

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Electric Vehicle Architecture*	VI	3	3	0	0	3
2	Charging Systems for Electric Vehicle*	VI	3	3	0	0	3
3	Electric Vehicle Motor Drives*	VII	3	3	0	0	3
4	MINOR STREAM BASKET 1	VII	3	3	0	0	3
5	MINOR STREAM BASKET 2	VII	2	3	0	0	2
6	MINOR STREAM BASKET 3	VIII	2	3	0	0	2
7	MINOR STREAM BASKET 4	VIII	3	3	0	0	3

*Mandatory Course for the Minor Stream

The following is the tentative list of courses that may be offered under the ***Minor Stream Basket*** in Minor Stream 1 – Electrical Systems:

Minor Stream Basket 1 (3 Credit courses)	***Minor Stream Basket 2 (3 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (2 Credit courses)***
Fundamentals of Electric Vehicle Power Trian	Modern Rectifier Technologies	IoT for Smart E-Mobility	Communication and Networking for Electric Vehicle
Grid Integration of Electric Vehicle	Modern Power Converters and Applications	Automotive Electronics	Autonomous and Connected Vehicles
Testing of Electric Vehicle	Modern Inverter Topologies	Artificial Intelligence for e-Mobility	Intelligent Transportation Systems
Energy Storage Systems	Power Semiconductor Devices	Cybersecurity for e-Mobility Systems	Vehicle Diagnostics System

MICROSPECIALIZATION

The University proposes to offer Micro-Specializations to Undergraduate students. Its salient features are as follows:

1. Each Micro-Specialization has a defined structure in terms of three sequential components:
    - **Component I** - One Foundation course that constitutes a mandatory requirement and also a prerequisite for subsequent components.
    - **Component II** - Two courses from a specified vertical.
    - **Component III** - Project/Design/Term Paper
2. A Student would be required to complete all three components (10-14 credits) from the specified stream to earn a Micro-Specialization.

Eligibility for Micro-Specialization registration

To register for a Micro-Specialization, the student must have completed all curricular requirements up to the previous semester and have a CGPA ≥ 8.5. The student must maintain a CGPA ≥ 8.5 without any backlog in the subsequent semesters to keep the Micro-Specialization registration active. The Micro-Specialization must not overlap with the Major Core courses or Minor Stream courses credited as part of the degree program.

This micro-specialization comprises a foundation component and elective courses focused on **electric vehicle technologies**. The foundation provides fundamental understanding of electric mobility systems, including energy sources, power conversion, and vehicle dynamics. The elective courses cover advanced topics such as battery technologies, electric drives, power electronics, charging infrastructure, and intelligent energy management systems. The program also emphasizes practical learning through project or design components addressing real-world EV applications and sustainable transportation challenges. Overall, it equips students with the skills to design, analyze, and develop efficient and eco-friendly electric vehicle systems.

Number of Subjects needed to earn Micro-Specialization: 4

Credits needed to earn the Micro-Specialization: 13 credits

Component	Subject / Project	L	T	P	C
I	Fundamentals of Electric Vehicle	3	0	0	**3**
II	Micro specialization Subject 2*	3	0	0	**3**
	Micro specialization Subject 3*	3	0	0	**3**
III	Design, development, analysis, and implementation of electric vehicle systems and intelligent energy solutions for sustainable, real-world, industrial, and emerging transportation applications.	0	0	8	**4**
Total Credits		9	0	8	**13**

* Subject 2 and Subject 3 can be taken from the list below.

S.No.	**COURSE TITLE**	**L**	**T**	P	C
1	Motors and Power Converters for EV	3	0	0	**3**
2	Embedded system in EV	3	0	0	**3**
3	Energy storage and EV charging systems	3	0	0	**3**

SYLLABUS

SEMESTER - I

Course Code	Category	MATRICES AND CALCULUS (Common to EEE, ECE, VLSI, MECH, CHEM, BME, CIVIL)	L	T	P	C	Contact Hours
	MD		3	1	0	4	4
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

1. To apply the concepts of eigenvalues and eigenvectors in the reduction of quadratic form.
2. To obtain Taylor's expansion of various functions and extreme values of functions.
3. To equip with the concepts of integral calculus and applying it in evaluating the integrals.
4. To apply the Green's theorem, Divergence theorem and Stokes theorem in engineering problems.

UNIT 1 - MATRICES (12 HOURS)

Eigenvalues and Eigenvectors - Cayley-Hamilton Theorem - Diagonalization: Similarity transformation - Quadratic form – Reduction of quadratic form to canonical form using orthogonal transformation, Eigen values by Power method

UNIT 2 - DIFFERENTIAL CALCULUS (12 HOURS)

Curvature, radius of curvature - Cartesian and parametric forms – Centre of curvature – Circle of curvature in Cartesian form, Evolutes, Envelopes, Evolute as envelope of normals.

UNIT 3 - MULTIPLE INTEGRAL (12 HOURS)

Double integrals, Triple integrals: Cartesian and polar coordinates – Change of order of integration, Change of variables, Area and volume as multiple integrals.

UNIT 4 - VECTOR CALCULUS (12 HOURS)

Gradient and directional derivative – Divergence and curl – Vector identities - line integral, Surface integral, Volume integral- Green's theorem, Gauss divergence and Stoke's theorems.

UNIT 5 - FUNCTIONS OF SEVERAL VARIABLE (12 HOURS)

Partial derivatives – Total derivative – Jacobian – Functions of two variables: Taylor's series and Maxima and minima– Constrained optimization using Lagrange's method.

TEXTBOOKS:

1. Grewal B.S, *Higher Engineering Mathematics*, Khanna Publishers, 45th Edition, 2020.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, Inc., 10th Edition, 2020.

REFERENCE BOOKS:

1. Bali, N.P., Goyal, M., Watkins, C., *Advanced Engineering Mathematics*, Laxmi Publications Pvt. Limited, 2007.
2. Boyce, W.E., and DiPrima, R.C*., Elementary Differential Equations and Boundary Value Problems*, Wiley India, 2012.
3. George B. Thomas Jr., Maurice D. Weir, Joel R. Hass, Thomas' *Calculus: Early Transcendental*, 13th Edition, Pearson Education, 2013.
4. O'Neil. P. V., *Advanced Engineering Mathematics*, 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.
5. Howard Anton, Irl C. Bivens, Stephen Davis, *Calculus Early Transcendentals*, 11th Edition, John Wiley & Sons, Inc., 2016.

COURSE OUTCOMES

	Course Outcomes	**Knowledge Level**
CO1	Analyze and diagonalize matrices using eigenvalues, eigenvectors, and similarity transformations.	KL3
CO2	Compute curvature, radius and centre of curvature, and find evolutes and envelopes of plane curves.	KL3
CO3	Evaluate double and triple integrals in Cartesian and polar coordinates, change the order of integration, and compute areas and volumes using multiple integrals.	KL3
CO4	Evaluate vector integrals using gradient, divergence, curl, and theorems like Green's, Gauss, and Stokes	KL3
CO5	Evaluate partial derivatives, total derivatives, Jacobians, and use Taylor series and Lagrange's method to solve maxima, minima, and constrained optimization problems	KL3

Course Code	Category	ENGINEERING PHYSICS	L	T	P	C	Contact Hours
	MD		3	0	0	3	3
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

This is an introductory physics course that aims to enhance the understanding of physics concepts in the different areas of speech, ultrasonics, lasers, optical communication and quantum mechanics that are of relevance to respective engineering programs. The course will enable the students to

- Understand the perception of sound, its metrics, and production and applications of ultrasound.
- Understand basics of quantum mechanics and associated theories.
- Explain physics of semiconductors.
- Describe the principle of laser action and working of lasers.
- Analyse the propagation of light through optical fibres and its application to communication systems and sensors

UNIT 1 - ACOUSTICS & ULTRASONICS (9 HOURS)

ACOUSTICS

Classification- Music & Noise - Characteristics of Sound: Pitch/Frequency, Loudness/Intensity-decibel scale - Weber–Fechner law – Loudness Curves- Quality/Timbre

ULTRASONICS

Production - Magnetostriction and Piezoelectric methods – Detection – Piezoelectric, Acoustic grating – Non-Destructive Testing – pulse echo system -reflection and transmission modes –Modes of data presentation- A, B and C scan displays – Sonogram

UNIT 2 - QUANTUM PHYSICS (9 HOURS)

Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh-Jeans law from Planck's theory – Properties of Matter waves - wave particle duality - Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box and extension to three dimensional box – Degeneracy of electron energy states – Quantum free electron theory – Density of states – Fermi-Dirac statistics– Free electron concentration in metals.

UNIT 3 - SEMICONDUCTORS (9 HOURS)

Classification of semiconductors based on doping and band gap – Intrinsic semiconductor – Concept of hole – carrier concentration derivation –Fermi level and its variation with temperature – electrical conductivity – band gap determination –Extrinsic semiconductors – Carrier concentration derivation in n-type and p-type semiconductors – Variation of Fermi level with temperature and impurity concentration.

UNIT 4 - LASERS (9 HOURS)

Interaction of Radiation with Matter-Spontaneous and stimulated emissions– Einstein's A and B coefficients – Conditions for Laser action –Population inversion – Active medium – pumping schemes – Optical resonant cavity- Light Amplification-Types of lasers – Nd: YAG, CO_2 and Semiconductor lasers- homo junction & hetero junction laser

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UNIT 5 - FIBRE OPTICS (9 HOURS)

Principle and propagation of light in optical fibres –Numerical aperture and Acceptance angle, Classification of optical fibres (material, mode & refractive index) – Losses in fibres – attenuation, dispersion – Fibre optical communication system (Block diagram) – Active and passive sensors – pressure, strain, displacement.

TEXTBOOK:

1. M. N. Avadhanulu, P. G. Kshirsagar, *A text book of Engineering Physics*, S. Chand & Co. Ltd. Revised Edition 2014.

REFERENCE BOOKS:

1. Kasap, S.O., *Principles of Electronic Materials and Devices*, Special Indian Edition McGraw-Hill Education, 3rd Edition, 2017.
2. Kittle Charles, *Introduction to Solid State Physics*, Wiley, 2004
3. Gaur R.K. and Gupta S.L., *Engineering Physics,* Dhanpat Rai publishers, 2012
4. Halliday, D., Resnick, R. & Walker, J., *Principles of Physics,* Wiley, 2015.
5. James Beauchamp, *Analysis, Synthesis, and Perception of Musical Sounds –The Sound of Music,* Springer; 2007.
6. Serway, R.A. & Jewett, J.W., *Physics for Scientists and Engineers,* Cengage Learning, 2010.
7. Tipler, P.A. & Mosca, G., *Physics for Scientists and Engineers with Modern Physics*, 2007.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Analyze the characteristics and perception of sound, understand production and detection of ultrasonic waves and their applications.	KL4
CO2	Explain the basic quantum mechanical concepts and their applications.	KL3
CO3	Analyze the physics of semiconductors.	KL4
CO4	Explain the principle, properties and working of different types of lasers.	KL3
CO5	Illustrate the principle of light propagation, causes for losses and dispersion and evaluate their impact on fiberoptic communication systems and working of fiberoptic displacement, pressure and strain sensors.	KL4

Course Code	Category	COMMUNICATIVE ENGLISH	L	T	P	C	Contact Hours
	AEC		2	0	2	3	4
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

The learners will be able to:

1. Enhance conversation fluency and networking skills in English.
2. Contribute efficiently to meetings and group discussions.
3. Deliver well-structured presentations and participate in interviews.
4. Learn the language and strategies of successful negotiations.
5. Communicate effectively during conflict-resolving situations.

UNIT 1 - CONVERSATION AND NETWORKING SKILLS (12 HOURS)

Introducing yourself, peers and others. Conversation skills: starting a conversation; keeping the conversation going; closing the conversation; giving directions and instructions; learning functional language needed for everyday interactions. Imparting the basic language skills and techniques for telephonic conversations. Role-plays as a technique for practicing conversation. Writing professional emails.

UNIT 2 – MEETING AND GROUP DISCUSSION SKILLS (12 HOURS)

Setting up, organizing and conducting effective meetings; learning the language used to lead a meeting; practicing how to agree and disagree with ideas and people politely. Reading sample minutes of meetings and pre-meeting preparation, and mock meetings. Making notes, summarizing, and reporting in meetings. Group discussion skills: Basic skills required for a GD; strategies for improving discussion skills; learning the language used for a GD; voicing an opinion and arguing a point effectively, leading a discussion; chairing a discussion; discussing to arrive at a consensus. Pre-GD preparation, reading GD transcripts and mock GDs for practice.

UNIT 3 – PRESENTATION AND INTERVIEW SKILLS (12 HOURS)

Making effective presentations: structure of a presentation; referring to visual data; describing visuals; non-verbal communication skills; examples of model presentations; and learning the language used to deliver effective and persuasive presentations. Advance topic research, mock presentations and reading sample presentations for practice. Applying for jobs; writing resumes; and cover letters. Participating in job interviews and other interviews. Strategies for effective interviewing: preparing for the interview, during-the-interview and after-the-interview etiquette. Common interview questions and learning interview language skills. Mock interviews and reading interview transcripts for practice.

UNIT 4 - NEGOTIATION SKILLS AND ASSERTIVENESS (12 HOURS)

Negotiation strategies; negotiating effectively; exchanging and comparing information; building rapport with people; practicing the language used in negotiations; considering and respecting

cultural differences while negotiating; making compromises. Communication styles: passive, aggressive and assertive. Reading case studies on cross-cultural negotiation scenarios and mock negotiation roleplays.

UNIT 5 – CONFLICT RESOLUTION AND DECISION-MAKING SKILLS (12 HOURS)

Resolving conflicts: listening actively to ideas; handling people smoothly; dealing with and attempting to solve conflicting problems. Making a decision: thinking about various possibilities before decision-making; communicating the pros and cons of a decision; presenting a mutually beneficial solution. Reading case studies and mock conflict resolution, decision making role plays. Developing cross-cultural communication skills.

TEXTBOOKS:

1. Bovee, C. L.& Thill, J. V. *Business Communication Today*, 15/e. Pearson Education India, 2016.
2. Beebe, S. A., & Mottet, T. P. *Business and Professional Communication,* 3rd edition, Pearson Higher Education AU, 2021.
3. Herbert Hirsch., *Essential Communication Strategies: For Scientists, Engineers, and Technology Professionals*, 2nd edition. Wiley-IEEE Press, 2007.

REFERENCE BOOKS:

1. Dodd, C. H., *Managing business and professional communication*, 3rd Edition, Allyn & Bacon/Pearson, 2012.
2. Dwyer, J., *Communication for Business and the Professions: Strategies and Skills*, 7th Edition, Pearson Higher Education AU, 2012.
3. Hasson, G., *Brilliant Communication Skills: What the Best Communicators Know, Do and Say*, Ft Pr, 2012.
4. Jones, L. and Alexander, R., *New International Business English Updated Edition Student's Book: Communication Skills in English for Business Purposes*, Vol. 3, Cambridge University Press, 2011.
5. Patterson, K., Grenny, J., McMillan, R. and Switzler, A., *Crucial Conversations: Tools for Talking When Stakes Are High*, Brilliance Audio, 2013.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Develop conversation skills and networking skills in English.	KL3
CO2	Communicate effectively in meetings and group discussions.	KL4
CO3	Deliver engaging presentations and professional interviews.	KL5
CO4	Speak and negotiate strategically in formal and informal settings.	KL4
CO5	Speak and negotiate strategically in formal and informal settings.	KL5

Course Code	Category	CIRCUIT THEORY	L	T	P	C	Contact Hours
	MC		3	0	0	3	3
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

1. To introduce the elements of electric circuits.
2. To perform steady-state analysis using governing laws.
3. To equip students with the skills to solve electric circuits using network theorems.
4. To analyze the transient response, resonance and coupled in electric circuits.
5. To impart knowledge on 3-phase circuits.

UNIT 1 - INTRODUCTION TO CIRCUIT ELEMENTS (9 HOURS)

Types of Electric sources and source transformation techniques - Electric circuit elements: Resistive, Inductive and Capacitive elements, for series parallel circuit – voltage and current division rule - Ohm's law, V-I relationship - Concept of reactance and impedance, impedance triangle, power triangle, power factor and energy calculations.

UNIT 2 – STEADY STATE ANALYSIS FOR DC AND AC CIRCUITS (9 HOURS)

Star-delta conversion - Kirchhoff's laws (KVL & KCL) - Branch current and mesh currents, Mesh analysis for independent, dependent sources, Supermesh - Nodal analysis for independent, and dependent sources, Supernode - Duality concept.

UNIT 3 – CIRCUIT THEOREMS (9 HOURS)

Circuit Theorems for AC and DC circuits: Superposition Theorem - Thevenin and Norton Theorems - Maximum power transfer theorem - Reciprocity Theorem.

UNIT 4 – TRANSIENT RESPONSE ANALYSIS RESONANCE AND COUPLE CIRCUITS (9 HOURS)

Transient response of RL, RC and RLC Circuits using DC input - Series and Parallel Resonance - Bandwidth - Quality Factor - Coupled circuits: self and mutual inductance-analysis of coupled circuits-dot rules-combination of mutually coupled coils.

UNIT 5 – THREE PHASE CIRCUITS (9 HOURS)

Balanced Three Phase voltages – Balanced Wye-Wye connection – Balanced Wye - Delta connection – Balanced delta - delta connection – Balanced delta - wye connection – Power in balanced system – Introduction to Unbalanced three phase system.

TEXTBOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly & Steven M. Durbin, *Engineering Circuits Analysis*, McGraw Hill publishers, 8th Edition, 2013.
2. Charles K. Alexander & Mathew N.O. Sadiku, *Fundamentals of Electric Circuits*, Second Edition", McGraw Hill, 7th Edition, 2013.

REFERENCE BOOKS:

1. Allan H. Robbins & Wilhelm C. Miller, *Circuit Analysis Theory and Practice*, Cengage Learning India, 5th Edition, 2013.
2. Chakrabarti, A, *Circuits Theory Analysis and synthesis*, Dhanpath Rai & Sons, Revised new Edition, 1999.
3. Joseph A. Edminister & Mahmood Nahri, *Electric circuits, Schaum's series*, McGraw-Hill, 6th Edition, 2010.
4. Richard C. Dorf, and James A. Svoboda, *Introduction to Electric Circuits*, John Wiley & Sons, Inc., 7th Edition 2015.
5. M E Van Valkenburg, N*etwork Analysis*, Prentice-Hall of India Pvt. Ltd, 3rd Edition, 2019.

COURSE OUTCOMES

	Course Outcomes	**Knowledge Level**
CO1	Apply fundamental circuit laws to compute electrical parameters and source conversion in any electrical network.	KL3
CO2	Analyze electrical circuits using mesh and nodal methods to determine unknown parameters in DC and AC circuits.	KL4
CO3	Apply the network theorems to analyze electric circuits.	KL3
CO4	Examine transient responses of RL, RC, and RLC circuits to assess its behavior and resonance conditions.	KL4
CO5	Compute three-phase circuit parameters and powers.	KL3

Course Code	Category	ELECTROMAGNETIC THEORY	L	T	P	C	Contact Hours
	MC		3	0	0	3	3
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

1. To understand the basic mathematical concepts related to electromagnetic vector fields.
2. To study the concepts of Electrostatic fields, electrical potential, and their applications.
3. To study the concepts of Magneto static fields, magnetic flux density and its applications.
4. To apply concepts related to electrodynamics in obtaining Maxwell's equations.
5. To understand Electromagnetic wave propagation and characterize the parameters.

UNIT 1 – VECTOR ANLYSIS (9 HOURS)

Sources and effects of electromagnetic fields – Coordinate Systems – Differential Elements of Length, Surface, and Volume - Vector fields – Gradient of a scalar field - Divergence of a vector field - Curl of a vector filed – Gauss's Divergence Theorem - Stoke's Theorem.

UNIT 2 – STATIC ELECTRIC FIELDS (9 HOURS)

Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications-Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics- Dielectric polarization – Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

UNIT 3 – STATIC MAGNETIC FIELDS (9 HOURS)

Lorentz force, magnetic field intensity (H) – Biot–Savart's Law - Ampere's Circuit Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic field in multiple media – Boundary conditions, scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density, Applications.

UNIT 4 – ELECTRODYNAMIC FIELDS (9 HOURS)

Faraday's law – Transformer and motional EMF –Displacement current - Maxwell's equations (Differential and integral form) – Relation between field theory and circuit theory-Electromagnetic boundary conditions - Applications of electrodynamic fields

UNIT 5 – ELECTROMAGNETIC WAVES (9 HOURS)

Electromagnetic wave equations – Wave parameters: velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth – Poynting vector.

TEXTBOOKS:

1. Mathew N. O. Sadiku and 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. Salivahanan S and Karthie S, *Electromagnetic Field Theory*, 2nd Edition, McGrawHill, 2018.

REFERENCE BOOKS:

1. V.V.Sarwate, *Electromagnetic fields and waves*, First Edition, Newage Publishers, 1993.
2. J.P.Tewari, *Engineering Electromagnetics - Theory, Problems and Applications*, Second Edition, Khanna Publishers.
3. Joseph. A. Edminister, *Schaum's Outline of Electromagnetics*, Third Edition (Schaum's Outline Series), McGraw Hill, 2010.
4. P. Ghosh, Lipika Datta, *Electromagnetic Field Theory*, First Edition, McGraw Hill Education(India) Private Limited, 2012.
5. K A Gangadhar, *Electromagnetic Field Theory*, Khanna Publishers; Eighth Reprint ,2015.
6. Kraus and Fleish, *Electromagnetics with Applications*, McGraw Hill International Editions, Fifth Edition, 2010.

COURSE OUTCOMES

	Course Outcomes	**Knowledge Level**
CO1	Apply vector analysis to assess the electromagnetic components in orthogonal coordinate systems.	KL3
CO2	Apply the concepts of static electric fields for evaluation of electrostatic devices.	KL3
CO3	Apply the concepts of static magnetic fields for evaluation of electromagnetic devices.	KL3
CO4	Apply the concepts of electrodynamic fields for design and evaluation of electromagnetic systems.	KL5
CO5	Apply the concepts related to electromagnetic wave equation for understanding the wave propagation.	KL3

Course Code	Category	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C	Contact Hours
	VAC		2	0	0	2	2
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

1. To provide students with a foundation in ethics and human values for personal, social, and professional life.
2. To enable students to understand and apply ethical principles in decision-making and workplace conduct.
3. To develop awareness of social responsibility, civic virtues, and sustainable practices in professional and personal contexts.

UNIT 1 INTRODUCTION TO ETHICS AND VALUES (6 HOURS)

Meaning and scope of ethics, morals, and values, Life skills and emotional intelligence, Personal versus professional ethics, Stakeholders and their influence on decisions, Ethical dilemmas and methods of resolution, Case studies highlighting basic ethical issues

UNIT 2 RESPONSIBILITY, SOCIAL IMPACT, AND WORKPLACE CONDUCT (6 HOURS)

Attributes of a profession, roles, duties, and responsibilities, Professional obligations and social impact of decisions, Corporate Social Responsibility (CSR) and sustainable practices, Legal and social responsibilities, Workplace safety and rights, Case studies on societal and organizational ethical issues

UNIT 3 THEORIES AND DECISION-MAKING FRAMEWORKS (6 HOURS)

Major ethical theories: Utilitarianism, Deontology, Virtue Ethics, Rights-based approaches, Application of theories in professional scenarios, Decision-making frameworks for dilemmas, Responsibility for safety, health, and well-being, Risk assessment and accountability, Case studies illustrating applied concepts

UNIT 4 RIGHTS, GLOBAL ISSUES, AND ETHICAL CODES (6 HOURS)

Rights and duties in workplace, Professional standards and codes of conduct, Ethics audit: implementation and evaluation, Global challenges: environmental ethics, media ethics, bioethics, research ethics, Cross-cultural considerations and international case studies

UNIT 5 HUMAN VALUES AND PROFESSIONAL DEVELOPMENT (6 HOURS)

Nature, classification, and significance of human values, Value-based decision-making in personal and professional life, Integration of human values in daily life, Harmony with self, family, society, and environment, Developing positive attitudes, moral courage, and integrity, Strategies for internalizing and applying values, Practical exercises and case studies on character building and ethical living.

TEXTBOOKS:

1. Professional Ethics Includes Human Values, R. Subramanian, Oxford University Press, 2nd Edition, 2017.
2. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 3rd revised edition, 2023.

REFERENCE:

1. A Textbook on Professional Ethics and Human Values by R.S. Naagarazan, New Age Intl. Publishers, 2006.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Human Values and Professional Ethics, by Vaishali R Khosla & Kavita Bhagat, Technical Publications, First Edition, 2009.

COURSE OUTCOMES

	Course Outcomes	**Knowledge Level**
CO1	Explain the basic concepts of ethics, morals, and values, and differentiate between personal and professional ethics.	KL2
CO2	Describe the responsibilities of professionals and the social and legal impact of their decisions, including CSR and workplace safety.	KL2
CO3	Discuss major ethical theories and their role in resolving ethical dilemmas in professional situations.	KL2
CO4	Identify rights, professional standards, ethical codes, and global challenges relevant to workplace and international practices.	KL2
CO5	Illustrate human values in personal and professional life to foster integrity, positive attitudes, and responsible behavior.	KL3

Course Code	Category	ENGINEERING PHYSICS LABORATORY	L	T	P	C	Contact Hours
	MD		0	0	4	2	4
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:
To determine some of the physical, electrical and optical properties of materials.

Tentative List of Experiments:

1. Determination of velocity and compressibility of the given liquid - Ultrasonic interferometer
2. Determination of Planck's Constant
3. Determination of specific resistance of the given wire - Carey Foster Bridge
4. Determination of energy bandgap of the given semiconductor - Band Gap of Semi-Conductor
5. Determination of grating element / average size of the particles of a given powder sample using laser
6. Determine the numerical aperture, acceptance angle & losses in fibres of the given optical fibre cable.

Advanced Physics Lab (Open-ended)

7. Mini Project that is conceived and executed by end of the semester

REFERENCE BOOKS:

1. Kasap, S.O., *Principles of Electronic Materials and Devices*, Special Indian Edition McGraw-Hill Education, 3rd Edition, 2017.
2. Kittle Charles, *Introduction to Solid State Physics*, Wiley, 2004
3. Gaur R.K. and Gupta S.L., *Engineering Physics,* Dhanpat Rai publishers, 2012
4. Halliday, D., Resnick, R. & Walker, J., *Principles of Physics,* Wiley, 2015.
5. James Beauchamp, *Analysis, Synthesis, and Perception of Musical Sounds –The Sound of Music,* Springer; 2007.
6. Serway, R.A. & Jewett, J.W., *Physics for Scientists and Engineers,* Cengage Learning, 2010.
7. Tipler, P.A. & Mosca, G., *Physics for Scientists and Engineers with Modern Physics*, 2007

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Determine material properties of medium associated with ultrasound propagation.	KL3
CO2	Use lasers for study of materials and optical fibres.	KL3
CO3	Determine electrical properties of metals and semiconductors like specific resistance of a conductor and bandgap of semiconductors.	KL3
CO4	Develop appropriate procedures/methodologies based on study objectives.	KL6

Course Code	Category	MAKERS SPACE LABORATORY	L	T	P	C	Contact Hours
	SEC		0	0	4	2	4
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

1. To provide hands-on experience to the students in various basic engineering practices in Mechanical and Civil Engineering
2. To provide hands-on training to the students in electrical wiring practices and the use of electronic components.

LIST OF EXPERIMENTS:

Mechanical & Civil Engineering Practice

1. **Makers Lab Safety & Tool Handling:** Lab orientation, workflow, PPE, power tool safety, material handling, measurement and marking, Outcome*:* Safe operation of makers lab tools.
2. **Power Tool Carpentry – Utility Product Fabrication:** Cutting, drilling, sanding, joint preparation. *Fabrication:* **Pen stand/utility box,** *Outcome:* Confidence in real carpentry operations.
3. **Carpentry Joints & Building Components:** Fabrication using lap and mortise–tenon joints. *Fabrication:* **Mini door/window frame or wall shelf,** *Outcome:* Understanding structural wood joints used on site.
4. **Plumbing Practice – Domestic Water Supply:** Pipe cutting, joining, and fitting (PVC & GI). *Fabrication:* **Wash basin plumbing system,** *Outcome:* Knowledge of household plumbing installation.
5. **Plumbing System Layout & Drainage:** Assembly of supply and drainage lines. *Fabrication:* **Mini water distribution / sanitary line model,** *Outcome:* Understanding real building plumbing layouts.
6. **Machining Practice – Functional Metal Component:** Drilling, tapping, countersinking, and work holding. *Fabrication:* **Fixture plate/tool holder,** *Outcome:* Exposure to workshop machining operations.
7. **Sheet Metal Fabrication – Industrial Product:** Cutting, bending, folding, riveting. *Fabrication:* **Mobile stand / small enclosure/duct prototype:** *Outcome:* Sheet metal fabrication skills.
8. **Mechanical Mechanism Models:** Assembly and study of motion systems. *Models:* **Gear train, belt-pulley, slider-crank, scissor mechanism.** *Outcome:* Practical understanding of motion transmission.

9. **Real-Life Mechanical Systems Study:** Hands-on observation and disassembly. *Systems:* **Hand pump, flush tank, pedestal fan mechanism.** *Outcome:* Linking theory with real engineering products.

10. **3D Printing – Engineering Prototyping:** Design and fabrication using additive manufacturing. *Fabrication:* **Mechanical bracket / civil pipe or truss model,** *Outcome:* Exposure to modern manufacturing practices.

11. **Laser Cutting & Hybrid Fabrication:** Laser cutting of wood/acrylic and integration with other materials. *Fabrication:* **Building layout plate/phone stand,** *Outcome:* Understanding digital fabrication workflows.

Electrical & Electronics Engineering Practice

1. **Domestic Electrical Wiring Practice:** Assemble a single-phase domestic wiring circuit for operating household appliances using fuse, switch, lamp, energy meter and test its operation. *Outcome***:** Demonstrate domestic electrical wiring practices.

2. **Electrical Measurements in RLC Circuit**: Assemble a single-phase RLC circuit and measure electrical quantities-voltage, current, power, and power factor. *Outcome*: Understand the practical measurement of electrical quantities in RLC circuit.

3. **Electrical Fault Simulation and Protection:** Identifying and analyzing common electrical faults. *Outcome:* Understand electrical faults, working of protective devices, and earthing systems for electrical safety.

4. **Soldering Practice**: Assembly and testing of mobile phone charging circuit. *Outcome:* Hands-on skill in soldering, component identification, and testing.

5. **Relay Control Circuit Using Logic Gates:** Assembly and testing of a relay-based control circuit using logic gates. *Outcome:* Understand the operation of a relay control circuit using logic gates.

6. **AC signal Parameters Measurement and Analysis**: Measurement of amplitude and frequency in a rectifier circuit using a CRO. *Outcome:* Understand the usage of CRO and measurement of AC signal parameters.

7. **Sensor and Actuator Interfacing:** Integration of sensors and actuators with a microcontroller. *Outcome:* Understand the programming of embedded controller for interfacing sensors and actuators.

8. **Dis-assembly and assembly of electrical home appliances**: Grinder Mixer, Ceiling Fan. *Outcome:* Hands-on skill in disassembling, assembling of domestic electrical appliances.

REFERENCE BOOKS:

1. S Gowri, T Jeyapoovan, *Engineering Practices Laboratory Manual*, 5th Edition, Vikas Publishing, 2016.
2. V Ramesh Babu, *Engineering Practices Laboratory*, VRB Publications, 2006.
3. Willis H Wagner, Howard Bud Smith, Mark W Huth, *Modern Carpentry*, 12th Edition, 2015.
4. P C Sharma, *Production Technology: Manufacturing Process*, S Chand publisher, 2006.
5. David W Rongey, *A Complete Guide to Home Electrical Wiring*, 2013.
6. K Jeyachandran, S Natarajan, S Balasubramanian, *A Primer on Engineering Practices Laboratory*, Anuradha Publications, 2007.

COURSE OUTCOMES

	Course Outcomes	**Knowledge Level**
CO1	Identify and explain makers lab safety practices, PPE usage, tools, workflow, and engineering materials used in fabrication.	KL2
CO2	Perform carpentry, plumbing, machining, and sheet metal work to fabricate real-time civil engineering components, domestic water supply systems, and functional mechanical components.	KL3
CO3	Apply modern fabrication techniques such as 3D printing and laser cutting to develop mechanical and civil engineering models and prototypes to meet practical engineering requirements.	KL3
CO4	Construct electrical circuits and demonstrate their working.	KL3
CO5	Demonstrate the implementation and control of electronic circuits for practical applications.	KL3

SEMESTER - II

Course Code	Category	DIFFERENTIAL EQUATIONS AND COMPLEX FUNCTIONS (Common to ECE, VLSI, BME, CIVIL, EEE, MECH, CHEM)	L	T	P	C	Contact Hours
	MC		3	0	0	3	3
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

The objective of the course is to enable the students

- To understand the concept of ordinary and partial differential equations and utilize it in solving engineering problems.
- Find the Laplace Transforms of standard functions and solve second order linear ordinary differential equations with constant coefficients.
- To construct Analytic functions and evaluate integrals using Cauchy's integral formula.

UNIT 1 - ORDINARY DIFFERENTIAL EQUATIONS (9 HOURS)

Solution of second and higher order linear differential equations with constant coefficients (RHS functions), Application to harmonic oscillation of an undamped Mass-Spring system- Method of variation of parameters - Simultaneous linear differential equations with constant coefficients of first order.

UNIT 2 - LAPLACE TRANSFORMS (9 HOURS)

Definition, properties – Transform of elementary functions, unit step function and unit impulse function, shifting theorems – Transforms of derivatives and integrals, Evaluation of integrals by Laplace transforms - Periodic functions – Initial and final value theorems.

UNIT 3 – INVERSE LAPLACE TRANSFORMS (9 HOURS)

Inverse transforms – Definition, Properties - Method of Partial Fractions, Inverse Laplace transforms of derivatives and integrals - Convolution theorem - Applications of Convolution Theorem - Ordinary Differential Equations: Solution by using Laplace Transforms.

UNIT 4 – ANALYTIC FUNCTIONS (9 HOURS)

Analytic functions – necessary and sufficient conditions, Cauchy-Riemann equations in Cartesian and polar form (with proof) – Properties – harmonic functions, Construction of analytic function, conformal mapping – some standard transformations $w = z + c$, cz, $1/z$, bilinear transformation

UNIT 5 – COMPLEX INTEGRATION (9 HOURS)

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 (except the poles on the real axis).

TEXTBOOKS:

1. Grewal B.S, *Higher Engineering Mathematics*, Khanna Publishers, 45th Edition, 2020.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, Inc., 10th Edition, 2020.

REFERENCE BOOKS:

1. Bali, N.P., Goyal, M., Watkins, C., *Advanced Engineering Mathematics*, Laxmi Publications Pvt. Limited, 2007.
2. Boyce, W.E., and DiPrima, R.C*., Elementary Differential Equations and Boundary Value Problems*, Wiley India, 2012.
3. George B. Thomas Jr., Maurice D. Weir, Joel R. Hass, Thomas' *Calculus: Early Transcendental*, 13th Edition, Pearson Education, 2013.
4. O'Neil. P. V., *Advanced Engineering Mathematics*, 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.
5. Howard Anton, Irl C. Bivens, Stephen Davis, *Calculus Early Transcendentals*, 11th Edition, John Wiley & Sons, Inc., 2016.

COURSE OUTCOMES

	Course Outcome	**Knowledge Level**
CO1	Solve second and higher order linear ordinary differential equations with constant coefficients and handle simultaneous linear ODEs.	KL4
CO2	Obtain the Laplace transforms of standard functions.	KL4
CO3	Apply the concepts of inverse Laplace transforms in solving differential equations.	KL3
CO4	Solve problems in analytic functions and construct analytic functions using C-R equations.	KL3
CO5	Compute line integrals, residues, and real integrals via residue theorems.	KL3

Course Code	Category	TECHNICAL WRITING	L	T	P	C	Contact Hours
	AEC		2	0	2	3	4
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

The learners will be able:

1. To prepare effective instructions, checklists and emails
2. To write different kinds of paragraphs and argumentative essays
3. To develop and revise effective resumes, cover letters and SOPs
4. To document and organize various kinds of reports, case studies and white papers
5. To create well-structured proposals and press releases.

UNIT 1 - WRITING INSTRUCTIONS, CHECKLISTS AND EMAILS (12 HOURS)

Writing instructions and checklists; using bulleted lists and numbered lists. Writing professional emails: appropriate greetings, subject line, writing three-body paragraphs – introduction, body, and closing paragraph; discussion of samples. Reading sample instructional texts and professional email models. Language skills: Tenses – present and past

UNIT 2 - WRITING ARGUMENTATIVE PARAGRAPHS AND ESSAYS (12 HOURS)

Writing paragraphs. Structure of a paragraph: basic, compare and contrast. Product descriptions and process descriptions. Interpreting charts and graphs. Reading and writing model argumentative essays and sample analytical paragraphs; handling three types of arguments: Classical, Rogerian, Toulmin; structure of an argumentative essay: introduction, building the thesis, body paragraphs with three arguments or claims and supporting evidence, conclusion. Sample essays. Language skills: Connectors and definitions.

UNIT 3 – WRITING JOB APPLICATIONS AND SUMMARIES (12 HOURS)

Writing job applications, resumes, and cover letters. Writing the statement of purpose (SOP): Outline – professional narrative, previous experience, research interests, and career goals. Writing summaries: reading the text; identifying main and supporting ideas. Writing paraphrases: step-by-step paraphrasing; text comparison; sentence analysis. Language skills: subject-verb agreements.

UNIT 4 – WRITING REPORTS, CASE STUDIES AND WHITE PAPERS (12 HOURS)

Writing datasheets: outline – descriptions, graphics, benefits, features, specifications, requirements, and contact information. Writing abstracts. Reading sample reports, case studies and whitepapers. Writing technical reports; practising IMRAD structure; Engineering reports & Feasibility reports. Writing case studies and white papers: main components of an issue case study – problems, search for solutions, implementation of the solution and results. Language skills: Active voice, passive voice

UNIT 5 – WRITING PROPOSALS AND PRESS RELEASES (12 HOURS)

Writing business proposals: format -- title page, table of contents, executive summary, project details, deliverables and milestones, budget, conclusion. Writing for Websites: Inverted pyramid style; headings and subheading; bulleted lists; short paragraphs with one idea. Writing press releases: outline – headline, date of publication, contact information, summary, intro paragraph, detail paragraphs, and about section. Language skills: Correction of errors, proofreading and editing.

TEXTBOOKS:

1. Laplante, P. A., *Technical Writing: A Practical Guide for Engineers, Scientists, and Nontechnical Professionals*, CRC Press, 2018.
2. Bonamy, D., *Technical English Level 2 Course Book*, Pearson, 2013..

REFERENCE BOOKS:

1. Kmiec, D. and Longo, B., *The IEEE Guide to Writing in the Engineering and Technical Fields*, John Wiley & Sons, 2017.
2. Lansford, L. and Astley, P., *Oxford English for Careers: Engineering 1: Student's Book,* Oxford University Press, 2013.
3. Ibbotson, M., *Cambridge English for Engineering*, Cambridge University Press, 2008.
4. Rubens, P., *Science and Technical Writing: A Manual of Style*, Routledge, 2002.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Write instructions, checklists and emails with clarity and readability.	KL3
CO2	Compose paragraphs and structure an argumentative essay effectively.	KL4
CO3	Create and edit resumes, cover letters and SOPs concisely.	KL4
CO4	Document well-structured reports, case studies and white papers.	KL5
CO5	Develop effective proposals and press releases.	KL5

Course Code	Category	PROGRAMMING IN PYTHON FOR DATA SCIENCE	L	T	P	C	Contact Hours
	VAC		1	0	2	2	3
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

- To learn Python fundamentals and modularity in problem solving.
- To learn data types in Python and file handling.
- To learn numerical computations using NumPy.
- To learn data manipulation using Pandas.
- To perform visualization and statistical analysis using Python libraries.

UNIT 1 - PYTHON FUNDAMENTALS (4 HOURS)

Introduction to Python – Expressions and operators - Variables and Assignment - conditional and Iterative statement; Functions: Local and global scope, Methods of passing arguments, Recursion.

UNIT 2 - DATA TYPES AND FILE HANDLING (3 HOURS)

Compound Data Types: Strings - Lists - Tuples - Dictionaries; File handling.

UNIT 3 – NUMPY FOR NUMERICAL COMPUTATION (2 HOURS)

Arrays in Python – Array creation in NumPy – Indexing and slicing operations – Arithmetic operations – Statistical operations using NumPy.

UNIT 4 – PANDAS FOR DATA MANIPULATION (3 HOURS)

Series and Data frames in Pandas – Data Loading - Indexing – Data cleaning and preprocessing - Data Manipulation: Sorting, grouping, handling missing values - statistical operations in data frames.

UNIT 5 – DATA VISUALIZATION AND STATISTICS (3 HOURS)

Data visualization using Matplotlib: line, bar, scatter, pie, histogram, multiplots; Descriptive Statistics - Correlation Analysis.

SUGGESTED EXPERIMENTS

1. Develop a program to classify students as Excellent, Good, Average, or At Risk using conditional statements.
2. Develop a program to count the number of days with sales above the average using iterative statements.
3. Develop a recursive function to normalize a dataset using Min–Max normalization.
4. Develop a program using strings to count the number of valid and invalid emails.
5. Develop a program to remove duplicate values from a list and sort the cleaned data in ascending order.
6. Develop a program using tuples to store the customer transaction data and compute the total transaction amount.

7. Develop a program to store account number as key and customer details (name, balance, account type) as values using dictionaries and update account balance after deposit or withdrawal.
8. Develop a program to read transaction details from a CSV file and write suspicious transactions to a separate file.
9. A dataset contains monthly sales figures stored in a NumPy array. Develop a program to extract sales data for a specific range of months and access rows and columns using slicing.
10. A dataset of customer balances is stored in a NumPy array. Develop a program to compute quartiles (Q1, Q2, Q3) and interquartile range (IQR).
11. Loan applicant data includes income, age, and credit score is stored in a CSV file. Filter applicants satisfying multiple conditions (e.g., income > ₹50,000 and credit score > 700) using Pandas.
12. A bank wants to visually analyze customer, transaction, and revenue data to support decision-making. Develop a Python application that uses different Matplotlib plots to represent various types of data.
13. Mini Project on Exploratory Data Analysis

TEXTBOOKS:

1. S Sridhar, J Indumathi, V M Hariharan, *Python Programming*, Pearson, 2023
2. Allen B. Downey, *Think Stats: Exploratory Data Analysis*, 3rd edition, O'Reilly, 2025.

REFERENCE BOOKS:

1. Wes McKinney, *Python for Data Analysis*, O'Reilly, 2022
2. Allen B. Downey, *Think Python", 3rd edition, O'Reilly Media, 2024*, Online Version: https://allendowney.github.io/ThinkPython/
3. Ron S. Kenett, Shelemyahu Zacks, Peter Gedeck, *Modern Statistics: A Computer-Based Approach with Python*, Springer, 2022.
4. Karl Beecher, *Computational Thinking – A beginner's Guide to Problem Solving and Programming*, British Computer Society (BCS), 2017.
5. John V Guttag, *Introduction to Computation and Programming Using Python*, 3rd edition, MIT Press, 2021.
6. Alan Agresti and Maria Kateri, *Foundations of Statistics for Data Scientists with R and Python*", First Edition, CRC Press, 2022.

COURSE OUTCOMES

	Course Outcome	Knowledge Level
CO1	Apply sequential, alternate, and iterative approaches for solving problems	KL3
CO2	Solve problems by using different data types and files.	KL3
CO3	Develop Python programs for numerical computations using NumPy.	KL3
CO4	Develop Python programs for data manipulation using Pandas.	KL3
CO5	Select appropriate Matplotlib visualization techniques to accurately represent data trends, patterns, and analytical outcomes.	KL5

Course Code	Category	ENVIRONMENTAL SCIENCE	L	T	P	C	Contact Hours
	VAC		2	0	0	2	2
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

This course aims to:

1. To develop a better understanding of human relationship with environment.
2. To explain the importance of conservation of resources.
3. To create awareness on pollution and environmental degradation.
4. To acquire knowledge on sustainable development.
5. To apply technical skills for solving environmental problems.

UNIT I ECOSYSTEM AND BIODIVERSITY (6 HOURS)

Structure and function of an ecosystem – energy flow- food chains, food webs and ecological pyramids – ecological succession. Introduction to biodiversity definition and types– values of biodiversity – threats to biodiversity-conservation of biodiversity: In-situ and ex-situ conservation of biodiversity; role of individuals and communities in biodiversity conservation.

UNIT II NATURAL RESOURCES (6 HOURS)

Forest, Water, Food, Energy, Mineral and Land resources – uses and case studies on over exploitation of natural resources; Conservation of natural resources; Equitable use of resources for sustainable lifestyles

UNIT III CURRENT ENVIRONMENTAL AND SOCIAL ISSUES (6 HOURS)

Air pollution – particulate pollution (Smog, acid rain, climate change and global warming, ozone layer depletion); Water pollution; Soil pollution and solid waste management; Noise pollution; Nuclear pollution; Role of an individual in the prevention of pollution. Disaster management; Human health and Environment: Issues with water and sanitation; Human rights, HIV/AIDS, Women and child welfare

UNIT IV SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL GOVERNANCE (6 HOURS)

Sustainable development goals (SDGs): Origin, Purpose, importance, and challenges in achieving SDG; Circular economy (4 R and 10 R); Upcycling and waste to wealth strategies; Extended Producer Responsibility; Green buildings; Electric and hybrid electric vehicles; Mission LiFE and Sustainable Lifestyle Practices; Environmental legislations: National Green Tribunal; National missions and policies towards SDGs; ESG framework and corporate sustainability

UNIT V ENGINEERING INTERVENTION TO REDUCE ENVIRONMENTAL STRESSES (6 HOURS)

Role of technology in environmental studies – AI and IoT- Real time data collection and analysis - Environmental modelling and simulation – GIS - Remote sensing – satellite and sensors - Use of drone for aerial mapping and surveying.

TEXTBOOKS:

1. Anubha Kaushik and Kaushik, C. P., *Environmental Science and Engineering*, New Age International Publishers, 14th Edition, 2014.
2. Benny Joseph, *Environmental Science and Engineering*, Tata McGraw-Hill, New Delhi, 2006.

REFERENCE BOOKS:

1. Gilbert M.Masters, *Introduction to Environmental Engineering and Science*, 2nd edition,Pearson Education, 2004.
2. Tyler Miller G. , and Scott E. Spoolman, *Environmental Science*, Cengage Learning India PVT, LTD, Delhi, 2014.
3. M.H. Fulekar, Bhawana Pathak and R.K.Kale, *Environment and Sustainable Development* Springer Nature, 2013.

COURSE OUTCOMES

	Course Outcomes	**Knowledge Level**
CO1	Acquire the basic concepts of ecosystems; understand the importance of biodiversity and conservation strategies.	KL2
CO2	Develop knowledge on natural resources and equitable use of natural resource.	KL2
CO3	Analyse the current environmental problems and its plausible solutions.	KL2
CO4	Explain the concept of sustainable development, its importance and key challenges in implementation of sustainable goals.	KL2
CO5	Describe the role of technology for assessment and management of environment and human health.	KL2

Course Code	Category	ELECTRONIC DEVICES AND CIRCUITS	L	T	P	C	Contact Hours
	MC		3	0	2	4	5
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

1. To Provide fundamental knowledge on semiconductor diodes, their characteristics, and applications in rectifiers and voltage regulation.
2. To Develop an understanding of transistors, thyristors, their configurations, input–output characteristics, and biasing techniques.
3. To Enable students to analyze and design small-signal amplifiers using BJT and MOSFET models.
4. To Introduce multistage and power amplifiers, their frequency response, and performance features for various classes of operation.
5. To Familiarize learners with feedback amplifiers and oscillators, their principles, stability criteria, and design considerations.

UNIT 1 - DIODE AND ITS APPLICATIONS (12 HOURS)

Theory: PN junction diode – Structure, Operation, VI characteristics, models; Applications - Half wave rectifier, Full wave rectifier, impact of filters; Zener diode – Breakdown characteristics, Voltage regulation; Varactor diode, Light emitting diode (LED), Schottky diode – Operation and Applications.

Lab experiments:

1. Characteristics of a Semiconductor diode and a Zener diode
2. Single-phase half-wave and full-wave rectifiers with inductive and capacitive filters
3. Zener diode as a voltage regulator.

UNIT 2 - TRANSISTORS AND THYRISTORS (12 HOURS)

Theory: Transistors: BJT, UJT, FET, MOSFET – Structure, Operation, BJT–Configurations, Input-output characteristics; Biasing methods of BJT & MOSFET.

Lab experiments:

1. Characteristics of a NPN Transistor under common emitter, common collector and common base configurations.
2. Characteristics of JFET and draw the equivalent circuit.
3. Characteristics of UJT and generation of saw tooth waveforms.
4. Setting and analyzing an operating point for a BJT amplifier.
5. Analysis of the MOSFET Characteristics.

UNIT 3 – SMALL-SIGNAL ANALYSIS OF AMPLIFIERS (12 HOURS)

Theory: Introduction to Two-port networks and h-parameters - Small signal analysis of CE amplifiers using hybrid and re models – Frequency response analysis; MOSFET – Configurations, Small signal models, Analysis of CS and Source follower amplifiers.

Lab experiments:

1. Design and analysis of the Common Emitter amplifier.
2. Frequency response characteristics of a Common Emitter amplifier.
3. Design and analysis of the MOSFET amplifiers.

UNIT 4 – MULTISTAGE AND POWER AMPLIFIERS (12 HOURS)

Theory: Introduction to Multistage amplifiers, Different coupling methods and their frequency response, Darlington connection - Single tuned and double tuned amplifiers- Operation and frequency response - Power amplifiers - Class A, Class B, Class AB, Class C and Class D amplifiers (Qualitative analysis only).

Lab experiments:

1. Analysis of Direct-coupled (Cascade and Cascode) amplifiers
2. Analysis of RC amplifiers
3. Analysis of Darlington amplifiers.
4. Analysis of Power amplifiers.

UNIT 5 – FEEDBACK AMPLIFIERS AND OSCILLATORS (12 HOURS)

Theory: Feedback amplifiers - Types, Stability, Distortion; Negative feedback: Voltage/current, series/shunt feedback amplifiers; Positive feedback: Barkhausen criterion, Operation and analysis of RC phase shift, Wien bridge, Hartely, Colpitts and crystal oscillators; Non-sinusoidal oscillators: Astable, Monostable & bistable Multivibrators.

Lab experiments:

1. Design and Analysis of RC phase shift oscillator.
2. Design and testing of RC phase shift oscillator.
3. Design and testing of LC oscillators.

TEXTBOOKS:

1. S.Salivahanan, N.Suresh Kumar, *Electronic Devices and Circuits*, McGraw Hill Education, New Delhi, Fourth Ed, 2016.
2. Boylestad, Robert L., and Louis Nashelsky, *Electronic Devices and Circuit Theory*, Pearson, 2011.

REFERENCE BOOKS:

1. Floyd, T. L., *Electronic Devices*, 9th Edition, Pearson Education, 2012.
2. Bell, D. A., *Electronic Devices and Circuits*, 7th Edition, Oxford University Press, 2008.
3. Millman, J., Halkias, C. C. and Jit, S., Millman's *Electronic Devices and Circuits*, 2nd Edition, Tata McGraw-Hill, 1998.
4. Rashid, M., *Electronic Devices and Circuits*, Cengage Learning.
5. Maini, A. K. and Agarwal, V., *Electronic Devices and Circuits*, 1st Edition, Wiley India Pvt. Ltd., 2009.

COURSE OUTCOMES

	Course Outcome	Knowledge Level
CO1	Explain the characteristics and applications of semiconductor diodes in rectification, filtering, and voltage regulation.	KL2
CO2	Analyze the characteristics and configurations of BJT, JFET, MOSFET, UJT, and thyristors for various applications.	KL4
CO3	Perform small-signal analysis of CE, CS, and source follower amplifiers using h-parameter and re-models.	KL4
CO4	Evaluate the performance of multistage and power amplifiers and describe different coupling methods and amplifier classes.	KL5
CO5	Design and analyze feedback amplifiers and oscillators, satisfying Barkhausen criteria for sustained oscillations.	KL6
CO6	Design a complete amplifier or oscillator system for a given specification by selecting appropriate devices, performing analysis, and ensuring stability, gain, and frequency response requirements.	KL6

Course Code	Category	DIGITAL LOGIC CIRCUITS	L	T	P	C	Contact Hours
	MC		3	0	2	4	5
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

1. To simplify the logical expressions using Boolean algebra and minimization technique for combinational circuits.
2. To design and implement combinational circuits.
3. To study various memory circuits and programming logical devices.
4. To study the design of various synchronous circuits.
5. To introduce the Datapath and design of control unit for the Datapath.

UNIT 1 - BOOLEAN ALGEBRA AND MINIMIZATION TECHNIQUES (12 HOURS)

Abstraction of Gates-TTL gate circuits - Boolean algebra: Boolean Identity, minimization of Boolean functions, De-Morgan's theorem, Boolean Arithmetic's-representation of logic functions-SOP and POS forms, Min term, Max term, minimization using K-maps (3 & 4 variables), Quine McCluskey method (more than 4 variables). Introduction to FPGA & VHDL.

Lab Practice – Design and testing of Multi-input and Multibit-input - Gates, Implementation of Boolean function using VHDL (Behavioral, Structural & Data flow modelling).

UNIT 2 - DESIGN OF COMBINATIONAL LOGIC CIRCUITS (12 HOURS)

Design of adders, subtractors, comparators, code converters, encoders, decoders, multiplexers and demultiplexers, implementation of logical functions using multiplexers and decoders.

Lab Practice – Design and testing of Adders, Subtractors, Multiplexer, Demultiplexer Comparators, Encoders & Decoders using VHDL

UNIT 3 – SYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLE LOGIC DEVICES (12 HOURS)

Sequential logic circuits- SR, JK, D and T flip flops - level triggering and edge triggering – Design of flip flop and conversion of flip flops. Memory Circuits - Shift registers. Introduction to Programmable Logic Devices: PROM – PLA –PAL.

Lab Practice – Design and testing of Flip-Flops, Conversion of flip-flop, Shift Registers using VHDL

UNIT 4 – DESIGN OF SYNCHRONOUS SEQUENTIAL CIRCUITS (12 HOURS)

Design of synchronous sequential circuits – design of synchronous sequential counters and non-sequential counters – lockout conditions. Modulo counters – design of synchronous sequential circuits using Moore and Mealy models- state diagram, state reduction, state assignment.

Lab Practice – Design and testing of Free running Counters-Modulo counters, sequential and non-sequential counters & Sequence Detectors using VHDL

UNIT 5 – DATA PATHS & DESIGN OF CONTROL UNIT (12 HOURS)

Data paths: Simple Arithmetic operation, Multiple Arithmetic Operations- -Design of Dedicated Data Paths – Simple IF THEN ELSE, Counting 1-to-n, Summation n down to 1 and factorial of n.
Deriving control words for Data Paths-Design of control unit- Simple IF THEN ELSE, Counting 1-to-n, Summation n down to 1. Generating status signals. Standalone controllers.

Lab Practice – VHDL- Design of Dedicated Data paths & Control units for IF THEN ELSE, Counting, Summation procedures.

TEXTBOOKS:

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. Enoch O. Hwang, *Digital Logic and Microprocessor Design with VHDL*, Thomson-Indian Edition, 2007.

REFERENCE BOOKS:

1. Tocci R.J., Neal S. Widmer, *Digital Systems: Principles and Applications*, Pearson Education Asia, 12th Edition, 2017.
2. Donald P Leach, Albert Paul Malvino, Goutam Sha, *Digital Principles and Applications*, Tata McGraw Hill, 7th Edition, 2010.
3. Thomas L Floyd, *Digital fundamentals*, Pearson Education Limited, 11th Edition, 2018.
4. Noman Nisam & Shimon Schocken, *Elements of Computing Systems- Building a Modern computer from first principles*, MIT Press - Cambridge: London; 2005.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Apply Boolean laws to simplify and implement logical expressions using VHDL.	KL3
CO2	Design and implement the combinational logic circuits using logical gates in VHDL.	KL6
CO3	Understand the various memory circuits and programmable logical devices.	KL2
CO4	Design and implement synchronous sequential logic circuits using flip-flops in VHDL.	KL6
CO5	Explain the concept of data path and design of control unit for the data path.	KL5
CO6	Design and implement digital logic circuits to solve a real-world problem.	KL6

Course Code	Category	CIRCUIT AND EMT LABORATORY	L	T	P	C	Contact Hours
	SEC		0	0	4	2	4
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

1. To learn the network reduction and verify the network theorems.
2. To study transient response and resonance circuits.
3. To compute electrostatic and electromagnetic induction parameters using software.

Tentative List of Experiments:

1. Study the network reduction, star -delta transformation and verify them experimentally.
2. Verify the Kirchhoff's law.
3. Study of Analog and digital oscilloscopes and measurement of sinusoidal voltage, frequency and phase.
4. Experimentally verify the network theorems.
5. Simulation of DC transients in electric circuits.
6. Simulation of resonance in electric circuits.
7. Measurement of Active and reactive Power for Star and Delta connected balanced loads.
8. Force between two conductors-FEM.
9. Calculation of Skin Depth in FEM.
10. Computation of magnetic field intensity and inductance using FEM.
11. Computation of Electric field intensity, voltage distribution and capacitance- FEM.
12. Plotting of vector, gradient, divergence, and curl fields in simulation.
13. Plotting of electric field and equipotential lines in simulation.
14. Plotting of magnetic fields in simulation.

REFERENCE BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly & Steven M. Durbin, *Engineering Circuits Analysis*, McGraw Hill publishers, 8th Edition, 2013.
2. Charles K. Alexander & Mathew N.O. Sadiku, *Fundamentals of Electric Circuits, Second Edition*, McGraw Hill, 7th Edition, 2013.
3. Chakrabarti, A, *Circuits Theory Analysis and synthesis*, Dhanpath Rai & Sons, Revised new Edition, 1999.
4. Mathew N. O. Sadiku and S.V. Kulkarni, *Principles of Electromagnetics*, 6th Edition, Oxford University Press Inc. Asian edition, 2015.
5. William H. Hayt and John A. Buck, *Engineering Electromagnetics*, McGraw Hill Special Indian edition, 2014.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Analyze electric circuits for various applications.	KL4
CO2	Validate the various network theorems.	KL5
CO3	Characterize the transient behavior and resonance of the circuits.	KL4
CO4	Utilize simulation tools to study and verify the behavior of electromagnetic circuits, and compare practical results with simulation results.	KL5