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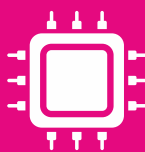
SAI RAM
ENGINEERING COLLEGE

An Autonomous Institution

West Tambaram, Chennai - 44

www.sairam.edu.in

*Approved by AICTE, New Delhi
Affiliated to Anna University*



DEPARTMENT OF
**ELECTRICAL AND ELECTRONICS
ENGINEERING**

**REGULATIONS
2024**

Academic Year 2024-25 onwards

AUTONOMOUS
CURRICULUM AND

SYLLABUS
I - IV
SEMESTERS

SRI SAIRAM ENGINEERING COLLEGE



VISION

To emerge as a "Centre of excellence " offering Technical Education and Research opportunities of very high standards to students, develop the total personality of the individual and instil high levels of discipline and strive to set global standards, making our students technologically superior and ethically stronger, who in turn shall contribute to the advancement of society and humankind.



MISSION

We dedicate and commit ourselves to achieve, sustain and foster unmatched excellence in Technical Education. To this end, we will pursue continuous development of infra-structure and enhance state-of-the-art equipment to provide our students a technologically up-to date and intellectually inspiring environment of learning, research, creativity, innovation and professional activity and inculcate in them ethical and moral values.



Educational Organization Management System (EOMS) Policy

We at Sri Sai Ram Engineering College are committed to empower our students not only to excel academically but also imbibe essential values, enabling them to become exemplary global citizens. We build a better nation by fostering excellence and innovative practices in Engineering, Technology and Management Education. We are dedicated to consistently enhancing our systems, infrastructure and services to meet the needs and expectations of all our stakeholders for sustainable growth

DEPARTMENT OF ELECTRICAL & ELECTRONICS ENGINEERING



VISION

To inculcate discipline, good quality education, research and training, wide knowledge to meet the global standards, opportunities to gain practical knowledge in the laboratories, awareness in emerging technologies in students to render their services for the betterment of the society with ethics.



MISSION

To provide a platform in acquiring knowledge in the field of Electrical and Electronics Engineering with highest quality in technical education and services to the society. To fulfill the needs:

1. To provide best teaching and mentoring through ethical and moral values.
2. To provide quality education for Electrical and Electronics Engineers that prepares them for exemplary life-long career and professional growth.
3. To develop cutting edge technologies through research that meets the needs of industry, government and the scientific community.
4. To guide our graduates to pursue their formal education further, including PG and PhD programmes.
5. To excel in student learning activities, to produce them as problem solvers as a team or individual by active interaction and effective communication with peers and stakeholders.

AUTONOMOUS CURRICULA AND SYLLABI

Regulations 2024

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	24BSMA101	Matrices and Calculus	3	1	0	4	4
2	24HSEN101	Communicative English	3	0	0	3	3
3	24BSPH101	Engineering Physics	3	0	0	3	3
4	24BSCY101	Engineering Chemistry	3	0	0	3	3
5	24ESCS101	Problem Solving and Programming in C	3	0	0	3	3
6	24ESGE101	Engineering Graphics	1	2	0	3	3
7	24HSTA101	Heritage of Tamils	1	0	0	1	1
PRACTICALS							
1	24BSPL101	Physics and Chemistry Laboratory	0	0	4	4	2
2	24ESPL101	Programming in C Laboratory	0	0	2	2	1
VALUE ADDITIONS - I							
1	24ENTP101	Functional Life Skills	0	0	2	2	1
2	24ESID101	Idea Engineering Lab -I	0	0	2	2	1
ONLINE SUPPLEMENTARY							
		Recommended by BoS					
Total						30	25

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	24BSMA202	Differential Equations, Complex Variables and Transforms	3	1	0	4	4
2	24HSEN201	Professional English	2	0	0	2	2
3	24BSPH201	Physics of Electronic Devices	3	0	0	3	3
4	24BSCY201	Chemistry for Environment and Sustainability	3	0	0	3	3
5	24EEPC201	Circuit Theory	2	1	0	3	3
6	24HSTA201	Tamils and Technology	1	0	0	1	1
7	24HSNC201	NCC Course Level 1*	2*	0	0	2*	0
PRACTICALS							
1	24ESGE102	Engineering Practices Laboratory	0	0	4	4	2
VALUE ADDITIONS - II							
1	24ENTP201	Digital Dynamics	0	0	2	2	0
2	24ESID201	Idea Engineering Lab - II	0	0	2	2	1
ONLINE SUPPLEMENTARY							
1	24ESMC201	MS Office (Mandatory - NC)	0	0	0	0	0
*only for NCC cadets			Total			24	19

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SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	24BSMA302	Linear Algebra and Partial Differential Equations	3	1	0	4	4
2	24EEPC301	Electromagnetic Fields	3	0	0	3	3
3	24EEPC302	Electrical Machines - I	3	0	0	3	3
4	24EEPC303	Analog Electronics	3	0	0	3	3
5	24EEPC304	Digital Electronics	3	0	0	3	3
6	24HSMC301	Universal Human Values - II	3	0	0	3	3
7	24HSNC301	NCC course Level 2*	3*	0	0	3*	0
PRACTICALS							
1	24EEPL301	Analog and Digital Electronics Laboratory	0	0	4	4	2
VALUE ADDITIONS - III							
1	24EETP301	Aptitude skills	0	0	2	2	1
2	24EED301	Innovative Design Lab - I	0	0	2	2	1
ONLINE SUPPLEMENTARY							
1	24ESMC301	Joy of Computing using Python (Mandatory - NC)	0	2	0	2	0
Total						29	23

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	24BSMA403	Statistics and Numerical Methods	3	1	0	4	4
2	24EEPC401	Transmission and Distribution	3	0	0	3	3
3	24EEPC402	Electrical Machines - II	3	0	0	3	3
4	24EEPC403	Measurements and Instrumentation	3	0	0	3	3
5	24EIPC404	Control Systems	3	1	0	4	3
6	24MGOE9xx	Open Elective - I #	3	0	0	3	3
7	24HSNC401	NCC course Level 3*	3	0	0	3#	0
PRACTICALS							
1	24EEPL401	Control and Instrumentation Laboratory	0	0	4	4	2
2	24EEPL402	Electrical Machines Laboratory	0	0	4	4	2
VALUE ADDITIONS - IV							
1	24EETP401	Aptitude skills	0	0	2	2	0
2	24EEID401	Innovative Design Lab - II	0	0	2	2	1
ONLINE SUPPLEMENTARY							
		Recommended by BoS	Total			32	24

*Only for NCC Cadets, to be conducted beyond working hours # Logistics (Department Specific)

AUTONOMOUS CURRICULA AND SYLLABI

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SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	24EEPC501	Power System Analysis	3	0	0	3	3
2	24EEPC502	Power Electronics	3	0	0	3	3
3	24EEEL5xx	Professional Elective - I	3	0	0	3	3
4	24SCOE901	Open Elective - II#	3	0	0	3	3
5	24HSMG501	Principles of Engineering Management	3	0	0	3	3
6	24MGMC501	Constitution of India	2	0	0	2	0
PRACTICALS							
1	24EEPL501	Power Electronics Laboratory	0	0	4	4	2
2	24EEPT501	Microprocessor and Microcontroller Laboratory with Theory	1	0	4	5	3
VALUE ADDITIONS - V							
1	24EETP501	Skill Enhancement	0	0	2	2	1
2	24EEID501	Prototype Development Laboratory - I	0	0	2	2	1
ONLINE SUPPLEMENTARY							
		Recommended by BoS # Social Media Overview and Security	Total			30	22

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	24EEPC601	Power System Operation and Control	3	0	0	3	3
2	24EEPC602	Embedded Systems	3	0	0	3	3
3	24EEEL6xx	Professional Elective-II	3	0	0	3	3
4	24EEEL6yy	Professional Elective-III	3	0	0	3	3
5	24EEEL6zz	Professional Elective-IV	3	0	0	3	3
6	24xxOE9xx	Open Elective-III	3	0	0	3	3
PRACTICALS							
1	24EEPL601	Power System Simulation Laboratory	0	0	4	4	2
VALUE ADDITIONS - VI							
1	24EETP601	Technical Skill	0	0	2	2	0
2	24EEID601	Prototype Development Lab - II	0	0	2	2	1
ONLINE SUPPLEMENTARY							
		Recommended by BoS	Total			26	21

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SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	24EEPC701	Electric Vehicles	3	0	0	3	3
2	24EEEL7xx	Professional Elective-V	3	0	0	3	3
3	24EEEL7yy	Professional Elective-VI	3	0	0	3	3
4	24XXOE9xx	Open Elective-IV	3	0	0	3	3
5	24MGEL703	Creative Innovation and Entrepreneurship	2	0	0	2	2
PRACTICALS							
1	24EEPT701	Renewable Energy Laboratory with Theory	1	0	4	5	3
2	20EEPJ701	Project Work - Phase I	0	0	8	8	4
VALUE ADDITIONS - VII							
1	24EETP701	Company Specific Skills	0	0	2	2	1
ONLINE SUPPLEMENTARY							
		Recommended by BoS	Total			29	22

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	24EEEL8XX	Professional Elective-VII	3	0	0	3	3
PRACTICALS							
1	24EEPJ801	Project Work - Phase II	0	0	12	12	6
VALUE ADDITIONS - VIII							
1	24EEIN801	Internship	0	0	9	9	3
Total						24	12

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PROFESSIONAL ELECTIVES - I

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24EEEL501	Power Plant Engineering	3	P&E
2	24EEEL502	Design of Photovoltaic Systems	3	P&E
3	24EEEL503	Energy Management and Energy Auditing	3	P&E
4	24EEEL504	Special Electric Machines	3	PE&EV
5	24EEEL505	Power Electronics Software Simulation	3	PE&EV
6	24EEEL506	Automotive Sensors and Communication	3	PE&EV
7	24EEEL507	Discrete Time Signal Processing	3	Embedded,A&C
8	24EEEL508	Sensors and Actuators	3	Embedded,A&C
9	24EEEL509	Internet Of Things For Electrical Engineering	3	Embedded,A&C
10	24EEEL510	Python for Data Science	3	AI&DS
11	24EEEL511	Programming,Data Structures and algorithms in python	3	AI&DS
12	24EEEL512	Data Science for Engineers	3	AI&DS
13	24MGEL501	Spirituality in Workplace	3	Mgmt

PROFESSIONAL ELECTIVES - II

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24EEEL601	Sustainable Power Generation Systems	3	P&E
2	24EEEL602	DC Microgrid And Control System	3	P&E
3	24EEEL603	Energy Efficiency in Thermal Utilities	3	P&E
4	24EEEL604	Design of Electrical Machines	3	PE&EV
5	24EEEL605	Power Electronics Applications in Power Systems	3	PE&EV
6	24EEEL606	Grid Integration of Electric Vehicle	3	PE&EV
7	24EEEL607	Principles of Communication Systems	3	Embedded,A&C
8	24EEEL608	Industrial Instrumentation	3	Embedded,A&C
9	24EEEL609	C++ for Embedded System	3	Embedded,A&C
10	24EEEL610	Computer Architecture	3	AI&DS
11	24EEEL611	Computer Networks And Internet Protocol	3	AI&DS
12	24EEEL612	Data Analytics	3	AI&DS
13	24MGEL502	Indian Ethos and values in Modern Management	3	Mgmt

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PROFESSIONAL ELECTIVES - III

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24EEEL613	DC Power Transmission Systems	3	P&E
2	24EEEL614	Economic Operations And Control of Power Systems	3	P&E
3	24EEEL615	Energy Efficiency in Electrical Utilities	3	P&E
4	24EEEL616	Electric Motor Design software and simulation	3	PE&EV
5	24EEEL617	Design of Power Electronic Converters	3	PE&EV
6	24EEEL618	Testing of Electric Vehicles	3	PE&EV
7	24EEEL619	Digital image Processing	3	Embedded,A&C
8	24EEEL620	Industrial Automation and Control	3	Embedded,A&C
9	24EEEL621	Embedded Sensing, Actuation And Interfacing System	3	Embedded,A&C
10	24EEEL622	Database Management System	3	AI&DS
11	24EEEL623	Operating System	3	AI&DS
12	24EEEL624	Object Oriented Programming	3	AI&DS
13	24MGEL601	Disaster management	3	Mgmt

PROFESSIONAL ELECTIVES - IV

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24EEEL701	Smart Grid: Basics To Advanced Technologies	3	P&E
2	24EEEL702	Digital Protection of Power System	3	P&E
3	24EEEL703	Energy Performance Assessment for Equipment and Utility Systems	3	P&E
4	24EEEL704	Control and Tuning Methods in Switched Mode Power Converters	3	PE&EV
5	24EEEL705	SMPS and UPS	3	PE&EV
6	24EEEL706	Automotive Security	3	PE&EV
7	24EEEL707	Industrial data Communication	3	Embedded,A&C
8	24EEEL708	Industrial Robotics : Theories for Implementation	3	Embedded,A&C
9	24EEEL709	Embedded Processors	3	Embedded,A&C
10	24EEEL710	Artificial Intelligence	3	AI&DS
11	24EEEL711	Blockchain and its Applications	3	AI&DS
12	24EEEL712	Big Data Analytics for Smart Grid	3	AI&DS
13	24MGEL602	Fintech For Engineers	3	Mgmt

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PROFESSIONAL ELECTIVES - V

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24EEEL713	High Voltage Engineering	3	P&E
2	24EEEL714	Power System Protection and Switchgear	3	P&E
3	24EEEL715	Physics of Renewable Energy Systems	3	P&E
4	24EEEL716	Battery Management System	3	PE&EV
5	24EEEL717	Automotive Systems	3	PE&EV
6	24EEEL718	Vehicle Dynamics and Control	3	PE&EV
7	24EEEL719	Photonics	3	Embedded,A&C
8	24EEEL720	Industrial Safety Engineering	3	Embedded,A&C
9	24EEEL721	Smart Home Automation	3	Embedded,A&C
10	24EEEL722	Cloud Computing	3	AI&DS
11	24EEEL723	Data Mining	3	AI&DS
12	24EEEL724	Deep Learning	3	AI&DS
13	24MGEL603	Total Quality Management	3	Mgmt

PROFESSIONAL ELECTIVES - VI

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24EEEL725	Restructured Power System	3	P&E
2	24EEEL726	Computational Intelligence Applied To Power Engineering	3	P&E
3	24EEEL727	Technologies for Clean and Renewable Energy Production	3	P&E
4	24EEEL728	Design of Motors and Power converters for Electric Vehicles	3	PE&EV
5	24EEEL729	High Power Multilevel Converters- Analysis, Design and Operational Issues	3	PE&EV
6	24EEEL730	Intelligent Control of Electric Vehicles	3	PE&EV
7	24EEEL731	High Speed Digital Design	3	Embedded,A&C
8	24EEEL732	Introduction to Industry 4.0 and Industrial Internet of Things	3	Embedded,A&C
9	24EEEL733	Embedded Control for Electric Drives	3	Embedded,A&C
10	24EEEL734	Soft computing Techniques	3	AI&DS
11	24EEEL735	Artificial Neural Networks	3	AI&DS
12	24EEEL736	Machine Learning Techniques for Electrical Engineering	3	AI&DS
13	24MGEL701	Foundation Skills in Integrated Product Development	3	Mgmt

INDUSTRY CONNECTED PROFESSIONAL ELECTIVES

HCL BASKET

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24ECIE611	Embedded Systems	3	Embedded
2	24ECIE612	Object Oriented Programming For Embedded Systems	3	Embedded
3	24ECIE711	Advanced Embedded Programming	3	Embedded
4	24ECIE712	Product Development Process	3	Embedded
5	24ECIE713	Mini Project	4	Embedded
6	24ECIE811	Internship	3	Embedded
7	24ECIE812	Final Project	6	Embedded

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO1** Graduate will apply the principles of basic science, mathematics and engineering fundamentals necessary to formulate, solve and analyze engineering problems.
- PEO2** Graduate will expertise in the field of Electrical and Electronics Engineering.
- PEO3** Graduate will acquire the knowledge for pursuing advanced degrees in Engineering, Science, Management, Research and Development.
- PEO4** Graduate will achieve professionalism, leadership qualities, self and continuous learning.
- PEO5** Graduate will fulfill the needs of the society by working as Engineers, Entrepreneurs in core as well as inter-disciplinary areas in an ethical and responsible manner.

PROGRAM SPECIFIC OUTCOMES (PSOs)

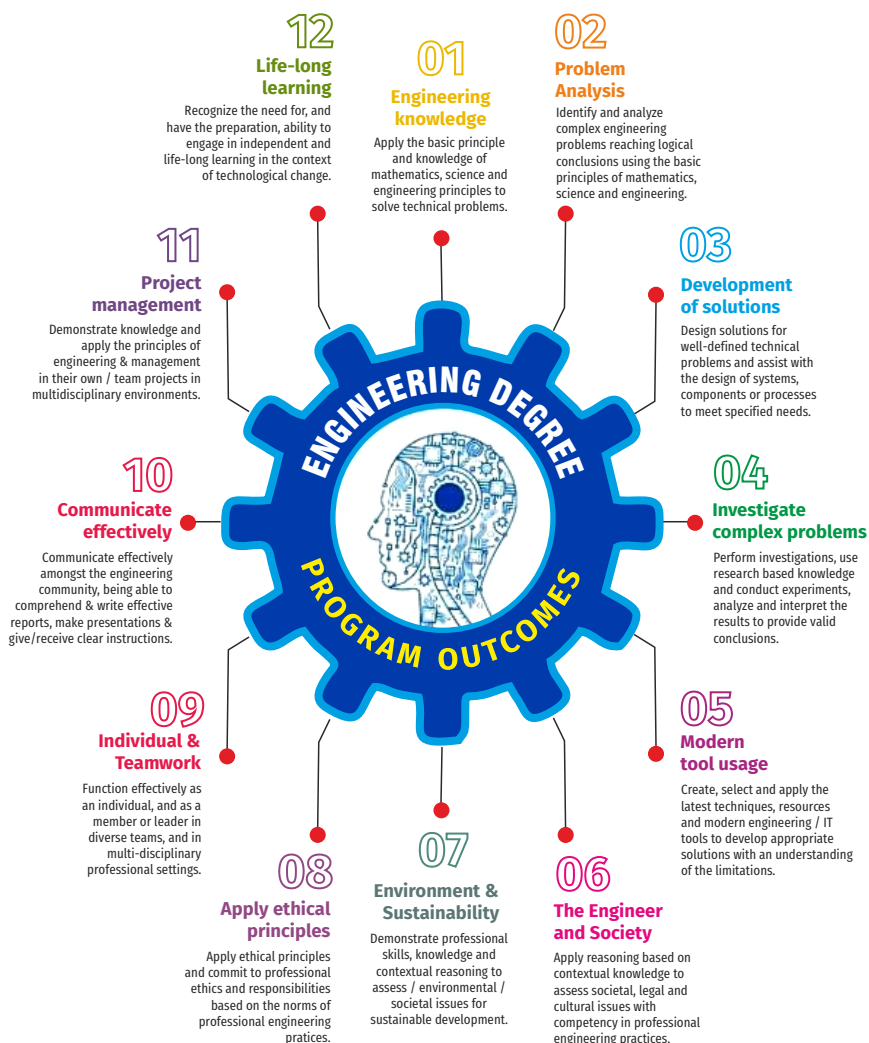
- PSO1** Analyze, Design and simulate diverse problems associated in the field of Electrical, Electronics and computer based system.
- PSO2** Ability to apply technological developments in field of Electrical & Electronics Engineering in Societal and environmental Context and Communicate effectively both individually and in multidisciplinary teams

COMPONENTS OF THE CURRICULUM (COC)

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total Number of credits
Basic Sciences (BS)	18	32	30
Engineering Sciences (ES)	7	17	12
Humanities and Social Sciences (HS)	8	13	13
Professional Electives (EL)	12	20	20
Program Core + Program Lab (PC+PL)	31	62	52
Program theory with Lab (PW) / Program Lab With Theory (PT)	3	10	6
Open Elective (OE)	7	12	12
Training & Placement (TP)	2	14	4
Innovation & Development (ID) / Project (PJ)	10	32	16
Internships (IN)	2	9	3
Mandatory Courses (MC)	NA	4	NA
Total		225	168

PROGRAMME OUTCOMES(POs)

PROGRAM OUTCOME REPRESENTS THE KNOWLEDGE, SKILLS AND ATTITUDES THAT THE STUDENTS WOULD BE EXPECTED TO HAVE AT THE END OF THE 4 YEAR ENGINEERING DEGREE PROGRAM



SEMESTER - I

24BSMA101 SDG NO. 4 & 9	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To understand and gain the knowledge of matrix algebra.
- To introduce the concepts of limits, continuity, derivatives, maxima and minima for functions of several variables.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To provide understanding of double integration, triple integration and their applications.
- To impart the knowledge of Fourier series..

MODULE - I MATRICES**12**

Eigenvalues and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem (without proof) – Symmetric and orthogonal matrices - Reduce the Quadratic to Canonical form using orthogonal transformation - Nature of Quadratic forms.

MODULE - II FUNCTIONS OF SEVERAL VARIABLES**12**

Limits, Continuity - Definitions - Partial derivatives -Taylor's series - Jacobians, Maxima and Minima - Method of Lagrange multipliers.

MODULE - III VECTOR DIFFERENTIATION**4**

Scalar and Vector valued functions- Gradient and Directional derivatives – Tangent plane - Divergence and Curl- Irrotational and Solenoidal vector fields - Scalar and Vector Potentials - Vector identities (without proof).

MODULE - IV VECTOR INTEGRATION**8**

Line integral over a plane curve - Surface integral - Area of a curved surface - Volume integral - Greens, Gauss divergence and Stoke's theorems -Verification and Application in evaluating line, Surface and Volume integrals. Problems involving Cube and Cuboids.

MODULE - V MULTIPLE INTEGRALS**12**

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

MODULE - VI FOURIER SERIES

Fourier series – Convergence of Fourier series -Half range Sine and Cosine series – Parseval's theorem.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Calculus and Analytic geometry, G.B. Thomas and R.L. Finney, 9th Edition, Pearson, Reprint, 2002.

REFERENCES:

1. Higher Engineering Mathematics, B. V. Ramana, 11th reprint, Tata McGraw-Hill, New Delhi, 2010.
2. Engineering Mathematics for first year, T. Veerarajan, Tata McGraw-Hill, New Delhi, 2008.
3. A text-book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2008.
4. Higher Engineering Mathematics, B. S. Grewal, 40th Edition, Khanna Publishers, New Delhi, 2007.

WEB REFERENCES:

1. <https://math.mit.edu/~gs/linearalgebra/ila0601.pdf>
2. <http://ocw.mit.edu/ans7870/18/18.013a/textbook/HTML/chapter30/>
3. <https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/2.-partial-derivatives/>
4. <http://ocw.mit.edu/ans7870/18/18.013a/textbook/HTML/chapter31/>

ONLINE RESOURCES:

1. <https://www.khanacademy.org/math/linear-algebra/alternate-bases/eigen-everything/v/linear-algebra-introduction-to-eigenvalues-and-eigenvectors>
2. <https://www.khanacademy.org/math/differential-calculus>

OUTCOMES:

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

1. Diagonalize the matrix using orthogonal transformation and apply Cayley Hamilton Theorem to find the inverse and integral powers of a square matrix. (K3)
2. Evaluate the limit, examine the continuity and use derivatives to find extreme values for functions of several variables. (K3)

3. Compute the derivatives of scalar and vector point functions. (K3)
4. Use the vector point function to establish the relation between line, surface and volume integrals. (K3)
5. Apply double and triple integrals to find the area and the volume of a region. (K3)
6. Compute Fourier series expansion of a function. (K3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	-	-	-	-	-	-	-	1
CO2	3	1	1	1	-	-	-	-	-	-	-	1
CO3	3	1	1	1	-	-	-	-	-	-	-	1
CO4	3	1	1	1	-	-	-	-	-	-	-	1
CO5	3	1	1	1	-	-	-	-	-	-	-	1
CO6	3	1	1	1	-	-	-	-	-	-	-	1

SEMESTER - I

24HSEN101 SDG NO. 4	COMMUNICATIVE ENGLISH				L	T	P	C
					3	0	0	3

OBJECTIVES:

- Develop the basic LSRW skills
- Acquire enhanced knowledge of English grammar
- Improve modern and technical vocabulary
- Enhance the communicative and cognitive skills
- Interpret the texts and write reviews critically

MODULE - I COMMUNICATION PROCESS**8**

Listening – informal conversations - Speaking – basics in speaking – speaking on given topics & situations – recording speeches and strategies to improve - Reading comprehension – skimming/ scanning/ predicting – question & answers – objective and descriptive answers - Writing – paragraph writing, personal notes - Language Development – parts of speech, prefix, suffix, word formation

MODULE - II LANGUAGE BARRIERS, LEVELS AND CHANNELS 8

Listening –interviews - Speaking – describing a simple process – asking and answering questions - Reading – critical reading – finding key information in a given text – ideation, mind mapping - Writing - dialogue,, instructions – Language Development – regular, irregular verbs, tenses, framing questions,

MODULE - III NARRATION AND SUMMATION 8

Listening - long texts - TED talks - extensive speech on current affairs - Speaking – role plays – asking about routine actions and expressing opinions - Reading- longer texts & making a critical analysis of the given text - Writing – essay (comparative / analytical), jumbled sentences, recommendations - Language Development – writing single sentence definitions, sequence words

MODULE - IV WRITING MECHANICS 7

Listening -debates and discussions – practicing multiple tasks –Speaking - self introduction about friends/ places/ hobbies - Reading -Making inference from the reading passage – Predicting the content of the reading passage - Writing – informal letters, e-mails - accuracy, coherence, brevity – Language Development- single word substitutes, compound words- conditionals

MODULE - V INTERPRETATION SKILLS 7

Listening- popular speeches and presentations - Speaking - impromptu speeches -Reading - articles – magazines - Writing – review writing, channel conversion – bar diagram/ table, poster/ picture interpretation - Language Development – modal verbs, collocations, 21st century vocabulary

MODULE - VI COGENT EXPOSITIONS 7

Listening - Motivational speeches - Speaking - Debates and discussion - Reading - analytical reading - newspapers - Writing - process description - Language Development - voices, sentences expressing purpose, synonyms & antonyms

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Board of Editors. Using English: A Coursebook for Undergraduate Engineers and Technologists. Orient Blackswan Limited, Hyderabad: 2015.
2. A Course in Technical English, D. Praveen Sam and K.N. Shoba, Cambridge University Press, 2020

REFERENCES:

1. Anderson, Paul V. Technical Communication: A Reader – Centered Approach. Cengage, New Delhi, 2008.
2. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason, USA, 2007.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford, 2007.
4. Chauhan, Gajendra Singh and et.al. Technical Communication (Latest Revised Edition). Cengage Learning India Pvt. Limited, 2018.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc19_hs31/preview
2. https://www.myenglishpages.com/speaking/#google_vignette

ONLINE RESOURCES:

1. <https://www.Pearson.com/english/catalogue/business-english/technical-english.html>
2. <https://www.cambridgeenglish.org/learning-english/free-resources/>

OUTCOMES:**Upon completion of the course, the student will be able to:**

1. Improve understanding and application of listening, speaking, reading, and writing skills (K2)
2. Demonstrate the ability to write personal notes, clear and coherent paragraphs (K2)
3. Apply analytical skills to write essays, rearrange jumbled sentences, and formulate recommendations (K3)
4. Apply skills to develop email etiquette and construct professional emails and informal letters (K3)
5. Analyze and interpret data to write comprehensive and effective reviews (K3)
6. Enhance vocabulary, improve grammatical accuracy, and confidently engage in debates (K2)

CO-PO, PSO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	-	-	-	-	-	-	-	-	2	3	-	3	-	-
C02	-	-	-	-	-	-	-	-	-	3	-	3	-	-
C03	-	-	-	-	-	-	-	-	-	3	-	3	-	-
C04	-	-	-	-	-	-	-	-	-	3	-	3	-	-
C05	-	-	-	-	-	-	-	-	-	3	-	3	-	-
C06	-	-	-	-	-	-	-	-	-	3	-	3	-	-

SEMESTER - I

24BSPH101 SDG NO. 4	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of mechanics and its use in engineering applications.
- To illustrate the various laws of electromagnetic waves and its applications.
- To understand the concept of waves and lasers and its applications.
- To apply the concepts of quantum mechanics to engineering studies.
- To identify the basic principles involved in thermal physics and its applications.
- To understand the basics of crystal for engineering applications.

MODULE -I PROPERTIES OF MATTER**8**

Elasticity – Hooke's law- Poisson's ratio - Stress - strain diagram and its uses - Twisting couple - shaft - Torsion pendulum: theory and experiment - bending of beams - bending moment - cantilever: theory and experiment - uniform and non-uniform bending: theory and experiment - I-shaped girders.

MODULE -II MECHANICAL WAVES AND LASERS**7**

Waves on a string – standing waves – traveling waves – Energy transfer of a wave – Reflection and refraction of light waves – interference – Theory of air wedge and experiment - Theory of laser – characteristics – Spontaneous and stimulated emission – Einstein's coefficients – population inversion – Nd-YAG laser, CO₂ laser – Basic applications of lasers in industry.

MODULE - III ELECTROMAGNETIC WAVES**8**

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 - Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence.

MODULE - IV BASIC AND APPLIED QUANTUM MECHANICS**7**

Black body radiation – Planck's derivation – Electrons and matter waves –The Schrodinger equation (Time dependent and time independent forms) – significance of wave function – Normalization –Free particle – particle in a infinite potential well: 1D, 2D and 3D Boxes; - Barrier penetration and quantum tunneling (qualitative) – Scanning Tunneling Microscope.

MODULE - V CRYSTAL PHYSICS**8**

Single crystalline, Polycrystalline and Amorphous materials - single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal - Miller indices - Interplanar distance - X-Ray diffraction - Calculation of number of atoms per unit cell - Atomic radius - Coordination number – packing factor for SC, BCC, FCC and HCP structures - Polymorphism and allotropy. Crystal Growth: Chochralski technique - Molecular beam epitaxy.

MODULE - VI THERMAL PHYSICS**7**

Transfer of heat energy - Conduction, Convection and Radiation - Thermal conductivity, Forbe's method and Lee's disc method - Conduction through compound media - series and parallel methods - Heat exchangers - Refrigerators and Solar water heaters.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. D.K. Bhattacharya & T.Poonam, "Engineering Physics". Oxford University Press, 2015.
2. R.K. Gaur & S.L. Gupta, "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. B.K. Pandey & S.Chaturvedi, "Engineering Physics", Cengage Learning India, 2017.
4. V. Rajendran, "Engineering Physics", Mc Graw Hill Publications Ltd. New Delhi, 2014.
5. M.N. Avadhanulu And P.G. Kshirsagar, "A textbook of Engineering Physics", S. Chand & Co Ltd. 2016.

REFERENCES:

1. D. Halliday, Resnick & J. Walker, "Principles of Physics", Wiley, 2015.
2. R.A. Serway, & J.W. Jewett, "Physics for Scientists and Engineers", Cengage Learning, 2010.
3. N.K. Verma, "Physics for Engineers", PHI Learning Private Limited, 2014.
4. P.A. Tipler & G. Mosca "Physics for Scientists and Engineers", W.H. Freeman, 2020.
5. Brijlal and Subramanyam, "Properties of Matter", S. Chand Publishing, 2018.
6. Shatendra Sharma & Jyotsna Sharma, "Engineering Physics", Pearson, 2018.
7. Arthur Beiser. "Concepts of Modern Physics", McGraw-Hill, 6th Edition. 2003.
8. Charles Kittel, "Introduction to Solid State Physics". John Wiley & Sons. 8th Edition, 2005.

OUTCOMES:

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

1. Understand the mechanical properties of materials. (K2)
2. Express the knowledge of waves and to discuss about lasers and its applications (K2)
3. Understand the properties of electromagnetic waves and its propagation in different medium (K2)
4. Discuss the dual nature of matter and radiation and application of one dimensional Schrodinger's wave equations to a matter wave system (K3)
5. Understand the basics of crystal, its structure determination and different growth techniques. (K2)
6. Discuss the heat transfer in different media and its applications. (K2)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	2	-	-	-	-	-	-	1
CO2	3	2	2	1	3	-	-	-	-	-	-	2
CO3	3	3	2	1	1	-	-	-	-	-	-	1
CO4	3	3	2	2	2	-	-	-	-	-	-	1
CO5	3	2	2	3	1	-	-	-	-	-	-	1
CO6	3	3	3	2	2	-	-	-	-	-	-	1

SEMESTER - I

24BSCY101 SDG NO. 4,7,8,9, 11,12 & 17	ENGINEERING CHEMISTRY	L 3	T 0	P 0	C 3
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OBJECTIVES:

- To enumerate the importance, synthesis, and applications of polymers.
- To impart basic knowledge of chemistry and the principles involved in electrochemistry, energy storage devices, and their commercial applications.
- To familiarize the fundamental laws and concepts of important photophysical and photochemical processes, as well as spectroscopy.
- To explore the fundamental concepts, laws, and principles of thermodynamics, and apply its derivations to optimize and innovate engineering processes across various disciplines.
- To comprehend the chemistry of fuels and combustion, and their applications across various engineering and industrial processes.
- To gain an understanding of the emergence and challenges of nanomaterials and nanotechnology across various scientific and technological disciplines.

MODULE-I POLYMER CHEMISTRY

8

Polymers: Definition, Degree of polymerization, Functionality of monomer, Classification of polymer with examples, Types of polymerization, Mechanism of addition polymerization (Free radical mechanism).

Plastics: Definition and Characteristics - Thermoplastics & Thermosets. Preparation, properties and engineering applications of plastics -PVC, Teflon, Kevlar and Bakelite.

Fibers: Characteristics fibers - Preparation, properties and applications of Nylon and Dacron. Biodegradable polymers & Conducting Polymers: Characteristics, Classification and their applications.

MODULE-II ELECTROCHEMISTRY AND BATTERY TECHNOLOGY

7

Electrochemistry: Types of Cells (Electrochemical and Electrolytic cell) – Redox reaction – Single and Standard electrode potential, Reference electrodes - SHE, Calomel electrode, Measurement of Single Electrode Potential, Nernst's equation (Derivation & Problems), Electrochemical series and its significance.

Batteries: Evolution of batteries – Primary and Secondary battery (Lead acid battery), Next Generation Battery Technology (NGBT) - Solid-state batteries (Lithium-ion), Sodium-ion batteries.

MODULE - III PHOTOCHEMISTRY & SPECTROSCOPY

7

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Quantum efficiency – determination- Photo processes - Jablonski diagram (Internal Conversion, Intersystem crossing, Fluorescence, Phosphorescence), Chemiluminescence and Photosensitization.

Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and Rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram only).

MODULE - IV CHEMICAL THERMODYNAMICS

8

Terminology of Thermodynamics - Laws of Thermodynamics – I law – Significance – Mathematical formulation and its applications. II law – Need for the II law. Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes, entropy of phase transitions; Clausius inequality. Helmholtz and Gibbs free energy functions, Criteria of spontaneity, Maxwell relations, Gibbs-Helmholtz equation, Van't Hoff Isotherm and Isochore.

MODULE - V FUELS

8

Fuels: Introduction – Classification of fuels – Coal – Analysis of coal (proximate and ultimate). Carbonization – manufacture of metallurgical coke (Otto Hoffmann method) – Petroleum – manufacture of synthetic petrol (Bergius process). Knocking – Octane number and Cetane number – Gaseous fuels – Compressed natural gas (CNG), Liquefied petroleum gas (LPG). Biofuels – Gobar gas and Biodiesel.

Combustion of fuels: Introduction – Calorific value – Higher and Lower Calorific values- Theoretical calculation of Calorific value (Dulong formula) – Flue gas analysis (ORSAT Method).

MODULE - VI NANO CHEMISTRY

7

Introduction - Types of nanomaterials - Emergence and challenges in nanotechnology- Synthesis routes for nanomaterials: Bottom-up and top-down approaches - Sol-gel, precipitation, Thermolysis, Laser ablation, Chemical Vapour Deposition (CVD), Electro deposition - Properties of nanomaterials- Mechanical properties, Chemical, Optical, Electrical and Magnetic properties-applications of nanomaterials (Gold nanoparticles as an example). Quantum Dots - concept, properties and applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015.
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015.
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.
4. Ravikrishnan A, 'Engineering Chemistry', Sri Krishna Hitech Publishing Company Pvt. Ltd, New Edition 2024.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.
4. Chemistry of Nanomaterials Vol.1 S.S.R Kumar Challa (Ed).
5. Advanced chemistry by Phillip Matthews Vol.1 and Vol.2.
6. Chemistry in Engineering and Technology Vol. 1 & 2, J.C. Kuriacose and J. Rajaram.
7. Applied chemistry - A textbook for Engineers and Technologists by H.D. Gesser.

OUTCOMES:**Upon completion of the course, the student will be able to:**

1. Explain the importance of polymers in science and technology, describe their roles in different applications and discuss their impacts on modern advancements. (K3)
2. Recognize the basic principles of electrochemistry and describe their application in battery technologies. (K3)
3. Apply the concepts of key photophysical and photochemical processes, as well as spectroscopy, to develop and optimize various applications. (K3)
4. Describe the principles of the second law of thermodynamics and its derivations to analyze engineering applications across all disciplines. (K3)
5. Categorize the chemistry of fuels and combustion and their applications at various levels. (K3)
6. Demonstrate the knowledge of nanomaterials, including their properties, behavior, interactions and applications across various disciplines of science and technology. (K3)

CO-PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1	-	-	-	-	-	-	-	1
CO2	3	2	2	2	-	-	-	-	-	-	-	1
CO3	2	1	1	-	-	-	-	-	-	-	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1
CO6	3	3	2	2	-	-	-	-	-	-	-	1

SEMESTER - I

24ESCS101 SDG NO. 4 & 9	PROBLEM SOLVING AND PROGRAMMING IN C				L	T	P	C
					3	0	0	3

OBJECTIVES:

- Interpret Mathematical problems using algorithms, flowchart and pseudocode.
- To understand about the programming language
- To develop C Programs using basic Programming Constructs, Loops, Arrays and Strings
- To develop applications in C using Functions, Pointers and Structures
- To perform I/O operations and File Handling in C

MODULE -I INTRODUCTION TO PROGRAMMING AND ALGORITHMS FOR PROBLEM SOLVING **7**

Introduction to Problem Solving through programs- Algorithm-Flowchart-Pseudocode-Memory, Variables, Values, Instructions, Programs-compilation process-Syntax and Semantic Errors- The language of C : Phases of developing a running computer program in C - Character set – Constants – Keywords – Primitive data types –Declaration, Type Conversion

MODULE - II BASICS OF C PROGRAMMING **7**

Sequential- Arithmetic Operators, Relational Operators, Logical Operators, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, selective – If Else-If, Switch- repetitive structures-for, while, do while, Nested loops, go to, break, continue –Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD and LCM, Prime number generation

MODULE - III ARRAYS AND STRINGS**8**

Introduction to Arrays: Declaration, Initialization – One Dimensional Array – Example Program: Computing Mean, Median and Mode - Two Dimensional Arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String Operations: Length, Compare, Concatenate - Copy – Selection Sort - Linear and Binary Search.

MODULE - IV FUNCTIONS AND POINTERS**9**

Introduction to Functions: Function Prototype, Function Definition, Function Call, Built-in Functions (String Functions, Math Functions) – Recursion – Example Program: Computation of Sine Series - Scientific Calculator using Built-in Functions - Binary Search using Recursive Functions - Factorial and Fibonacci Generation - Towers of Hanoi problem - – Pointers – Pointer Operators – Pointer Arithmetic – Arrays and Pointers – Array of Pointers – Example Program: Sorting of Names – Parameter Passing: Pass by Value - Pass by Reference – Example Program: Swapping of Two Numbers using Pass by Reference.

MODULE - V STRUCTURES**7**

Structure - Nested Structures – Pointer and Structures – Array of Structures – Example Program using Structures and Pointers – Self Referential Structures – Dynamic Memory Allocation - Singly Linked List – Typedef.

MODULE - VI FILE PROCESSING**7**

Files – Types of File Processing: Sequential Access, Random Access – Sequential Access File - Example Program: Finding Average of Numbers stored in Sequential Access File - Random Access File - Example Program: Transaction Processing Using Random Access Files – Command Line Arguments.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. R.G. Dromey, "How to solve it by Computers", Reprint, PHI Publishers, 2011.
2. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2018.
3. Kernighan, B.W and Ritchie D.M, "The C Programming language", Second Edition, Pearson Education, 2015.

REFERENCES:

1. Yashwant Kanetkar, "Let us C", 18th Edition, BPB Publications, 2021.
2. Byron Gottfried, "Programming with C", Fourth Edition, Tata McGraw Hill Education, 2018.
3. Paul Deitel and Harvey Deitel, "C How to Program", Seventh edition, Pearson Publication, 2015.
4. Jeri R. Hanly & Elliot B.Koffman, "Problem Solving and Program Design in C", Pearson Education, 2013.
5. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009.
6. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
7. Hanly J R & Koffman E.B, "Problem Solving and Programme design in C", Pearson Education, 2009.

WEB REFERENCES:

1. <https://www.learn-c.org/>
2. <https://codeforwin.org/>
3. <https://www.cprogramming.com>

ONLINE RESOURCES:

1. https://www.linuxtopia.org/online_books/programing_books/gnu_c_programming_tutorial
2. <https://nptel.ac.in/courses/106105171>
3. https://swayam.gov.in/nd1_noc19_cs42/preview

OUTCOMES:**Upon completion of the course, the student will be able to:**

1. Understand the concepts of algorithms for solving a problem.(K2)
2. Illustrate the various constructs in C to develop simple applications.(K3)
3. Understand the concepts of Array & Strings.(K2)
4. Demonstrate the usage of Functions and Pointers.(K3)
5. Explain the Structure and union concepts.(K2)
6. Describe the file manipulation and its organisation.(K2)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	3	3	3	3	2	-	-	-	-	-	2	2	2	2
C02	3	3	3	3	2	-	-	-	-	-	2	2	2	2
C03	3	3	3	3	2	-	-	-	-	-	2	-	2	2
C04	2	2	-	2	2	-	-	-	-	-	1	-	3	2
C05	2	2	-	-	1	-	-	-	-	-	1	-	3	3
C06	2	2	-	-	2	-	-	-	-	-	1	-	3	3

SEMESTER - I

24ESGE101 SDG NO. 4,6,7,9, 12,14 & 15	ENGINEERING GRAPHICS				L	T	P	C
					1	2	0	3

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products.
- To visualize the job in three dimensions.
- To have a clear conception and appreciation of the shape, size, proportion and design.
- To expose the student community to existing national standards related to technical drawings.

MODULE - I PLANE CURVES**6+4**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid on Horizontal Surfaces – Drawing of tangents and normal to the above curves.

MODULE - II PROJECTION OF POINTS, LINES AND PLANES**6+4**

Projection of Points (Concept only). Projection (Elevation and Plan) of straight lines, inclined to both reference planes by rotating line method. Projection of plane surfaces, inclined to one of the reference planes by rotating object method.

MODULE - III PROJECTION OF SOLIDS**6+4**

Projection of regular solids (Prisms, Pyramids, Cylinder and cone) in first quadrant, by rotating object method when the axis is inclined to one of the

reference planes.

MODULE - IV ORTHOGRAPHIC PROJECTION

6+4

Orthographic Projection - Principles of orthographic projections, Orthographic projection of objects from pictorial view.

MODULE - V SECTION AND DEVELOPMENT OF LATERAL SURFACE 6+4

Projection of sectioned solids (Prisms, Pyramids, Cylinder and cone) and true shape of the sections, when the axis of the solid is perpendicular to HP alone and cutting plane inclined to HP only. Development of lateral surfaces of sectioned regular vertical solids (Prisms, Pyramids, Cylinder and Cone) with cutting plane inclined to HP only.

MODULE - VI ISOMETRIC PROJECTIONS

6+4

Isometric projection – Principle, isometric scale, Isometric views and Isometric projections of truncated solids - Prisms, Pyramids, Cylinder and Cone in simple vertical positions only.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2011.
2. T. Jeyapoovan, “Engineering Graphics using AUTOCAD”, Vikas Publishing House Pvt Ltd, 7th Edition.

REFERENCES:

1. N S Parthasarathy and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
2. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.
3. Natrajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.

WEB REFERENCES:

1. <https://archive.nptel.ac.in/courses/112/102/112102304/>

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/105/104/105104148/>
2. <https://nptel.ac.in/courses/112/103/112103019/>

OUTCOMES:**Upon completion of the course, the student will be able to:**

1. Perform free hand drawing of conical sections and cycloids. (K3)
2. Sketch the orthographic projection of lines and plane surfaces of rectangle, square, pentagon and Hexagon. (K3)
3. Draw the orthographic projection of regular solids like prism, pyramids, cylinder and cone using change of position method. (K3)
4. Draw plan, elevation and side views for the 3dimensional isometric drawing by using the concepts of orthographic projection. (K3)
5. Draw the section and development of lateral surfaces for the regular solids like Prism, Pyramid, Cylinder and Cone for the axis perpendicular to HP. (K3)
6. Draw the isometric view, projection for regular and truncated solids like Prism, Pyramid, Cylinder and Cone. (K3)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	-	-	-	-	-	-	2	-	2	-	-	3	2
C02	3	-	-	-	-	-	-	2	-	2	-	-	3	2
C03	3	-	-	-	-	-	-	2	-	2	-	-	3	2
C04	3	-	-	-	-	-	-	2	-	2	-	-	3	2
C05	3	-	-	-	-	-	-	2	-	2	-	-	3	2
C06	3	-	-	-	-	-	-	2	-	2	-	-	3	2

SEMESTER - I

24HSTA101 SDG NO. 4	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

OBJECTIVES:

- Develop interest for classical language and literature to promote Tamil heritage
- Understand the ancient Tamil sculptures, folk and martial arts and contribution of Tamil to the freedom of India

UNIT - I LANGUAGE AND LITERATURE**3**

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

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

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

UNIT - III FOLK AND MARTIAL ARTS**3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT- IV THINAI CONCEPT OF TAMILS**3**

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

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

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

TOTAL : 15 PERIODS**TEXT-CUM-REFERENCE BOOKS**

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
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.

தமிழர் மரபு

அலகு - I மொழி மற்றும் இலக்கியம்:

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியொர் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு - II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை:

3

நடுகல் முதல் நவீன சிற்பங்கள் வளர் - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - கதர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு - III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலொட்டம், தொல்பாலைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு - IV தமிழர்களின் திறைக் கோட்பாடுகள்:

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்கொப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு - V **இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:** **3**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
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.

OUTCOMES:

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

1. Understand Tamil as a classical language & Literature (K2)
2. Explore about Tamil Heritage & Sculptures, Role of temples (K2)
3. Appreciate Sports and games of Tamils (K2)
4. Perceive Thinaï concept of Tamils (K2)
5. Comprehend Education and literacy during Sangam Age (K2)
6. Understand the Contribution of Tamils to National Movement & Indian Culture (K2)

CO- PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	-	-	-	-	-	3	-	-	-	-	-	3	-	-
C02	-	-	-	-	-	3	-	-	-	-	-	3	-	-
C03	-	-	-	-	-	3	-	-	-	-	-	3	-	-
C04	-	-	-	-	-	3	-	-	-	-	-	3	-	-
C05	-	-	-	-	-	3	-	-	-	-	-	3	-	-
C06	-	-	-	-	-	3	-	-	-	-	-	3	-	-

SEMESTER - I

24BSPL101 SDG NO. 4,6,11, 12 & 17	PHYSICS AND CHEMISTRY LABORATORY				L	T	P	C
					0	0	4	2

PHYSICS LABORATORY (Any Five Experiments to be conducted)**OBJECTIVES:**

- Demonstrate the wave nature of light using diffraction and interference properties.
- Study the thermal conductivity of a bad conductor.
- Verify experimentally the elastic properties of materials.

Sl.No. Name of the Experiment

- 1 (a) Determination of wavelength of Laser
(b) Determination of numerical aperture and acceptance angle in an optical fiber.
(c) Determination of particle size using laser source.
- 2 Determination of thermal conductivity of a bad conductor – Lee's Disc method.
- 3 Determination of Young's modulus by non-uniform bending method.
- 4 Determination of the period of oscillation of a given torsional pendulum for a fixed length and find the rigidity modulus of the wire.
- 5 Find out the thickness of the given wire by air wedge method.
- 6 Calculation of lattice cell parameter – X-ray diffraction method.
- 7 Determination of Planck's constant.
- 8 Determination of wavelength of mercury spectrum – spectrometer grating.

- 9 Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
- 10 Determination of band gap of a semiconductor.
- 11 Determination of Hall coefficient by Hall Effect experiment.
- 12 Determination of solar cell characteristics.

CHEMISTRY LABORATORY (Any Five Experiments to be conducted)

OBJECTIVES:

- To acquaint students with practical knowledge of the basic concepts of chemistry that they will encounter during their studies and in the industry and engineering fields.
- To acquaint students with the determination of the molecular weight of a polymer by viscometry.
- To develop and understand the basic concepts of acidic and basic nature using pH.

Sl.No. Name of the Experiment

- 1 Conductometric titration of strong acid vs strong base.
- 2 Determination of chloride content of water sample by Argentometric method.
- 3 Determination of strength of acids in a mixture of acids using conductivity meter.
- 4 Determination of total, temporary & permanent hardness of water by EDTA method.
- 5 Estimation of iron content of the given solution using potentiometer.
- 6 Determination of DO content of water sample by Winkler's method.
- 7 Determination of strength of given hydrochloric acid using pH meter.
- 8 Estimation of iron content of the water sample using spectrophotometer (1,10- Phenanthroline / thiocyanate method).
- 9 Estimation of Sodium and Potassium in the given sample of water using Flame Photometer.
- 10 Determination of molecular weights of polymer samples using Ostwald's Viscometer.
- 11 Synthesis of nano-CdS by precipitation. (Demonstration only)
- 12 Corrosion experiment-weight loss method.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Engineering Physics Lab, Dr. G. SenthilKumar, VRB publishers. (2019)
2. Engineering Physics Practical, Dr. P. Mani, Dhanam Publications. (2020)

TEXTBOOK:

1. Vogel's Textbook of Quantitative Chemical Analysis (8th edition, 2014).
2. Practical Physical chemistry by B. Viswanathan, P. S. Raghavan (Vivabooks), 2009.
3. Foundation of Experimental Chemistry by Jubaraj B. Baruah, ParikshitGogoi, 2010.

OUTCOMES:**Upon completion of the course, the student will be able to:**

1. Demonstrate the wave nature of light using diffraction and interference properties. (K3)
2. Study the thermal conductivity of a bad conductor. (K3)
3. Verify experimentally the elastic properties of materials. (K3)
4. Describe multiple measurement techniques, including volumetric titrations, conductivity, pH, redox potential and optical density measurements, used to estimate the amount of substance present in a solution. (K3)
5. Apply spectroscopic techniques to determine the concentration of metal ions in solutions and use viscometry to determine the molecular weight of a polymer. (K3)
6. Demonstrate the ability to synthesize nanoparticles using simple chemical or physical methods and apply the weight loss method to study and analyze the corrosion behavior of materials in different environments. (K3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	3
CO2	3	3	2	2	-	-	-	-	-	-	-	2
CO3	3	3	2	2	-	-	-	-	-	-	-	3
CO4	2	2	2	1	-	-	-	-	-	-	-	1
CO5	2	2	2	1	-	-	-	-	-	-	-	1
CO6	2	2	2	1	-	-	-	-	-	-	-	1

SEMESTER - I

24ESPL101 SDG NO. 4 & 9	PROGRAMMING IN C LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop programs in C using basic Programming Constructs
- To develop applications in C using Arrays and Strings
- To design and implement applications in C using Functions, Structures
- To develop applications in C using Files

LIST OF EXPERIMENTS

1. Write a program using I/O statements and expressions.
2. Write programs using decision-making constructs.
3. Write a program to find whether the given year is a leap year or not?
(Hint: not every century is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Write a program to perform the Calculator operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Write a program to check whether a given number is an Armstrong number or not?
6. Write a program to check whether a given number is odd or even?
7. Write a program to find the factorial of a given number.
8. Write a program to find out the average of 4 integers.
9. Write a program to print half pyramid of *.
10. Write a program to display array elements using two dimensional arrays.
11. Write a program to perform swapping using a function.
12. Write a program to display all prime numbers between two intervals using functions.
13. Write a program to solve towers of Hanoi using recursion.
14. Write a program to get the largest element of an array using the function.
15. Write a program to concatenate two strings.
16. Write a program to find the length of String.
17. Write a program to find the frequency of a character in a string.
18. Write a program to store Student Information in Structure and Display it.

19. The annual examination is conducted for 10 students for five subjects.
Write a program to read the data and determine the following:
- Total marks obtained by each student.
 - The highest marks in each subject and the marks of the student who secured it.
 - The student who obtained the highest total marks.
20. Write a program to demonstrate file operations (e.g. count the number of characters, words and lines in a file, replace a specific word with the given word in the same file).

TOTAL: 30 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- Stand alone desktops with C compiler 30 Nos. (Or)
Server with C compiler supporting 30 terminals or more.

OUTCOMES:

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

- Illustrate C programs for simple applications making use of basic constructs, arrays, strings, functions and recursion. (K2)
- Demonstrate C programs involving pointers, and structures. (K3)
- Interpret applications using sequential and random access files. (K3)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	3	3	2	-	-	-	-	-	-	3	1	2
C02	3	3	3	3	2	-	-	-	-	-	-	3	2	1
C03	3	3	3	3	2	-	-	-	-	-	-	3	3	2

SEMESTER - I

24ENTP101 SDG NO. 4	FUNCTIONAL LIFE SKILLS				L	T	P	C
					0	0	2	1

OBJECTIVES:

- Resolve common communication problems
- Observe the effectiveness of nonverbal messages
- Communicate precisely through the digital media
- Understand the importance of empathetic listening
- Explore reading and speaking processes

MODULE - I LISTENING**5**

Techniques of effective listening
Listening and comprehending
Probing questions
Barriers to listening
Reflection from listening

MODULE - II SPEECH MECHANICS**5**

Pronunciation
Enunciation
Vocabulary
Fluency
Common errors

MODULE - III READING SKILLS**5**

Techniques of effective reading
Kinds of reading
Gathering ideas and information from the text
Evaluating the ideas and information
Interpreting the text from multiple angles

MODULE - IV WRITING ASPECTS**5**

Writing process
Effective writing strategies
Different modes of writing
Optimizing the use of resources
Editing

MODULE - V PRESENTATION SKILLS**5**

Types of presentations
Nonverbal communication
Understanding the purpose and the audience
Beginning and closure of presentations
Presentation tools and strategies

MODULE - VI ARTICULATION ASPECTS**5**

Perform exercises
Slow speeches

Long speeches
Monologues, Dialogues and Conversation
Feedback necessity

TOTAL : 30 PERIODS

REFERENCES:

1. Sen, Madhuchanda.2010, An Introduction to Critical Thinking, Delhi, Pearson.
2. Effective Communication Skills Strategies for Success. Edited by Nitin Bhatnager and Mamta Bhatnager. 2023, Pearson
3. Technical Communication: Principles and Practice, Meenakshi Raman and Sangeeta Sharma. Oxford University Press, 2015

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_hs31/preview
2. https://www.myenglishpages.com/speaking/#google_vignette

OUTCOMES:

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

1. Utilize various listening techniques effectively (K1)
2. Demonstrate the ability to speak spontaneously in different contexts (K1)
3. Comprehend and interpret written texts accurately (K2)
4. Exhibit the ability to write freely with sufficient and relevant content (K1)
5. Articulate explanations clearly and concisely (K1)
6. Understand and present convincing speeches/ arguments effectively (K2)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	-	-	-	-	-	-	-	-	-	2	-	2	-	-
C02	-	-	-	-	-	-	-	-	-	2	-	2	-	-
C03	-	-	-	-	-	-	-	-	-	2	-	2	-	-
C04	-	-	-	-	-	-	-	-	-	2	-	2	-	-
C05	-	-	-	-	-	-	-	-	-	2	-	2	-	-
C06	-	-	-	-	-	-	-	-	-	2	-	2	-	-

SEMESTER - I

24ESID101 SDG NO. 1-17	IDEA ENGINEERING LAB - I	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the significance of Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs) of the United Nations
- To familiarize with SDG targets and indicators
- To identify the Constitutional implementation pertaining to SDGs in Panchayat Raj
- To acquire knowledge of the State and the Central government welfare schemes
- To recognise the role of educational institutions' in community development
- To develop critical thinking skills to address complex societal challenges through an immersion program

MODULE - 1 United Nations Sustainability and the Sustainable Development Agenda

3

- Introduction to Sustainability
- Indian Rural Environment: Necessity and Sustainability
- Millennium Development Goals (MDGs)
- United Nations Sustainable Development Goals (SDGs) & the Agenda
- Overview of the Sustainable Development Goals (SDGs)

MODULE - 2 Universal SDG Targets

4

SDG Framework

Key Components:

- Pillars of the SDGs
- Targets of the Goals
- Indicators of the Targets

MODULE - 3 SDG and Indian Gram Panchayat

3

Gram Panchayat

- Salient Features of Constitutional Amendments
- Transition from SDGs to LSDGs (Localizing Sustainable Development Goals)

MODULE - 4 Government Schemes**4****Introduction to State and Central Government Schemes**

- Overview of Government Schemes
- Localization and Implementation at the Regional Level
- Impact on Local Communities

MODULE - 5 Community Engagement**4****Key Recommendations of the National Education Policy****Guidelines for Fostering Social Responsibility:**

- Awareness
- Participation
- Collaboration

MODULE - 6 Idea Generation**12****Immersion Program****Focus Areas:**

- Channelizing Ideas
- Forming Working Teams for SDGs (Sustainable Development Goals)

TOTAL: 30 PERIODS**REFERENCES:**

1. Joy Elamon and Ms. Mariamma Sanu George, "The Handbook on Sustainable Development Goals and Gram Panchayats", State Institute for Rural Development (SIRD).
2. Dr.C.R.Rene Robin, Dr.PA.Shanthi, Dr.B.Thanuja & Dr.V.Yuvaraj, "Sairam SDG Idea Engineering Lab I", Sri Sairam Engineering College.

WEB REFERENCES

1. UN Sustainable Development Goals
2. <https://srmuniv.digimat.in/nptel/courses/video/109106200/L30.html>
3. <https://avcce.digimat.in/nptel/courses/video/109106200/L26.html>

OUTCOMES:**Upon completion of the course, the student will be able to:**

1. Understand the United Nations Agenda of MDGs and SDGs (K1)
2. Summarize the targets and indicators of SDGs (K2)
3. Interpret the constitutional amendments of LSDG in Gram Panchayat (K2)
4. Classify various localized and regional government schemes (K2)

5. Understand social responsibility in community development (K1)
6. Implement viable projects in SDGs through the immersion program (K3)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	2	-	2	-	2	2
CO2	-	-	-	-	-	2	2	-	2	-	2	2
CO3	-	-	-	-	-	2	2	-	2	-	2	2
CO4	-	-	-	-	-	2	2	-	2	-	2	2
CO5	-	-	-	-	-	2	2	-	2	-	2	2
CO6	2	2	-	-	-	2	2	-	2	-	2	2

SEMESTER - II

24BSMA202 SDG NO. 4	DIFFERENTIAL EQUATIONS, COMPLEX VARIABLES AND TRANSFORMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- The objective of this course is to familiarize the prospective engineers with techniques in Ordinary differential equations, Complex variables, Z - Transforms, Fourier Transforms and Laplace transforms. It aims to equip the students to deal with advanced levels of mathematics and applications that would be essential for their disciplines.

MODULE - I ORDINARY DIFFERENTIAL EQUATIONS 12

Second and Higher order linear differential equations with constant coefficients - Method of variation of Parameters -Homogeneous equation of Euler's and Legendre's type - System of simultaneous first order linear differential equations with constant coefficients.

MODULE - II COMPLEX VARIABLES 9

Analytic functions – Necessary and sufficient conditions for analyticity in cartesian and polar coordinates (without proof)- Properties- Harmonic Conjugate-Construction of analytic functions-Conformal mapping -Bilinear transformation ($w=1/z$).

MODULE - III COMPLEX INTEGRATION 9

Cauchy- Goursat theorem (without proof) - Cauchy Integral formula (without proof) - Zeroes of Analytic functions - Singularities - Laurent's Series - Residues – Cauchy Residue theorem (without proof).

MODULE - IV LAPLACE TRANSFORMS 12

Existence conditions – Transforms of elementary functions – Transform of Unit step function and Unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives – Transform of Periodic functions - Inverse Laplace Transforms - Initial and Final value theorems – Convolution theorem (excluding proof) -- Application of solution of linear second order ordinary differential equations with constant coefficients.

MODULE - V FOURIER TRANSFORMS 9

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Convolution theorem – Parseval's identity.

MODULE - VI 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.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Advanced Engineering Mathematics, Erwin Kresizg, 9th Edition, John Wiley & Sons, 2006.
2. Advanced Modern Engineering Mathematics, Glyn James, 3rd Edition, Pearson Education, 2010.

REFERENCES:

1. Higher Engineering Mathematics, Dass, H.K., and Er. Rajnish Verma, S. Chand Private Ltd., 2011.
2. Higher Engineering Mathematics, B.S. Grewal, 44th Edition, Khanna Publishers, 2023.
3. Advanced Engineering Mathematics, Peter V. O'Neil, 7th Edition, Cengage learning, 2012.
4. An Introduction to Ordinary Differential Equations, E. A. Coddinton, Prentice Hall, 1961.
5. Higher Engineering Mathematics, Ramana. B.V., 11th reprint, Tata McGraw-Hill, New Delhi, 2010.
6. A Text Book of Engineering Mathematics, N. P. Bali and Manish Goyal, Laxmi Publications, Reprint 2008.

WEB COURSES:

1. <http://archive.nptel.ac.in/courses/111/106/111106100/>
2. <https://nptel.ac.in/courses/111105134/> (Week-3 Complex Differentiation)
3. <https://nptel.ac.in/courses/111105134> (Week 4 Complex Integration)
4. <https://archive.nptel.ac.in/courses/111/106/111106111/>
5. <http://www.nptelvideos.com/course.php?id=90>

ONLINE RESOURCES:

1. <https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/lecture-1-introduction/>
2. <https://ocw.mit.edu/courses/18-04-complex-variables-with-applications-spring-2018/>

OUTCOMES:**Upon completion of the course, the student will be able to:**

1. Solve ordinary differential equations of second and higher order with constant coefficients, variable coefficients and simultaneous linear differential equations. (K3)
2. Construct an analytic function and apply the properties of analytic functions to check for harmonic and orthogonal functions and find the images of circle and straight lines under the standard transformations. (K3)
3. Use Cauchy's integral theorem, formula and Cauchy's Residue theorem to evaluate complex and real integrals, find the Taylor's and Laurent's series expansion. (K3)
4. Apply Laplace and inverse Laplace Transforms to solve the linear ordinary differential equations with constant coefficients. (K3)
5. Find Fourier transforms and Fourier sine and cosine transforms of simple functions. (K3)
6. Solve difference equations using Z-transforms. (K3)

CO-PO, MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	3	1	1	1	-	-	-	-	-	-	-	2	-	-
C02	3	1	1	1	-	-	-	-	-	-	-	2	-	-
C03	3	1	1	1	-	-	-	-	-	-	-	2	-	-
C04	3	1	1	1	-	-	-	-	-	-	-	2	-	-
C05	3	1	1	1	-	-	-	-	-	-	-	2	-	-
C06	3	1	1	1	-	-	-	-	-	-	-	2	-	-

SEMESTER - II

24HSEN201 SDG NO. 4	PROFESSIONAL ENGLISH				L	T	P	C
					2	0	0	2

OBJECTIVES:

- Acquire techniques for comprehending and critically analyzing passages
- Improve the communicative competence
- Enhance learners' ability to read and write complex texts, summaries, definitions and reports
- Write effective formal letters and reports

- Develop skills for preparing effective job application

MODULE - I EFFECTIVE COMMUNICATION 6

Listening – Listening to conversations – Speaking – making conversations in real life occurrences – Reading - short stories, happenings - Writing – autobiographical writing, preparation of checklist – communication and types of communication – Language Development -- subject - verb agreement, commonly confused words – spellings

MODULE - II BASICS OF TECHNICAL WRITING 5

Listening – listening to advertisements and products – Speaking - creating greetings/wishes/excuses and thanks – Reading – articles/novels - Writing - summary of articles, writing modes, formats, compositions - Language Development - reported speech, numerical adjectives

MODULE - III REPORT WRITING 4

Listening – listening to podcasts – Speaking - practicing telephonic conversations – observing and responding. Reading – regular columns of newspapers/magazines - Writing – reports – feasibility, accident, preparation of agenda and minutes – Language Development - cause & effect expressions, discourse markers

MODULE - IV DIVERSE WRITING SKILLS 5

Listening – documentaries, anecdotes and short stories - Speaking – expressing opinions using verbal and non-verbal communication – Reading biographies/autobiographies, travelog, – Writing – formal letters – inviting guests – acceptance/declining letters - Language Development- degrees of comparison – embedded sentences - acronyms and abbreviations

MODULE - V CAREER COMPETENCIES 6

Listening – expert talks – recommending suggestions & solutions – Speaking – Debate- participating in a group discussion – learning GD strategies – Reading – innovations, ideations - Writing – Job application, resume, – proposals – Language Development – verbal analogies – phrasal verbs

MODULE - VI LEXICAL ENHANCEMENT 4

Listening - technical and general talks - Speaking - oral presentation with visual aids - Reading - successful stories/autobiographies - Writing - writing blogs - Language Development - common errors in English, idiomatic expressions

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Board of editors. Fluency in English: A Course book for Engineering and Technology. Orient Blackswan, Hyderabad 2016.
2. Raman, Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford University Press.

REFERENCES:

1. Bailey, Stephen. Academic Writing: A Practical Guide for Students. Routledge, New York, 2011.
2. Raman, Meenakshi, Sharma, Sangeeta. Technical Communication. Principles and Practice. Oxford University Press, New Delhi, 2014.
3. Muralikrishnan & Mishra Sunitha, Communication skills for Engineers 2nd ed. Pearson, Tamil Nadu, India 2011. P. Kiranmai and Rajeevan, Geetha. Basic Communication Skills, Foundation Books, New Delhi, 2013.
4. Vesilind Aarne P, Public Speaking and Writing Skills for Engineering Students (2nd Ed), Lakeshore press, 2007
5. Richards, Jack C. Interchange Students' Book – 2. Cambridge University Press, New Delhi, 2015.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_hs21/preview
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/109106122/lec1.pdf
3. https://takelessons.com/en-in/search?service=English&sort=1&utm_

ONLINE RESOURCES:

1. <https://www.coursera.org/specializations/improve-english?>
2. <https://www.fluentu.com/blog/educator-english/business-english-conversation-topics/>

OUTCOMES:

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

1. Demonstrate an understanding of various types of communication and prepare effective checklists.(K2)
2. Summarize articles/ write ups (K2)
3. Construct feasibility reports, accident reports, survey reports and meeting minutes (K3)
4. Apply skills to compose official letters with emphasis and clarity (K3)
5. Compose job applications and technical proposals (K3)

6. Demonstrate the ability to express opinions in both oral and written forms of communication (K2)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	-	-	-	-	-	-	-	-	-	3	-	3	-	-
C02	-	-	-	-	-	-	-	-	-	3	-	3	-	-
C03	-	-	-	-	-	-	-	-	-	3	-	3	-	-
C04	-	-	-	-	-	-	-	-	-	3	-	3	-	-
C05	-	-	-	-	-	-	-	-	-	3	-	3	-	-
C06	-	-	-	-	-	-	-	-	-	3	-	3	-	-

SEMESTER - II

24BSPH201 SDG NO. 4	PHYSICS OF ELECTRONIC DEVICES				L	T	P	C
					3	0	0	3

OBJECTIVES:

- To acquaint the electrical properties of materials.
- To introduce the Optical properties of Materials
- To present the principles of semiconductor physics and its applications.
- To illustrate the properties and applications of nano devices
- To educate the properties of magnetic and dielectric materials and their uses.
- To acquaint the applications of switching and display devices

MODULE -I ELECTRICAL PROPERTIES OF MATERIALS

8

Classical free electron theory - Expression for electrical conductivity - Thermal conductivity expression - Wiedemann-Franz law - Success and failures - electrons in metals - Particle in a three dimensional box - degenerate states - Fermi- Dirac statistics - Density of energy states - Electron in periodic potential- Energy bands in solids – Electron effective mass- concept of hole.

MODULE - II OPTICAL PROPERTIES OF MATERIALS**7**

Classification of optical materials- optical absorption and emission Process in Material charge generation and recombination- optical absorption loss and gain.- Optoelectronic devices-Solar cells –LED –Nonlinear optics- Modulators, switching devices Plasmonics (Qualitative)

MODULE - III SEMICONDUCTOR AND TRANSPORT PHYSICS**8**

Semiconductors – Energy band diagram – direct and indirect band gap semiconductors –Intrinsic semiconductor– Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – PN -Junction Diode -Construction, Working and Characteristics -Carrier transport in Semiconductors:, Mobility ,Drift and Diffusion Current densities.

MODULE - IV NANO DEVICES**7**

Quantum Confinement-Quantum structures-Density of states in quantum well, wires, and dots(Quantitative)- Band Gap of Nano materials- Tunnelling-Single electron phenomena-Single electron transistor- Quantum DOT lasers- Conductivity of metallic nano wires-Carbon Nano Tubes(CNT):Structures, Properties and applications.

MODULE - V MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS**8**

Magnetism in materials - Magnetic field and induction - Magnetization - permeability and susceptibility - Types of magnetic materials - microscopic classification of magnetic materials Ferromagnetism-Domain Theory - Hysteresis phenomenon-solid state storage devices-Dielectric materials –Introduction-Types of Polarization (qualitative) - internal field - Clausius-Mossotti relation –dielectric loss - dielectric breakdown (definitions)- Dielectric constant measurement by Schering bridge method.

MODULE - VI SWITCHING AND DISPLAY DEVICES**7**

Transistor - NPN, PNP working-Early effect-Current equations-Input and Output Characteristics of CB, CE and CC configurations-JFET and its characteristics-MOSFET and its characteristics- Construction and Working of D-MOSFET-UJT,SCR-CCD and Optocoupler. IoT concept and use in industry.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. S.O. Kasap. Principles of Electronic Materials and Devices, McGraw Hill Education (Indian Edition), 2020.

2. R.F.Pierret. Semiconductor Device Fundamentals. Pearson (Indian Edition), 2006.
3. G.W.Hanson. Fundamentals of Nanoelectronics. Pearson Education (Indian Edition), 2009.
4. Dr.P.Mani. Physics for Electronic Devices, Dhanam Publications, 2024.

REFERENCES:

1. Laszlo Solymar, Walsh, Donald, Syms and Richard R.A., Electrical Properties of Materials, Oxford Univ. Press (Indian Edition) 2015.
2. Jasprit Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Education (Indian Edition), 2019.
3. Mark Fox, Optical Properties of Solids, Oxford Univ.Press, 2001.
4. N.Gershenfeld. The Physics of Information Technology. Cambridge University Press, 2011.

OUTCOMES:

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

1. Know basics of electrical properties of conducting materials (K2)
2. Acquire knowledge of optical properties of materials and devices (K2)
3. Understand the concepts of semiconductor physics and transport phenomena (K2)
4. Appreciate the importance of nanotechnology and nanodevices (K2)
5. Gain knowledge on the magnetic and dielectric properties of materials and their applications (K2)
6. Understanding the concept and working of Switching and Display Devices (K2)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	1
CO2	3	3	1	2	-	-	-	-	-	-	-	2
CO3	3	3	1	2	-	-	-	-	-	-	-	1
CO4	3	3	1	2	-	-	-	-	-	-	-	3
CO5	3	3	2	2	-	-	-	-	-	-	-	2
CO6	3	3	3	2	-	-	-	-	-	-	-	2

SEMESTER - II

24BSCY201 SDG NO. 4	CHEMISTRY FOR ENVIRONMENT AND SUSTAINABILITY	L 3	T 0	P 0	C 3
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OBJECTIVES:

- To gain a comprehensive understanding of environmental science, the intricate relationships within ecosystems, and the crucial role of biodiversity conservation..
- To introduce the structure and components of the atmosphere, and provide an overview of the photochemical reactions involved.
- To foster a sound understanding of water quality parameters and water treatment techniques.
- To explore the various components of soil and understand the steps involved in Solid Waste Management (SWM).
- To advocate the benefits of renewable energy and promote awareness of sustainable energy practices. .
- To implement the principles of Green Chemistry in alignment with the Sustainable Development Goals (SDGs).

MODULE -I INTRODUCTION TO ENVIRONMENTAL SCIENCE 8

Environment: Definition, concept of environment and its components - scope and importance of environment – need for public awareness.

Ecosystem: Structure and functions: Structures - Biotic and Abiotic components. Functions - Energy flow in ecosystems, food chains and food webs. Biogeochemical cycles (C, N & P), Ecological succession.

Biodiversity and its conservation: Definition, types, importance of biodiversity, values and threats to biodiversity. Endangered and endemic species - concept and basis of identification of 'Hotspots'; hotspots in India. Strategies for biodiversity conservation: in situ, ex situ and in vitro conservation.

MODULE -II ATMOSPHERIC CHEMISTRY 7

Atmospheric Chemistry - Composition and structure of atmosphere. Climate change - greenhouse effect - role of greenhouse gases (CO₂, CH₄, N₂O, CFCs) on global warming. Chemical and photochemical reactions in the atmosphere - Formation of smog, PAN, acid rain (causes, effect and control measures). Oxygen and ozone chemistry - Ozone layer depletion (causes, effect and control measures).

MODULE - III WATER CHEMISTRY**8**

Importance and scope of water chemistry - Sources and impurities in water - Water Quality Parameters - Specifications as per WHO/BIS standards. Hardness of water, types, numerical problems on hardness of water. Softening of water - Internal treatment (Lime-soda, Phosphate, Calgon, Sodium Aluminate and Colloidal conditioning). External treatments: Ion exchange and Zeolite processes. Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water by Reverse osmosis. Sustainable water management practices (water recycling and rainwater harvesting)

MODULE - IV SOIL CHEMISTRY AND SOLID WASTE MANAGEMENT**7**

Soil Chemistry: Chemical composition of soil, Acid-Base and Ion-Exchange Reactions in Soil, Soil acidity and salinity. Importance of NPK in Soil Fertility. Modern agriculture - Impacts of both excessive and insufficient fertilizer use, alongside the effects of pesticides on soil chemistry and the environment. Sustainable agriculture - Approaches to improve soil salinity (leaching, soil amendments, crop rotation), Design and use of green pesticides for sustainable farming.

Solid Waste Management System: Sources and types of solid waste, Elements of solid waste management, Methods of residential and commercial waste collection, Treatment / processing - Incineration, Composting, Landfill - Dumpsite rehabilitation.

MODULE - V ENERGY AND ENVIRONMENT**8**

Energy sources – Renewable and non-renewable energy sources. Principle and generation of solar energy (solar collectors, photo-voltaic modules, solar ponds), wind energy, geothermal energy; tidal energy, OTEC energy from biomass, biofuels, Nuclear energy - fission and fusion, Nuclear fuels, Nuclear reactor – principles and types. Need for energy efficiency, Energy conservation and sustainability - action strategies for sustainable energy management from a future perspective.

MODULE - VI GREEN CHEMISTRY AND SUSTAINABILITY**7**

Green Chemistry: Introduction to green chemistry, Principles of Green Chemistry (12-principles), the concept of atom economy and chemical synthesis, Important techniques used in green chemistry. Application of green chemistry, viz. replacement of ozone depleting substances including CFCs, manufacture of biodegradable polymers, use of H₂O₂ as benign bleaching agents in the paper industry.

Sustainable Development: Definition and concepts of sustainable development, Need for sustainable development; Sustainable development

goals – 17 SDG goals.

Sustainable practices: Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment and Environmental Impact Assessment.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
3. Ravikrishnan A, 'Environmental Science and Engineering', Sri Krishna Hitech Publishing Company Pvt. Ltd, Revised Edition 2020.
4. Vogel's Textbook of Quantitative Chemical Analysis (8th edition, 2014).

REFERENCES:

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Chemistry for Environmental Engineering, Clair N. Sawyer, Perry L. McCarty, Gene F. Parkin, 4th Edition, McGraw-Hill.

OUTCOMES:

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

1. Develop a foundational understanding of environmental science, the interactions within ecosystems, the significance of biodiversity, and the importance of conservation strategies for maintaining ecological balance. (K3)
2. Identify the primary components of the atmosphere, explain the causes of atmospheric pollution, and propose basic strategies to promote a sustainable and clean atmosphere. (K3)
3. Demonstrate complex water quality parameters, and develop innovative methods for producing cost-effective soft water suitable for both industrial use and potable consumption. (K3)
4. Describe the composition and functions of soil components, analyze the sources and characteristics of solid wastes, and evaluate the methods and strategies employed in solid waste management (SWM). (K3)

5. Explain renewable and non-renewable resources, describe various methods for harnessing energy from different sources and explain their applications in various contexts. (K3)
6. Illustrate a comprehensive understanding of green chemistry principles and their alignment with sustainable development goals, preparing them to contribute to environmentally friendly and sustainable practices in their future careers.(K3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	1
CO2	3	3	2	2	-	-	-	-	-	-	-	1
CO3	3	3	2	2	-	-	-	-	-	-	-	1
CO4	3	2	2	2	-	-	-	-	-	-	-	1
CO5	2	2	2	1	-	-	-	-	-	-	-	1
CO6	2	2	2	1	-	-	-	-	-	-	-	1

SEMESTER - II

24EEPC201 108105159 SDG NO. 4 & 9	CIRCUIT THEORY					L	T	P	CP	C
						2	1	0	3	3

OBJECTIVES:

- To utilize the concepts of basic laws for solving DC circuits.
- To apply the fundamentals of AC circuits to solve mesh current and node voltage method.
- To apply Network theorems to simplify for both DC and AC circuits
- To solve the Transient response of circuits for RL, RC and RLC circuits with DC and AC input.
- To develop the Frequency response for resonance circuits, single tuned circuits.
- To develop the performance parameters of three phase systems and power measurement.

MODULE - I BASIC DC CIRCUITS ANALYSIS 7

Resistive elements - Ohm's law Resistors in series and parallel circuits – Kirchhoff's law- Network reduction-Voltage and current division, source transformation – Star Delta conversion - Mesh current and node voltage methods for DC circuits.

MODULE - II FUNDAMENTALS OF AC CIRCUITS ANALYSIS 7

AC Fundamentals- Average and RMS value - Phasor diagram – Power, Power factor and energy – Mesh current and node voltage methods for AC circuits.

MODULE - III NETWORK THEOREMS FOR DC AND AC CIRCUITS 7

Superposition theorem - Thevenin's and Norton's theorems – Maximum power transfer theorem.

MODULE - IV TRANSIENT RESPONSE ANALYSIS 8

R, L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and AC sinusoidal input.

MODULE - V RESONANCE AND COUPLED CIRCUITS 8

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

MODULE - VI THREE PHASE CIRCUITS 8

Three phase 3-wire and 4-wire circuits - Star and delta connection for balanced and un balanced loads– Phasor diagram of voltages and currents – Power and power factor measurement in three phase circuits.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", McGraw Hill, Fifth Edition, 2015.
2. Charles K.Alexander, Mathew N.O.Sadiku, "Fundamentals of Electric Circuits", Sixth Edition, McGraw Hill, 2022.
3. Joseph A.Edminister, Mahmood Nahri, "Electric circuits", (Schaum's outline series), Mc Graw- Hill, New Delhi, Fifth edition, 2010.

REFERENCES:

1. Chakrabarti A, "Circuits Theory Analysis and Synthesis", Dhanpath Rai & Sons, New Delhi, Seventh edition, 2023.

2. A Nagoor kani, "Circuit Analysis," McGraw Hill, First edition, 2018
3. William H. Hayt, Jack Kemmerly, Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill, ninth edition, 2020.
4. Mahadevan K, Chitra C., "Electric Circuits Analysis," Prentice-Hall of India Pvt Ltd., New Delhi, Second edition, 2018.
5. Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley & Sons, Inc., 9th edition, 2015.

WEB RESOURCES:

1. <https://www.edx.org/learn/circuits/massachusetts-institute-of-technology-circuits-and-electronics-1-basic-circuit-analysis>
2. <https://www.circuit-magic.com/>
3. <https://www.khanacademy.org/science/electrical-engineering/ee-circuit-analysis-topic>

ONLINE RESOURCES:

1. <https://archive.nptel.ac.in/courses/108/102/108102097/>
2. <https://archive.nptel.ac.in/courses/108/105/108105159/>
3. https://onlinecourses.nptel.ac.in/noc22_ee90/preview

OUTCOMES:

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

1. Apply Ohm's law, Kirchhoff's laws, star-delta conversion, mesh current and node voltage methods in DC circuits. (K3)
2. Apply basic AC fundamentals and mesh and nodal techniques in AC circuits. (K3)
3. Make use of Superposition, Thevenin's, Norton's and Maximum power transfer theorems for network reduction of DC and AC circuits. (K3)
4. Solve the transient response of RL, RC, RLC circuits using Laplace transforms for DC and AC inputs. (K3)
5. Develop the frequency response of series and parallel resonance circuits and single tuned circuits. (K3)
6. Develop the performance parameters of three phase three wire and four wire circuits for various conditions. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	2	2	2	-	2	-	-	-	-	2	2	2
C02	3	2	2	2	-	2	-	-	-	-	2	2	2
C03	3	2	2	2	-	2	-	-	-	-	2	2	2
C04	3	2	2	2	-	2	-	-	-	-	2	2	2
C05	3	2	2	2	-	2	-	-	-	-	2	2	2
C06	3	2	2	2	-	2	-	-	-	-	2	2	2

SEMESTER - II

24HSTA201 SDG NO. 4	TAMILS AND TECHNOLOGY				L	T	P	C
					1	0	0	1

OBJECTIVES:

- Understand the techniques that help for a better livelihood
- Identify the methods used for scientific Tamil computing

UNIT - I WEAVING AND CERAMIC TECHNOLOGY**3**

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

UNIT - II DESIGN AND CONSTRUCTION TECHNOLOGY**3**

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

UNIT - III MANUFACTURING TECHNOLOGY**3**

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

UNIT - IV AGRICULTURE AND IRRIGATION TECHNOLOGY**3**

Dam, Tank, ponds, Sluice, Significance of 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.

UNIT - V SCIENTIFIC TAMIL & TAMIL COMPUTING**3**

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

TOTAL : 15 PERIODS**TEXT-CUM-REFERENCE BOOKS**

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருதை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
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.

தமிழர் மரபு**அலகு - I நெசவு மற்றும் பாணைத் தொழில்நுட்பம்:****3**

சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கிறல் குறியீடுகள்.

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

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும்

நடுகல்லும் — சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் கொலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு - III உற்பத்தித் தொழில் நுட்பம்:

3

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

அலகு - IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்:

3

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

அலகு - V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்:

3

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருதை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
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.

OUTCOMES:

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

1. Understand Weaving and Ceramic Technology during Sangam Age (K2)
2. Explore about Design & Construction of House and Temples during Sangam Age (K2)
3. Appreciate Manufacturing Technology of Tamils (K2)
4. Perceive Agriculture and Agro-processing during Sangam Age (K2)
5. Comprehend Ancient Knowledge of Ocean & Fisheries (K2)
6. Understand the Scientific Tamil & Tamil Computing (K2)

CO- PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	-	-	-	-	3	-	-	-	-	-	3	-	-
C02	3	-	-	-	-	3	-	-	-	-	-	3	-	-
C03	3	-	-	-	-	3	-	-	-	-	-	3	-	-
C04	3	-	-	-	-	3	-	-	-	-	-	3	-	-
C05	3	-	-	-	-	3	-	-	-	-	-	3	-	-
C06	3	-	-	-	-	3	-	-	-	-	-	3	-	-

SEMESTER - II

24HSNC201 SDG NO. 4	NCC COURSE LEVEL 1	L	T	P	C
		2	0	0	0

ARMY WING

NCC GENERAL 6

NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2

NATIONAL INTEGRATION AND AWARENESS 4

NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1

PERSONALITY DEVELOPMENT 7

PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2

LEADERSHIP 5

L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8

SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL: 30 PERIODS

NAVAL WING**NCC GENERAL****6**

NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2

NATIONAL INTEGRATION AND AWARENESS**4**

NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1

PERSONALITY DEVELOPMENT**7**

PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2

LEADERSHIP**5**

L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhansi Ki Rani	2

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**8**

SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL: 30 PERIODS**ARMY WING****NCC GENERAL****6**

NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2

NATIONAL INTEGRATION AND AWARENESS		4
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
PERSONALITY DEVELOPMENT		7
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		5
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		8
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL: 30 PERIODS

SEMESTER - II

24ESGE102 - SDG NO. 4,9,12	ENGINEERING PRACTICES LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To provide exposure to the students with hands-on experience on various basic engineering practices in Electrical and Electronics Engineering, Civil and Mechanical Engineering.

ELECTRICAL ENGINEERING PRACTICE

- Residential house wiring using switches, fuse, indicator, lamp, and energy meter.
- Fluorescent lamp wiring.
- Staircase wiring.

4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipment – Resistor- colour coding, measurement of AC signal parameter (peak-peak RMS, period, frequency) using CRO.
2. Study of logic gates AND, OR, EX-OR, and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components, Devices, and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of Half Wave Rectifier and Full Wave Rectifier.
6. Simulation of Half Wave Rectifier and Full Wave Rectifier using TinkerCAD.

CIVIL ENGINEERING PRACTICE

Buildings:

Study of plumbing and carpentry components of residential and industrial buildings, safety aspects.

Plumbing Works:

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5. Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise: Wood work, joints by sawing, planing and cutting.

MECHANICAL ENGINEERING PRACTICE

Welding:

1. Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
2. Gas welding demo practice.

Basic Machining:

1. Simple Turning and Taper turning.
2. Drilling Practice.

Sheet Metal Work:

1. Forming & Bending.
2. Model making – Trays and funnels.
3. Different type of joints.

Demonstration on:

1. Smithy operations, upsetting, swaging, setting down and bending.
Example – Exercise – Production of hexagonal headed bolt.
2. Foundry operations like mould preparation for gear and step cone pulley.
3. Fitting – Exercises – Preparation of square fitting and V – fitting models.

TOTAL: 60 PERIODS**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS****ELECTRICAL**

- | | |
|--|---------|
| 1. Assorted electrical components for house wiring | 15 Sets |
| 2. Electrical measuring instruments | 10 Sets |
| 3. Study purpose items: | |
| Iron box, fan and regulator, emergency lamp | 1 Each |
| 4. Megger (250V/500V) | 1 No |
| 5. Power Tools: | |
| Range Finder | 2 Nos |
| Digital Live-wire detector | 2 Nos |

ELECTRONICS

- | | |
|---|--------|
| 1. Soldering guns | 10 Nos |
| 2. Assorted electronic components for making circuits | 50 Nos |
| 3. Small PCBs | 10 Nos |
| 4. Multimeters | 40 Nos |

CIVIL

- | | |
|---|---------|
| 1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets |
|---|---------|

2. Carpentry vice (fitted to work bench).	15 Nos
3. Standard woodworking tools.	15 Sets
4. Models of industrial trusses, door joints, furniture joints	5 each
5. Power Tools:	
Rotary Hammer	2 Nos
Demolition Hammer	2 Nos
Circular Saw	2 Nos
Planner	2 Nos
Hand Drilling Machine	2 Nos
Jigsaw	2 Nos

MECHANICAL

1. Arc welding transformer with cables and holders	5 Nos
2. Arc welding transformer with cables and holders	5 Nos
3. Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos
5. Centre lathe.	2 Nos
6. Hearth furnace, anvil and smithy tools.	2 Sets
7. Moulding table, foundry tools.	2 Sets
8. Power Tool: Angle Grinder.	2 Nos
9. Study-purpose items: centrifugal pump, air-conditioner.	1 each

OUTCOMES:

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

1. Infer the values of resistance, peak to peak RMS values, time period, frequency. [K2]
2. Outline the logic gates, rectifier, timer circuits and soldering practices. [K2]
3. Demonstrate the measurement of electrical parameters such as voltage, current, resistance, power and energy. (K2)
4. Illustrate the residential wiring, staircase wiring and fluorescent lamp wiring. [K2]
5. Prepare the carpentry and plumbing joints. (K2)
6. Perform the basic operations of welding, sheet metal work and basic machining operations in Lathe and Drilling (K2)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	2	1	-	-	-	-	-	-	1	-	3	2
C02	3	2	1	-	-	-	-	-	-	1	-	3	2
C03	3	2	1	-	-	-	-	-	-	1	-	3	2
C04	3	1	1	-	-	-	-	-	-	1	-	3	2
C05	2	-	-	-	-	-	2	-	-	-	-	2	2
C06	2	-	-	-	-	-	2	-	-	-	-	2	2

SEMESTER - II

24ENTP201 SDG NO. 4	DIGITAL DYNAMICS	L	T	P	C
		0	0	2	0

OBJECTIVES:

- Explore online communication
- Master computer skills
- Use virtual platforms
- Understand digital ethics and cyber security
- Observe and follow do's and don'ts

MODULE - I DIGITAL CULTURE AND SOCIETY

6

Adapting to changes

Importance in today's digital landscape

Digital identity and self- presentation

Online communities and forums

Digital divide and consequences

Online collaboration and collective action

MODULE - II DIGITAL LITERACY AND ACCESS TO TECHNOLOGY

5

Computer skills

Social and cultural understanding

Social media campaign and Activism

Netiquettes

Trending Technologies

Digital tools and softwares

MODULE - III DIGITAL ETHICS

3

Digital ethics and moral panics

The art of protecting secrets

Overview of digital tools

MODULE - IV CYBER SECURITY

3

Threats, vulnerability and consequences

Data making and usage practice

Importance of security

MODULE - V DIGITAL NETWORKING

Remote work and virtual teams

Authenticity in digital interactions

Engaging content creation

Tools and techniques for insightful usage

Balancing online and offline interactions

Collaboration for research and innovation

MODULE - VI BUREAU OF INDIAN STANDARDS (BIS): BASIC CONCEPTS, STANDARDS FORMATION PROCESS AND CHALLENGES

6

Standardization –Basic Concepts:

Basic concepts of standardization

Purpose of standardization, marking and certification of articles and processes

Importance of standards to industry, policy makers, trade, sustainability and innovation

Standards Formulation Process and Challenges:

Objectives, roles and functions of BIS, Bureau of Indian Standards Act, ISO/ IEC Directives

WTO Good Practices for Standardization

World of Standards:

Important Indian and International Standards

TOTAL: 30 PERIODS**REFERENCES:**

1. Communication Skills and Soft Skills – an Integrated Approach. Edited by E. Sureshkumar, P. Sreehari and J. Savithri, Pearson.
2. Silvia. P.J.2007. How to Read a Lot. Washington DC, American Psychological Association.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_hs31/preview
2. <https://www.sscnasscom.com/ssc-projects/capacity-building-and-development/training/gbfs/>

OUTCOMES:

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

1. Demonstrate basic understanding of effective online communication techniques (K1)

2. Show and utilize fundamental computer skills (K1)
3. Comprehend and apply the use of virtual platforms to enhance communication reachability (K2)
4. Understand and implement principles of digital ethics (K2)
5. Use basic technologies for securing data and maintaining information integrity (K1)
6. Understand the importance of standardization and adhere to BIS (K2)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	-	-	-	-	-	-	-	-	-	2	-	2	-	-
C02	-	-	-	-	-	-	-	-	-	2	-	2	-	-
C03	-	-	-	-	-	-	-	-	-	2	-	2	-	-
C04	-	-	-	-	-	-	-	-	-	2	-	2	-	-
C05	-	-	-	-	-	-	-	-	-	2	-	2	-	-
C06	-	-	-	-	-	-	-	-	-	2	-	2	-	-

SEMESTER - II

24ESID201 SDG NO. 1-17	IDEA ENGINEERING LAB - II	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

To impart the basics of technologies that are used to identify sustainable solutions to societal problems

- To Provide awareness on Printed Circuit Board (PCB) design using ORCAD software.
- To Raise awareness of at least three Internet of Things (IoT) projects and their applications.
- To Upskill learners through practical experience with 3D printing and scanning technologies.
- To prepare the learners to correctly align the ideas to SDGs
- To comprehensive knowledge on entrepreneurship and effective idea presentation techniques.
- To evaluate the effectiveness and implementation strategy of SDGs through SCOUT for SDGs

MODULE-1	BASICS OF DESIGN THINKING IN ELECTRICAL AND ELECTRONIC COMPONENTS	4
	<ul style="list-style-type: none"> ● Awareness Session on Basics of Design Thinking ● Study of Active & Passive Electronic Components ● Study of Basic AC & DC Electrical Circuits ● Study of Microprocessors & Microcontrollers ● Demonstration of Arduino Board, ESP 32 Board ,Raspberry Pi Board & PCB design software-Eagle ● Demonstration of PCB design using the software's Orcad, Eagle etc. 	
MODULE-2	EMBEDDED SYSTEMS, IOT AND ROBOTICS	4
	<ul style="list-style-type: none"> ● Study of sensors and transducers ● Study of embedded protocols ● Study of IOT protocols ● Demonstration of applications using embedded C ● Demonstration of robotic models ● Demonstration of drone models 	
MODULE-3	BASICS OF MECHANICAL ENGINEERING	4
	<ul style="list-style-type: none"> ● Study of mechanical modeling using fusion 360 ● Demonstration of 3D scanner ● Demonstration of 3D printer ● Demonstration of laser cutter and RD works software ● Study of slicer software ● Study of master cam software 	
MODULE 4	ALIGNMENT AND MAPPING OF IDEAS	4
	<ul style="list-style-type: none"> ● Project Title: Problem Statement, solution and justification for SDG and SAP 	
MODULE-5	ENTREPRENEURSHIP SKILLS	4
	<ul style="list-style-type: none"> ● Startup Awareness ● Entrepreneurship Opportunities ● Mock Presentations ● Innovation ● Novelty Feasibility ● Presentation Skills 	

MODULE-6 SCOUT for SDGs**4**

History of Scouting and Guiding - Introduction to Rovering and Ranging - Education objectives - Different Sections of Scouting- Bunnies, Cubs-Bulbuls, Scouts-Guides, Rovers-Ranger

Promise and Law: Scouting and Guiding with meaning to each point-how a boy and girl implement it on the daily life, saving life, Duties as citizens.

Leadership Skills: Mindsets of Leadership, Carrier Council. Community Service: Meaning, Types, duration, difference between community Service and Community Development.

Sairam SDG Ideathon**6**

- Preparedness of Ideathon
- Idea Pitching

TOTAL: 30 PERIODS**REFERENCES:**

1. D P Kothari and I.J Nagarath, "Basic Electrical and Electronics Engineering", McGraw Hill Education (India) Private Limited, Second Edition, 2020
2. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
3. Elements of Mechanical Engineering by N M Bhatt and J R Mehta, Mahajan Publishing House
4. Basic Mechanical Engineering by Pravin Kumar, Pearson Education
5. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
6. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi, 4th Reprint, 2017.
7. John J. Craig, Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
8. Scouts Hand Book

WEB REFERENCES

1. https://onlinecourses.nptel.ac.in/noc24_ee112/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs115/preview
3. https://onlinecourses.nptel.ac.in/noc24_me104/preview
4. https://onlinecourses.nptel.ac.in/noc24_me88/preview
5. <http://sdgs.scout.org>

OUTCOMES:**Upon completion of the course, the student will be able to:**

1. Gain the knowledge on Basic Electronics & Electrical Circuits (K2)
2. Understand the Basics of Embedded systems, IOT & Robotics (K1)
3. Explore the Basics of Mechanical Modeling (K2)
4. Interpret the mapping of SDGs to ideas. (K2)
5. Comprehend the guidance for the Idea presentation and to Innovate the ideas for market opportunities (K2)
6. Understand the scouting as a way of life for community development and illustrate the ideas for Ideathon event emphatically (K4)

CO-PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	-	-	-	2	2	-	2	-	2
CO2	3	-	-	-	-	2	2	-	2	-	2
CO3	3	-	-	-	-	2	2	-	2	-	2
CO4	3	-	-	-	-	2	2	-	2	-	2
CO5	3	-	-	-	-	2	2	-	2	-	2
CO6	2	2	-	-	2	2	2	-	2	-	2

SEMESTER - III

24BSMA302 - SDG NO. 4	LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- The aim of this course is to impart knowledge in the concepts of linear algebra as a prerequisite for the recent thrust areas of technological advancement.
- To know the importance of partial differential equations in modelling various engineering problems.

MODULE - I VECTOR SPACES**9**

Vectors and Linear combinations-Vector spaces (Definitions and examples) – Subspaces (Definitions and examples) – Linear independence and linear dependence – Bases and dimensions.

MODULE - II LINEAR TRANSFORMATION**12**

Linear transformation - Null and range spaces - Dimension theorem (Statement only) - Matrix of a linear transformation

MODULE - III INNER PRODUCT SPACES**9**

Inner product - Norm - Gram Schmidt orthogonalization process (Statement only) - QR decomposition.

MODULE - IV ADJOINT OPERATORS**9**

Adjoint of a linear operator - Least square approximation- Normal and self-adjoint operators.

MODULE - V SOLUTIONS OF FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS**12**

Solutions of standard types of first order partial differential equations - Singular integral - Complete integral – Lagrange's linear equation.

MODULE - VI SOLUTIONS OF LINEAR PARTIAL DIFFERENTIAL EQUATIONS**9**

Linear homogeneous and non-homogeneous partial differential equations of second and higher order with constant coefficients.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Linear Algebra, Friedberg A.H., Insel A.J. and Spence L., 4th Edition, Pearson, 2018.
2. Transforms and Partial Differential Equation, Veerarajan T., 3rd Edition, Tata McGraw Hill Education Pvt. Ltd., , New Delhi.

REFERENCES:

1. Linear Algebra and its applications, Strang G., Thomson (Brooks/Cole), New Delhi, 2005.
2. Linear Algebra and its Applications ,Lay D. C. , 5th Edition, Pearson Education, 2015.
3. Linear Algebra – A Geometric Approach, Kumaresan S.,Prentice – Hall of India, New Delhi, Reprint, 2010.
4. Higher Engineering Mathematics, B. V. Ramana, 11th reprint, Tata McGraw-Hill, New Delhi, 2010.
5. A text-book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2008.
6. Higher Engineering Mathematics, B. S. Grewal, 40th Edition, Khanna Publishers, New Delhi, 2007.

WEB RESOURCES

1. <https://nptel.ac.in/courses/111/103/111103021/>
2. <https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/download/>
3. <https://theengineeringmaths.com/wp-content/uploads/2016/02/Partial-differential-equations.pdf>

ONLINE RESOURCES:

1. <https://www.khanacademy.org/math/linear-algebra>
2. <https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/>
3. <https://freevideolectures.com/course/3244/advanced-engineering-mathematics>
4. https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/video_galleries/video-lectures/
5. <https://nptel.ac.in/courses/111106135>

OUTCOMES**Upon completion of the course, the student will be able to:**

1. Determine the bases and dimension of vector spaces and subspaces (CO1) (K3)
2. Compute the rank, nullity and matrix of a linear transformation and. (CO2) (K3)
3. Construct an orthonormal basis using Gram-Schmidt orthogonalization process and use it for QR decomposition of a matrix.. (CO3) (K3)
4. Determine the adjoint of a linear operator and solve least squares approximation problems. (CO4) (K3)
5. Compute the general, particular, and singular integrals of first-order partial differential equations, including Lagrange's linear equation. (CO5) (K3)
6. Solve linear homogeneous and non-homogeneous partial differential equations of second and higher order with constant coefficients. (CO6) (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2
CO2	3	2	-	-	-	-	-	-	-	-	-	3	2
CO3	3	2	-	-	-	-	-	-	-	-	-	3	2
CO4	3	2	-	-	-	-	-	-	-	-	-	3	2
CO5	3	2	-	-	-	-	-	-	-	-	-	2	3
CO6	3	2	-	-	-	-	-	-	-	-	-	2	3

SEMESTER - III

24EPC301 108106073 SDG NO. 4, 9, 11	ELECTROMAGNETIC FIELDS					L	T	P	CP	C
						3	0	0	3	3

OBJECTIVES:

- To impart knowledge on mathematical and vector concepts related to electromagnetic fields.
- To describe electrostatic fields and their associated laws.
- To describe magnetostatic fields and their associated laws.
- To give insight to different methods of electromagnetic force generation and Maxwell's equations.

- To impart knowledge on electromagnetic wave propagation and characterizing parameters.
- To explore real time applications of electromagnetic fields.

MODULE - I VECTOR ANALYSIS**8**

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields – Gradient, Divergence, Curl – theorems and applications.

MODULE - II ELECTROSTATICS**8**

Coulomb's Law–Electric field intensity–Field due to discrete and continuous charges– Gauss's law and its applications - Electric potential - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations - Capacitance, Energy and Energy density.

MODULE - III MAGNETOSTATICS**8**

Lorentz force, Magnetic field intensity (H) – Biot-Savart's Law - Ampere's Circuital Law – H due to straight conductors, circular loop, infinite sheet of current, Magnetic flux density (B) - Boundary conditions - Scalar and vector potential, Poisson's Equation, Magnetic force, Torque, Inductance, Energy density.

MODULE - IV ELECTRODYNAMIC FIELDS**7**

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

MODULE - V ELECTROMAGNETIC WAVES**7**

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance- skin depth - Poynting vector – Plane wave reflection and refraction.

MODULE - VI ELECTROMAGNETIC FIELD APPLICATIONS**7**

Electrostatic Discharge- Radio-frequency microelectromechanical systems (RF MEMS) - Super Capacitors - Magnetic Levitation and Wireless power transfer.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Mathew N.O. Sadiku “Principles of Electromagnetics”, 7th Edition, Oxford University Press Inc, 2018.

- William H. Hayt and John A. Buck and Jaleel M. Akhtar “Engineering Electromagnetics”, McGrawHill, 9th edition, 2020.

REFERENCES:

- S. Salivahanan, S. Karthie, “ Electromagnetic Fields and Waves”, 3rd Edition, Pearson Publication, 2024.
- J.P.Tewari, “Engineering Electromagnetics - Theory, Problems and Applications”, Second Edition, Khanna Publishers, 2013
- Joseph. A.Edminister, “Schaum’s Outline of Electromagnetics”, fourth Edition (Schaum’s Outline Series), McGrawHill, 2018.
- S.P.Ghosh, Lipika Datta, “Electromagnetic Field Theory”, First Edition, McGraw Hill Education (India) Private Limited, 2017.
- K.A.Gangadhar, “Electromagnetic Field Theory”, Khanna Publishers; Eight edition Reprint: 2015.

WEB RESOURCES:

- <https://www.britannica.com/science/electrostatics>
- <https://www.britannica.com/science/magnetostatics>
- <http://www.clerkmaxwellfoundation.org/>

ONLINE RESOURCES:

- <https://nptel.ac.in/courses/108104087>
- <https://ocw.mit.edu/courses/8-311-electromagnetic-theory-spring-2004/>

OUTCOMES

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

- Apply vector concepts related to electromagnetic fields for different coordinate systems. (K3)
- Analyse the fundamental principles and laws of electrostatic fields, and calculate electric field intensity and potential for different charge distributions. (K4)
- Analyse magneto static fields by using Biot–Savart’s law and Ampere’s law, and compute related magnetic forces and inductance. (K4)
- Interpret Maxwell’s equations for static and dynamic fields and the generation of electromagnetic forces in time-varying fields. (K4)
- Explain the electromagnetic wave propagation, including key wave parameters, reflection, refraction, and energy flow. (K4)
- Apply the concepts of Electromagnetic fields for various real time applications. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	2	2	2	-	1	-	-	-	-	-	2	2
C02	2	2	2	2	-	1	-	-	-	-	-	2	2
C03	2	2	2	2	-	1	-	-	-	-	-	2	2
C04	2	2	2	2	-	1	-	-	-	-	-	2	2
C05	2	2	2	2	-	1	-	-	-	-	-	2	2
C06	2	2	2	2	-	1	-	-	-	-	-	2	2

SEMESTER - III

24EEPC302 108105155 SDG NO. 4	ELECTRICAL MACHINES - I					L	T	P	CP	C
						3	0	0	3	3

OBJECTIVES:

- To explain the principles of electromechanical energy conversion and magnetic circuits.
- To describe the construction, operation, and types of DC machines
- To analyze the performance characteristics and testing methods of DC machines.
- To investigate the speed control techniques of DC motors.
- To illustrate the construction, working principles, and performance analysis of transformers.
- To examine real-world applications of DC machines and transformers.

MODULE -I PRINCIPLES OF ENERGY CONVERSION**8**

Basic magnetic circuit analysis, Faraday's law of electromagnetic induction –singly and doubly excited magnetic field systems – torque production in rotating machines.

MODULE -II DC GENERATORS**8**

Construction, principle of operation of DC generator – emf equation– types, Characteristics, commutation - armature reaction, Losses and Efficiency – Condition for maximum efficiency.

MODULE -III DC MOTORS**8**

Principle of operation – torque equation of DC motor– types – electrical & mechanical characteristics –starting – speed control - braking.

MODULE - IV TRANSFORMERS**7**

Constructional details of transformers – Principle of operation – EMF equation – Equivalent circuit – Transformer on no-load and load – Voltage Regulation – Auto transformers – Three phase transformers.

MODULE - V TESTING OF DC MACHINES AND TRANSFORMERS**7**

Testing of DC machines – Brake test, Swinburne's test and Hopkinson's test – Testing of transformers – load test – Sumpner's test - All day efficiency

MODULE - VI APPLICATIONS OF DC MACHINES AND TRANSFORMERS **7**

DC machines for industrial applications, conventional transformers for power transmission and distribution- smart transformers for modern power systems.

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. Dr. P.S. Bhimbra, "Electrical Machinery", Khanna Publications, Revised Edition, 2021
2. Nagrath, I.J. and Kothari, D.P., "Electrical Machines", Tata McGraw-Hill Education Private Limited Publishing Company Ltd., 5th Edition, 2017.
3. B. L. Theraja and AK Theraja, "A Textbook of Electrical Technology", Volume 2, S. Chand Publications, 2015.
4. A.K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, New Delhi, 1984.

REFERENCE BOOKS:

1. A.E. Fitzgerald and Charles Kingsley, "Electric Machinery", Tata McGraw-Hill Education Publications, Revised Edition, 2022.
2. Vincent Del Toro, "Electrical Engineering Fundamentals", 4th Edition, Prentice Hall Publications, 2017.
3. Parker Smith, N.N., 'Parker Smith's Problems in Electrical Engineering', 9th Edition, CBS Publishers and Distributors, 9th Edition, 2003.

WEB RESOURCES:

1. <https://www.electricaleasy.com>
2. <https://www.electrical4u.com>

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/108105155>
2. <https://nptel.ac.in/courses/108102146>
3. <https://www.sciencedirect.com/search?q=electrical%20machines>

OUTCOMES

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

1. Apply the principles of electromechanical energy conversion and the concepts of magnetic circuits in electrical machines.(K3)
2. Examine the basic construction and working of DC generators, commutation and losses affect their performance.(K4)
3. Analyze the performance of DC motors under different conditions of operation, control, and braking.(K4)
4. Interpret the behavior of transformers using equivalent circuits and voltage regulation for various configurations.(K4)
5. Make use of practical tests to study the performance of DC machines and transformers. (K3)
6. Categorise the use of DC machines and transformers in real-world industrial and power system applications. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	1	1	1	-	-	-	-	-	1	1	-	2
C02	2	2	1	2	-	-	-	-	-	-	-	-	2
C03	2	1	2	1	-	-	-	-	-	1	1	-	2
C04	2	2	1	1	-	-	-	-	-	1	1	-	2
C05	2	1	2	1	-	-	-	-	-	1	2	-	2
C06	2	2	2	2	-	-	-	-	-	1	2	-	2

SEMESTER - III

24EEPC303 108101094 / 108106084 SDG NO. 4	ANALOG ELECTRONICS					L	T	P	CP	C
						3	0	0	3	3

OBJECTIVES:

- To develop the amplifier circuits by applying the biasing concept.
- To design different types of amplifiers and analyse their response.
- To understand the concept of an oscillator and its types.
- To comprehend the characteristics and applications of OPAMP.
- To analyze the concept of OP AMP used for various applications.
- To design and implement analog ICs for real world applications.

MODULE - I FET AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 7

BJT - Biasing circuits, JFET and MOSFET, Characteristics of CS, CG and CD amplifier configurations and Biasing circuits, Differential amplifier- Common mode and Difference mode analysis, Cascode Differential Amplifier.

MODULE - II POWER AMPLIFIERS 7

Classification of Feedback Amplifiers - Advantages of Negative feedback , Power amplifiers:- Class A, B and C Power amplifiers, Class AB Push-Pull - cross-over distortion, Complementary Symmetry Push-Pull amplifiers - Design of power output and efficiency.

MODULE - III OSCILLATORS 7

Barkhausen criterion for oscillation, Hartley and Colpitts oscillators, Phase shift, Wein bridge, Crystal oscillators and Clapp oscillator.

MODULE - IV OP-AMP CHARACTERISTICS 8

OP-AMP characteristics - DC characteristics, AC characteristics. Basic applications of op-amp – Inverting and Non-inverting Amplifiers, differential amplifier, summer, differentiator and integrator, V/I and I/V converter.

MODULE - V OP-AMP APPLICATIONS 8

Instrumentation amplifier, Multivibrators, peak detector, clippers, S/H circuit - D/A converter - weighted resistor and R- 2R ladder types, A/D converters - flash type, dual slope type and successive approximation type.

MODULE - VI TIMERS AND REGULATORS 8

IC555 Timer, Monostable and Astable modes of operation – Fixed voltage regulators LM78XX, LM79XX, Variable voltage regulator 723, Switching regulator.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. A.S. Sedra, K.C. Smith, T.C. Carusone, and V. Gaudet, "Microelectronics Circuits", 2019, 8th edition, Oxford university press.
2. D.Roy Choudhary, Shail Bala Jain, "Linear Integrated Circuits", Fifth edition, New Age International Publishers, 2018.

REFERENCES:

1. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition, 2017.

2. Robert L. Boylestad & Louis Nashelsky, "Electronic Devices and Circuit Theory", 11th Edition January 2015
3. S.Salivahanan, V.S.Kanchana Bhaaskaran, "Linear Integrated Circuits and Applications", First edition, 2018, McGraw Hill Education.
4. Ramakant A.Gayakward, "Op-amps and Linear Integrated Circuits", Fourth edition (25 May 2015), Pearson Education.

WEB RESOURCES:

1. <https://www.electronics-tutorials.ws/>
2. <https://archive.nptel.ac.in/courses/108/105/108105158/>
3. <https://archive.nptel.ac.in/courses/108/106/108106084/>
4. <https://www.khanacademy.org/science/electrical-engineering/eeamplifiers>
5. <https://nptel.ac.in/courses/117107094/>

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/117103063/>
2. <https://www.coursera.org/specializations/semiconductor-devices>
3. <http://www.nptelvideos.in/2012/11/digital-integrated-circuits.html>
4. <https://nptel.ac.in/courses/108/108/108108111/>

OUTCOMES

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

1. Analyze the biasing techniques of BJT, JFET, and MOSFET amplifiers to design analog amplifier circuits. (K4)
2. Apply the principles of negative feedback to summarize the characteristics, evaluate the efficiency, and distortion characteristics of various classes of power amplifiers. (K3)
3. Make use of the positive feedback and principle of Barkhausen criterion to determine the frequency of oscillation of various oscillators. (K3)
4. Construct the basic amplifier circuits using OP-AMP and summarize its characteristics. (K3)
5. Analyze the concept of OP-AMP used in various linear and non linear applications. (K4)
6. Develop the timer circuits and regulators for engineering applications. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	2	2	2	-	-	-	-	-	-	-	2	-
C02	3	2	2	2	-	-	-	-	-	-	-	2	-
C03	3	2	2	2	-	-	-	-	-	-	-	2	-
C04	3	2	2	2	-	-	-	-	-	-	-	2	-
C05	3	2	2	2	-	-	-	-	-	-	-	2	-
C06	3	2	2	2	-	-	-	-	-	-	-	2	-

SEMESTER - III

24EEPC304 108105132 SDG NO. 4	DIGITAL ELECTRONICS					L	T	P	CP	C
						3	0	0	3	3

OBJECTIVES:

- To understand the design of integrated circuits.
- To study the simplification methods of the logical expressions.
- To study the design of combinational circuits.
- To learn the design of synchronous and asynchronous circuits.
- To design various Programmable Logic Devices and to apply VHDL to design and implement digital circuits.
- To learn the real time applications of digital logic circuits.

PRE REQUISITES:

- Basic knowledge about Number system
- Logic Gates functioning

MODULE -I DIGITAL INTEGRATED CIRCUITS**8**

Logic families and their characteristics: RTL, DTL, TTL, CMOS, and ECL integrated circuits and their performance comparison – Logic levels, propagation delay time, power dissipation, fan-out and fan-in, noise margin.

MODULE -II BOOLEAN FUNCTIONS**7**

DeMorgan's theorems – Realization of switching functions using logic gates – Switching equations – Canonical logic forms – Sum of Products (SOP) and

Product of Sums (POS) – Simplification of Boolean Functions using Karnaugh map.

MODULE - III IMPLEMENTATION OF BASIC COMBINATIONAL CIRCUITS 7

Binary adder, subtractor, BCD adder, code convertors, decoder, encoder, priority encoder, multiplexers, demultiplexers, binary comparator – Hazards in digital logic circuits.

MODULE - IV SEQUENTIAL LOGIC CIRCUITS 8

Working of SR, JK, D and T flip-flops – Clocked and edge triggered flipflops – Asynchronous and synchronous counters – Shift Registers – State diagrams and state tables – State table reduction – Excitation table and state equations – Design and analysis of simple synchronous sequential circuits – Mealy and Moore models.

MODULE - V PROGRAMMABLE LOGIC DEVICES AND DIGITAL SIMULATION 8

Programmable Logic Devices – Programmable Read-Only Memory, Programmable Logic Arrays and Programmable Array Logic, Field Programmable Gate Arrays, CPLD. Introduction to VHDL – Operators – Simple coding for combinational logic circuits- Adder, subtractor, multiplexer and demultiplexer, simple coding for sequential circuits- Flip-Flops, counter, shift registers.

MODULE - VI APPLICATIONS OF DIGITAL LOGIC CIRCUITS 7

Real-time examples of digital logic circuits: Automatic vending machines, digital stopwatches, digital calculators, traffic light controllers, automatic door locks, industrial automation systems.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. R P. Jain, KishorSarawadekar, "Modern Digital Electronics", 5th Edition, mcGrawHill, 2022.
2. Kumar, A. Anand, "Fundamentals Of Digital Circuits", 4th edition, PHI, 2016.

REFERENCE BOOKS:

1. M. Morris Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL and system Verilog", 6th edition, Pearson Publication, 2018.

2. S. Salivahanan, S. Arivazhagan, “ Digital Circuits And Design” 5th Edition, Oxford University Press, March 2018.
3. Charles H. Roth, Jr., Larry L. Kinney, and Eugene B. John, “ Fundamentals of Logic Design, Enhanced Seventh Edition, Cengage Publications, 2019.
4. Natarajan R Ananda, “ Digital Design” PHI publications, 2015.

WEB RESOURCES:

1. <https://youtu.be/M0mx8S05v60?si=Rhnj0TaF0QkBA9QB>
2. <https://youtu.be/FKvnmxte98A?si=2eDD4Cr13G0MzdWL>
3. <https://youtu.be/WW-NPtIzHwk?si=XX6wvDHvxNvXTYnH>

ONLINE RESOURCES:

1. <https://archive.nptel.ac.in/courses/108/105/108105132/>
2. <https://archive.nptel.ac.in/courses/108/105/108105113/>
3. <https://nptel.ac.in/courses/106108099>
4. <https://nptel.ac.in/courses/108106069>

OUTCOMES**Upon completion of the course, the student will be able to:**

1. Apply the characteristics of various logic families to obtain their performance based on logic levels. (K3)
2. Utilize Boolean algebra and Karnaugh maps to simplify logic functions.(K3)
3. Construct arithmetic and control logic circuits using combinational design techniques and identify static and dynamic hazards in digital logic systems.(K3)
4. Analyze the simple sequential circuits. (K4)
5. Apply the concepts of programmable logic devices and VHDL code in digital system design. (K3)
6. Make use of digital logic circuits in real-time systems.(K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	2	-	-	-	-	-	-	-	-	-	2	-
C02	3	2	2	-	-	-	-	-	-	-	-	2	-
C03	3	2	2	1	-	-	-	-	-	-	-	2	-
C04	3	2	2	1	-	-	-	-	-	-	-	2	-
C05	3	2	2	-	1	-	-	-	-	-	-	2	-
C06	3	2	2	1	-	-	-	-	-	-	1	2	-

SEMESTER - III

24HSMC301 - SDG NO. 4, 9	UNIVERSAL HUMAN VALUES – II					L	T	P	CP	C
						2	1	0	3	3

OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Developing clarity with harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.
- Recognizing the potential of excellence than competition

SYLLABUS:

The course has 28 lectures and 14 practice sessions in 6 modules:

MODULE-I COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION (5+2)

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration-what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self- exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly-A critical appraisal of the current scenario

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

MODULE - II UNDERSTANDING HARMONY IN THE HUMAN BEING -

HARMONY IN MYSELF

(5+2)

6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.
7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of 'I' and harmony in 'I'
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

MODULE - III UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY HARMONY IN HUMAN-HUMAN RELATIONSHIP

(6+2)

12. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
13. Understanding the meaning of Trust; Difference between intention and competence
14. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
15. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

MODULE - IV UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE (6+2)

16. Understanding the harmony in the Nature
17. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature
18. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
19. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

MODULE - V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS (4+4)

20. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family
21. Natural acceptance of human values
22. Definitiveness of Ethical Human Conduct
23. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
24. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people- friendly and eco friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

MODULE - VI UNIVERSAL HUMAN ORDER (4+3)

25. Programs to ensure Sanyam and Health
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc

TOTAL : 45 PERIODS

TEXT BOOKS:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 3rd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.

REFERENCES:

1. AICTE Model Curriculum in Humanities, Social Science and Management Courses (UG Engineering & Technology) Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence-JC Kumarappa
8. Bharat Mein Angreji Raj- Pandit Sunderlal
9. Rediscovering India- by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda- Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

OUTCOMES**Upon completion of the course, the student will be able to:**

1. Express the harmony of relationship among human being, family, society, nature and existence with right understanding and right feeling. (K2)
2. Develop the responsibility of handling problems by finding holistic and sustainable solutions based on the natural acceptance for maintaining mutual human relationships. (K2)
3. Develop a holistic perspective of life based on self-exploration about self, family, society and nature/existence. (K2)
4. Elucidate a critical ability for dedicative commitment towards human values, relationships and society. (K2)
5. Implement the process of verification and validation of learning in daily life. (K2)
6. Develop self reflection, commitment and courage to act in life challenging situations. (K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
C01	-	-	-	-	-	3	3	2	-	-	3
C02	-	1	-	-	-	3	3	2	-	-	-
C03	-	-	3	-	-	3	3	2	-	-	-
C04	-	-	-	-	-	3	3	2	-	2	3
C05	-	-	-	-	-	3	3	-	-	-	3
C06	-	-	-	-	-	3	3	-	-	3	2

SEMESTER - III

24HSNC301 - SDG NO. 4	NCC COURSE LEVEL 2					L	T	P	CP	C
						3	0	0	3	0

ARMY WING**PERSONALITY DEVELOPMENT****9**

PD 3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5	Public Speaking	3

LEADERSHIP**7**

L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
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DISASTER MANAGEMENT**13**

DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1

ENVIRONMENTAL AWARENESS & CONSERVATION**3**

EA 1	Environmental Awareness and Conservation	3
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GENERAL AWARENESS**4**

GA 1	General Knowledge	4
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ARMED FORCES 6

AF 1	Armed Forces, Army, CAPF, Police	6
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ADVENTURE 1

AD 1	Introduction to Adventure Activities	1
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BORDER & COASTAL AREAS 2

BCA 1	History, Geography & Topography of Border/Coastal areas	2
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TOTAL: 45 PERIODS**NAVAL WING****PERSONALITY DEVELOPMENT 9**

PD 3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5	Public Speaking	3

LEADERSHIP 7

L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
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DISASTER MANAGEMENT 13

DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1

ENVIRONMENTAL AWARENESS & CONSERVATION 3

EA 1	Environmental Awareness and Conservation	3
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GENERAL AWARENESS 4

GA 1	General Knowledge	4
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NAVAL ORIENTATION 6

AF 1	Armed Forces and Navy Capsule	3
EEZ 1	EEZ Maritime Security and ICG	3

ADVENTURE 1

AD 1	Introduction to Adventure Activities	1
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BORDER & COASTAL AREAS 2

BCA 1	History, Geography & Topography of Border/Coastal areas	2
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TOTAL: 45 PERIODS**AIR FORCE WING****PERSONALITY DEVELOPMENT 9**

PD 3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5	Public Speaking	3

LEADERSHIP 7

L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
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DISASTER MANAGEMENT 13

DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1

ENVIRONMENTAL AWARENESS & CONSERVATION 3

EA 1	Environmental Awareness and Conservation	3
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GENERAL AWARENESS 4

GA 1	General Knowledge	4
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GENERAL SERVICE KNOWLEDGE 6

GSK 1	Armed Forces & IAF Capsule	2
GSK 2	Modes of Entry in IAF, Civil Aviation	2
GSK 3	Aircrafts - Types, Capabilities & Role	2

ADVENTURE 1

AD 1	Introduction to Adventure Activities	1
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BORDER & COASTAL AREAS**2**

BCA 1 History, Geography & Topography of Border/Coastal areas

2**TOTAL :45 PERIODS****SEMESTER - III**

24EEPL301 - SDG NO. 4, 9	ANALOG AND DIGITAL ELECTRONICS LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To understand and implement basic combinational circuits such as adders, subtractors, multiplexers, and demultiplexers.
- To develop the ability to design and analyze code conversion circuits including binary to Gray code and vice versa.
- To design and implement sequential logic circuits such as counters and shift registers using standard ICs.
- To study the operation and application of analog semiconductor devices such as PN junction diodes, Zener diodes, BJT, and JFET.
- To explore the applications of operational amplifiers in amplifier, integrator, and differentiator configurations.
- To understand the functioning and application of timing and oscillator circuits using 555 timers and RC phase shift oscillators.

LIST OF EXPERIMENTS

1. Implementation of Adder, subtractor circuits.
2. Code converters: Binary to Gray code converter and vice- versa.
3. Implementation of parity generator and parity checker circuits.
4. Implementation of Priority Encoders and Binary Decoders
5. Implementation of Asynchronous Decade Counters.
6. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitability IC's.
7. Implementation of multiplexer and demultiplexer.
8. Experimental characterization of PN junction diode and Zener Diode.
9. Experimental Characterization of BJT, JFET.
10. Application of Op-Amp: inverting and non-inverting amplifier, Integrator and Differentiator.
11. Timer IC application: Study of NE/SE 555 timer in Astable and Monostable mode operations.
12. Experimental design of RC phase shift oscillator using BJT.

TOTAL : 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Sl No.	Name of the equipment / component	Quantity	Remarks
1.	Digital Trainer Kit	10	
2.	Dual,(0-30V)variable Power Supply	10	-
3.	CRO 9	30MHz	
4.	Digital Multimeter	10	Digital
5.	Function Generator	8	1MHz
6.	IC Tester (Analog)	2	
7.	Breadboard 10		
8.	IC741/ICNE555	10	
9.	Digital IC types		
10.	Transistor-BC 107		
11.	Diodes,IN4001		
12.	Zener diodes		
13.	Capacitors		
14.	JFET semiconductor device -BFW10		
15.	Digital Storage Oscilloscope	1	
16.	Resistors		
17.	Single Strand Wire		
18.	Consumables (Sufficient quantity)		

OUTCOMES**Upon completion of the course, the student will be able to:**

1. Apply the concept of combinational logic circuits and implement the logic circuits of adders, subtractors, priority encoders, and decoders.(K3)
2. Apply digital logic techniques to convert binary codes to Gray codes and vice versa through circuit implementation.(K3)
3. Construct and examine sequential circuits such as asynchronous counters and various types of shift registers (SISO, SIPO, PISO, PIPO). (K3)
4. Analyze the electrical behavior of semiconductor devices such as PN junction diodes, Zener diodes, BJT, and JFET through experiments.(K4)
5. Construct the inverting, non-inverting amplifiers, Integrator and Differentiator using OPAMP. (K3)
6. Construct the timer circuits using 555 timer and RC phase shift oscillators using BJT. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	2	2	1	-	-	-	2	-	-	-	2	-
C02	2	2	2	1	-	-	-	2	-	-	-	2	-
C03	2	2	2	1	-	-	-	2	-	-	-	2	-
C04	2	2	2	1	-	-	-	2	-	-	-	2	-
C05	2	2	2	1	-	-	-	2	-	-	-	2	-
C06	2	2	2	1	-	-	-	2	-	-	-	2	-

SEMESTER - III

24EETP301 - SDG NO. 4	APTITUDE SKILLS					L	T	P	CP	C
						0	0	2	2	1

APTITUDE & COGNITIVE SKILLS – PHASE 1**OBJECTIVES:**

- Educate and enrich students on quantitative ability, reasoning ability, and verbal ability.
- Build a strong foundation for solving recruitment-based problems with speed and accuracy.
- Enhance creative thinking skills.
- Enhance logical problem-solving skills.

MODULE - I QUANTITATIVE ABILITY**22**

Number Properties, Speed Math, HCF and LCM, Percentages, Time and Work, Time Speed and Distance, Ratio Proportion and Variations, Averages Mixtures and Alligation

MODULE - II REASONING ABILITY**16**

Profit and Loss, Simple Interest and Compound Interest, Blood Relation, Directions, Coding and Decoding, Series, Ranking and Arrangements

MODULE - III VERBAL ABILITY**7**

Subject-Verb Agreement, Tenses, Prepositions - Concepts, Error Spotting, Sentence Correction, Fill in the Blanks

TOTAL: 45 PERIODS

REFERENCES:

1. Quantitative Aptitude for Competitive exams - Volume 1 & 2 – R.S. Aggarwal- Revised Edition 2022 -Schand
2. A Modern Approach to Verbal and Non-Verbal Reasoning - Volume 1 & 2 – R.S. Aggarwal - Revised edition 2022-Schand
3. High School English Grammar & Composition – Wren & Martin -2023 Edition

PHASE - 2**(LIFE SKILLS, RANGER AND ROVER & BIS STANDARDS)****OBJECTIVES:**

- Familiarize the team skills and life skills.
- Familiarize with the Indian Standards on various electrical components

MODULE -I JEEVAN KAUSHAL 2.0 – TEAM SKILLS AND LIFE SKILLS 14

Trust and Collaboration: Importance of Trust in Creating a Collaborative Team- Agree to Disagree and Disagree to Agree – Spirit of Teamwork- Understanding Fear of Being Judged and Strategies to Overcome Fear.

Listening as a Team: Advantages of Effective Listening, Listening as a Team Member and Team Leader.

Brainstorming: Brainstorming as a Technique to Promote Idea Generation, Brainstorming: Meaning and the Process, Procedure for Conducting Brainstorming, Importance of Using Brainstorming Technique, Types of Brainstorming.

Social and Cultural Etiquette: Need for Etiquette, Aspects of Social and Cultural/Corporate Etiquette in Promoting Teamwork, Importance of Time, Place, Propriety and Adaptability to Diverse.

Internal Communication: Internal Communication – Meaning and Need, Use of Various Channels of Transmitting Information to Team Members including Digital and Physical.

Leadership Skills: Understanding Leadership and Its Importance, Models of Leadership, Basic Leadership Skills.

MODULE - II RANGER AND ROVER**10**

Four Bonds of BSG: Sign, Salute, Left Handshake, Moto and Good Turn.

Discipline and Uniform: Uniform of Rovers and Rangers, 14 Programme ideals.

Knowledge of Merit: Know about Knowledge of Merit Badges (Proficiency Badge).

Sustainability E-learning: (Online Course Available in WOSM Learning Zone).

Activating the Earth Tribe Initiative in your Community.

MODULE - III INDIAN STANDARDS ON TRANSFORMERS AND MOTORS 6

Transformers: Working Principle of Transformer, Classification of Transformers, Tests of Transformers, Indian Standards available on various types of transformers

Motors: Part 1: Introduction to Motors & Uses of Motors in India- Fundamentals of Motors - Operation of DC Motor - Operation of AC Motors - Operation of AC Induction Motors - Operation of AC Synchronous Motors - Motor Efficiency - Major Types of Motors Losses Explained - Main Strategies to Reduces Loss - Importance of Motor Standardization

Part 2: Summary and explanation of Important Indian Standards - IS 12615: 2018- IS 996: 2009 - IS 9283:2013 - IS 15999 series - IS/IEC 60034-5: 2000 - IS 6362:1995 (IEC Pub 34-6: 1991) - IS 12075: 2008.

TOTAL: 30 PERIODS

REFERENCES:

1. Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0, UGC, New Delhi.
2. A World Built on Standards: A Textbook for Higher Education, Published by: Danish Standards Foundation, 2015.
3. SO / IEC Guide 59, BIS Standards Formulation Manual, 2nd Revision, 2022.

ONLINE RESOURCES:

1. https://lms.scout.org/course_items/show/1172182?course_id=214307#course-item-id=1172182
2. https://lms.scout.org/courses/show/214123?force_course_hub=true
3. https://www.ugc.gov.in/pdfnews/4874522_Draft-Curriculum-for-Life-Skill-Jeevan-Kaushal.pdf (ugc.gov.in)

OUTCOMES

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

1. Demonstrate improved quantitative aptitude for solving numerical problems. [K2]
2. Apply logical reasoning to tackle reasoning-based challenges. [K3]
3. Make use of grammar and language exercises to enhance verbal communication and comprehension skills. [K2]
4. Demonstrate critical thinking and problem-solving skills in various cognitive scenarios. [K2]

5. Explain the importance of life skills in personal and professional development. [K2]
6. Summarize the importance of Indian Standards on various electrical components. (K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	2	2	2	-	-	-	-	-	-	2	1	-
C02	2	2	2	2	1	-	-	-	1	-	2	1	-
C03	2	2	2	2	-	-	-	-	1	2	2	1	-
C04	2	2	2	2	1	-	-	-	1	-	2	1	-
C05	-	-	-	-	-	3	-	-	1	-	2	1	-
C06	2	-	2	2	2	-	-	-	-	-	2	2	2

SEMESTER - III

24EIID301 - SDG NO. 4,11,15	INNOVATIVE DESIGN LAB - I					L	T	P	CP	C
						0	0	2	2	1

OBJECTIVES:

- To provide opportunities for students to develop an entrepreneurial mindset and explore real-world problem-solving through a startup-centric approach.
- To enable hands-on experience in identifying market needs
- To enable development of skill sets for designing, validating, and realizing a Minimum Viable Product (MVP) for an entrepreneurial venture.
- To guide students in validating market opportunity, and formulating a solution with realistic constraints.
- To inculcate ethical research practices, foster a commitment to lifelong learning, and promote the development of socially responsible and sustainable innovations aligned with relevant Sustainable Development Goals (SDGs).
- To prepare students to design sustainable business models and present entrepreneurial ideas through structured, outcome-driven business pitches using core startup frameworks.

COURSE METHODOLOGY:

1. This initiative is designed to inculcate ethical principles of research and to get involved in a life-long learning process for the students, specifically through the lens of entrepreneurship and innovation.
2. The project work must involve identifying a problem, validating market opportunity, and developing a solution with realistic constraints, culminating in a business plan and prototype/MVP. It must also include appropriate elements of the following: market research, competitive analysis, value proposition design, business model development, financial feasibility, go-to-market strategy, and potentially software/hardware development for the MVP.
3. Project can be individual work or a group project, with a maximum of 3 students. In case of a group project, the individual project report of each student should specify the individual's contribution to the group project. The roles and responsibilities of all team members must be well-defined and documented.
4. On completion of the project, the student shall submit a detailed project report outlining their entrepreneurial journey, solution development, and business plan. The project should be reviewed and the report shall be evaluated, and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION:

1. First evaluation (Milestone 1 - Week 4): 20 marks (Focus on Problem Identification, Opportunity Discovery, Customer & Markets, Value Proposition)
2. Second evaluation (Milestone 2 - Week 8): 30 marks (Focus on Competitive Advantage, Business Model, and MVP Development)
3. Final evaluation (Milestone 3 & 4 - Last week of the semester): 50 marks (Focus on Financial Feasibility, Go-to-Market Strategy, Growth and Scale, Funding Strategy, and Overall Project Report & Viva-Voce)

Note: All three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

OUTCOMES:**At the end of the course, the student should be able to:**

1. Apply entrepreneurial thinking to identify and articulate real-world problems and explore market needs using structured approaches. (K3)
2. Develop skill sets to design potential solutions and validate market opportunities within realistic constraints. (K4)
3. Evaluate sustainable, ethical, and responsible innovation strategies, and communicate business models effectively. (K5)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	3	2	-	-	-	-	2	-	-	-	2	2
C02	3	3	2	-	-	-	-	2	-	-	-	2	2
C03	3	3	2	-	-	-	-	2	-	-	-	2	2

SEMESTER - IV

24BSMA403	STATISTICS AND NUMERICAL METHODS	L	T	P	CP	C
SDG NO. 4		3	1	0	5	4

OBJECTIVES:

- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems
- To identify relationship between multiple input variables
- To introduce the basic concepts of solving algebraic and transcendental equations
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines
- To introduce the knowledge of various techniques and methods of solving ordinary and partial differential equations

MODULE - I TESTING OF HYPOTHESIS**12**

Sampling distributions - Statistical hypothesis - large sample tests based on single proportion and difference proportions, single mean and difference of means - Tests based on t, and F-distributions for mean, variance respectively - Chi-square test for independence of attributes - Goodness of fit.

MODULE - II DESIGN OF EXPERIMENTS**9**

One way and two-way classifications - Completely randomized design - Randomized block design - Latin square design.

MODULE - III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**12**

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 - Maximum Eigenvalues of a matrix by Power method.

MODULE - IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION**9**

Lagrange's and Newton's divided difference interpolation - Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical single integrals using Trapezoidal and Simpson's 1/3 rules.

MODULE - V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

9

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

MODULE - VI NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

9

Solution of two-dimensional Laplace's and Poisson's equations on rectangular domain-Forward time central space scheme - One dimensional heat flow equation by Crank Nicholson Method-One dimensional wave equation by explicit method.

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Miller and Freund's Probability and Statistics for Engineers, Johnson, R.A., Miller, I and Freund J., 8th Edition, Pearson Education, Asia, 2015.
2. Numerical methods for Scientific and Engineering Computation, Jain M. K., Iyengar S. R. K. , Jain R. K., New Age international Publishers, 2003
3. Numerical Methods in Engineering and Science, Grewal. B.S. and Grewal. J.S., 10th Edition, Khanna Publishers, New Delhi, 2015.

REFERENCES:

1. Numerical Analysis, Burden, R. L. and Faires, J. D., 9th Edition, Cengage Learning, 2016.
2. Probability and Statistics for Engineering and the Sciences, Devore J. L., 8th Edition, Cengage Learning, New Delhi, 2014.
3. Applied Numerical Analysis, Gerald C. F. and Wheatley P.O., Pearson Education, Asia, New Delhi, 2006.
4. Probability and Statistics for Engineers and Scientists, Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., , 8th Edition, Pearson Education, Asia, 2007.
5. Numerical methods, Kandasamy P, Thilagavathy K., Gunavathy K., S. Chand, 2006.

WEB REFERENCES:

1. <https://www.classcentral.com/course/swayam-numerical-analysis-17709>
2. <https://online-learning.harvard.edu/course/statistics-and-r?delta=1>

ONLINE RESOURCES:

1. <https://freevideolectures.com/course/3057/numerical-methods-and-computation>
2. <https://nptel.ac.in/courses/111107105/>

OUTCOMES

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

1. Apply appropriate statistical hypothesis tests for large and small samples to make inferences about population parameters using t, F, and Chi-square distributions. (K3)
2. Apply appropriate experimental designs such as CRD, RBD, and Latin Square to analyze and interpret data from one-way and two-way classifications. (K3)
3. Apply numerical methods to solve algebraic, transcendental, and linear systems of equations, and compute dominant Eigenvalues using the Power method. (K3)
4. Apply interpolation techniques and numerical methods to approximate derivatives and evaluate definite integrals. (K3)
5. Apply single-step and multi-step numerical methods to solve first-order ordinary differential equations. (K3)
6. Apply finite difference methods to solve partial differential equations such as Laplace, Poisson, heat, and wave equations. (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	2	-	-	-	-	-	-	-	-	-	2	-
C02	3	2	-	-	-	-	-	-	-	-	-	2	-
C03	3	2	-	-	-	-	-	-	-	-	-	3	2
C04	3	2	-	-	-	-	-	-	-	-	-	3	2
C05	3	2	-	-	-	-	-	-	-	-	-	3	3
C06	3	2	-	-	-	-	-	-	-	-	-	3	3

SEMESTER - IV

24EEPC 401	TRANSMISSION AND DISTRIBUTION	L	T	P	CP	C
- SDG NO. 4, 12		3	0	0	3	3

OBJECTIVES:

- To study the structure of electric power systems, need of EHV and HVDC transmission systems.
- To develop expressions for the computation of transmission line parameters.
- To obtain the equivalent circuit and study the performance of the transmission lines.
- To understand the mechanical design of transmission lines and to analyze the voltage distribution in insulator strings.
- To study the construction of cables and methods of grading.
- To understand the types of distribution system, techniques of voltage control and power factor improvement.

PRE REQUISITE: Basic Electrical Engineering, Circuit Theory

MODULE - I TRANSMISSION SYSTEM OVERVIEW**6**

Structure of power system – Indian power grid scenario - Transmission system classification – Advantages of high transmission voltage – Types of conductors – Line supports – Types of towers – Need of EHV and HVDC transmission system.

MODULE - II TRANSMISSION LINE PARAMETERS**8**

Resistance, inductance and capacitance of single and three phase transmission lines - Self and mutual GMD; skin and proximity effects - Simulation study on inductance and capacitance effects in transmission line.

MODULE - III MODELLING AND PERFORMANCE OF TRANSMISSION LINES**8**

Performance of short, medium and long lines - Equivalent circuits, phasor diagram - Transmission efficiency and voltage regulation - Phenomenon of corona – Corona loss - Critical voltages – Effect on line performance.

MODULE - IV MECHANICAL DESIGN OF LINES**8**

Tension and sag calculation – Effects of wind and ice loading. Insulators: types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators.

MODULE - V UNDERGROUND CABLES**8**

Types of cables – Constructional features – Insulation resistance – Potential gradient-Capacitance of single core and three core cables-Grading of cables - Heating of cables.

MODULE - VI DISTRIBUTION SYSTEMS**7**

Classification of distribution systems –Kelvin's law - AC and DC distribution calculation - Techniques of voltage control with case study - Power factor improvement – Distribution loss – Types of substations.

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. C.L.Wadhwa, "Electrical Power Systems", New Academic Science Ltd,2009.
2. S.N. Singh, "Electric Power Generation, Transmission and Distribution", Prentice Hall of India Pvt. Ltd, New Delhi, Second Edition,2011.

REFERENCES:

1. B.R.Gupta, "Power System Analysis and Design" S. Chand, New Delhi, Sixth Edition, 2011.
2. V.K.Mehta, Rohit Mehta, "Principles of power system", S. Chand & Company Ltd, New Delhi, Third Edition, 2005.
3. D.P.Kothari, I.J. Nagarath, "Power System Engineering", McGraw-Hill Publishing Company limited, New Delhi, Third Edition, 2019.
4. Luces M.Fualken berry, Walter Coffe,"Electrical Power Distribution and Transmission", Pearson Education, First Edition, 2006.

WEB REFERENCES:

1. <https://www.electrical4u.com/transmission-line-in-power-system>
2. <https://www.electrical4u.com/2017/03/underground-power-cables.html>
3. <https://www.eeguide.com/insulating-materials-for-underground-cables>

ONLINE RESOURCES:

1. <https://www.coursera.org/lecture/electric-power-systems/transmission-subtransmission-imo4x>
2. <https://martechmedia.com/index.php/technical-elearning/course-catalog/electrical-distribution/>

OUTCOMES

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

1. Apply the knowledge of power system structure and components to describe the significance of high voltage transmission system.(K3)
2. Apply standard methods to compute resistance, inductance, and capacitance of transmission lines for the given conductor configuration.(K3)
3. Analyze the performance of short, medium, and long transmission lines and assess the impact of corona. (K4)
4. Examine the mechanical design aspects of transmission lines and determine string efficiency in insulator strings. (K4)
5. Identify the electrical parameters of underground cables. (K3)
6. Solve basic analytical problems in distribution system and summarize the importance of voltage control and power factor improvement.(K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	1	-	-	-	-	-	-	-	3	1	1
CO2	3	2	2	1	2	-	-	-	-	-	3	2	1
CO3	3	2	2	1	-	-	-	-	-	-	3	2	1
CO4	3	2	2	1	-	-	-	-	-	-	3	2	1
CO5	3	2	2	-	-	-	-	-	-	-	3	2	2
CO6	3	2	2	1	-	-	-	-	-	-	3	2	1

SEMESTER - IV

24EEPC402 108105131 SDG NO. 8,9	ELECTRICAL MACHINES-II					L	T	P	CP	C
						3	0	0	3	3

OBJECTIVES:

- To study the construction and performance of salient and non – salient type synchronous generators.
- To impart knowledge on the principle of operation and performance of synchronous motors.
- To study the construction, principle of operation and performance of induction machines.
- To study different Starting and speed control of three-phase induction motors.

- To study the construction, principle of operation and performance of single phase induction motors.
- To introduce the special machines.

MODULE - I SYNCHRONOUS GENERATORS

7

Constructional details – Types of rotors – EMF equation – Armature reaction – Voltage regulation – EMF, MMF, ZPF and A.S.A methods – Two reaction theory – Slip test -Synchronizing and Parallel operation.

MODULE - II SYNCHRONOUS MOTORS

7

Principle of operation – V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed - Hunting – damper windings- Synchronous condenser.

MODULE - III THREE PHASE INDUCTION MOTORS

7

Constructional details – Types of rotors -- Principle of operation – Slip – Torque Equation - Condition for maximum torque - Torque-Slip characteristics – Equivalent circuit - Losses and efficiency – Load test - No load and blocked rotor tests - Separation of losses – Induction generator .

MODULE - IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTORS

8

Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star- delta starters – Speed control – Voltage control, Frequency control and pole changing – Cascaded connection-V/f control – Slip power recovery scheme-Braking of three phase induction motor - Plugging, dynamic braking and regenerative braking.

MODULE - V SINGLE PHASE INDUCTION MOTORS

8

Constructional details of single phase induction motors – Double field revolving theory – Equivalent circuit – No load and blocked rotor test – Starting of single-phase induction motors – Capacitor-start capacitor run Induction motor-Shaded pole Induction Motor.

MODULE - VI SPECIAL MACHINES

8

Stepper motors– Repulsion motor - Hysteresis motor - Servo motors - Permanent Magnet Brushless DC motor.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. J.B.Gupta, "Theory and Performance of Electrical Machines", S.K.Kataria & Sons , 15th Edition 2015.
2. B.L.Theraja and A.K.Theraja, "A Textbook of Electrical Technology", S.Chand, 2012.
3. Vincent Del Toro, "Basic Electric Machines" Pearson India Education, 2016.
4. E.G. Janardanan, "Special electrical machines", PHI learning Private Limited, Delhi, 2014.

REFERENCE BOOKS:

1. P.S.Bimbhra, "Electrical Machinery", Khanna Publishers, 7th Edition, Reprint, 2013.
2. B.R. Gupta, "Fundamental of Electric Machines", New age International Publishers, 3rd Edition, Reprint 2015.
3. S.K. Bhattacharya, "Electrical Machines", McGraw - Hill Education, New Delhi, 3rd Edition, 2009.
4. Nagrath, I.J. and Kothari.D.P., "Electric Machines", McGraw-Hill Education, 4th Edition, 2011.
5. Er.R.K.Rajput, "Electrical Machines ", Laxmi Publications, 6th Edition, 2016.
6. R.Srinivasan, "Special Electrical Machines", Lakshmi Publications, 2013.

WEB RESOURCES:

1. <https://www.electricaleasy.com>
2. <https://www.electrical4u.com>

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/108/105/108105131/>
2. <https://nptel.ac.in/courses/108/106/108106072/>
3. <https://www.sciencedirect.com>
4. <https://www.btechguru.com/engineering>

OUTCOMES**Upon completion of the course, the student will be able to:**

1. Apply the concepts of synchronous generators to determine EMF, torque, power, and assess voltage regulation using standard methods. (K3)
2. Apply the working principles of synchronous motors to find torque, study characteristics, understand hunting, starting methods, and their use as a synchronous condenser.(K3)

- Analyze the construction and working of three-phase induction motors to interpret torque equations and assess performance characteristics under various operating conditions. (K4)
- Analyze starting, speed control, and braking methods of three-phase induction motors for varying industrial needs. (K4)
- Examine the behavior of single-phase induction motors using the double-field revolving theory and equivalent circuits. (K4)
- Analyze the construction and operating principles of special machines to distinguish their functionalities. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	2	1	1	-	-	-	-	-	1	1	-	2
C02	2	1	1	1	-	-	-	-	-	-	-	-	2
C03	2	2	2	1	-	-	-	-	-	1	1	-	2
C04	2	1	1	1	-	-	-	-	-	1	2	-	2
C05	2	2	2	1	-	-	-	-	-	1	2	-	2
C06	2	1	2	1	-	-	-	-	-	1	2	-	2

SEMESTER - IV

24EEPC403 108105153 SDG NO. 4, 9, 11	MEASUREMENTS AND INSTRUMENTATION				L	T	P	CP	C
					3	0	0	3	3

OBJECTIVES:

- To introduce the fundamental concepts of measuring systems, their performance parameters and error analysis.
- To familiarize with the construction, working principles, and applications of various electromechanical instruments.
- To perform electrical measurements using DC and AC bridge networks and potentiometers.
- To introduce various types of transducers and their selection criteria for different applications along with display instruments.
- To impart knowledge about the working, advantages and usage of modern digital measurement instruments for practical applications.
- To provide exposure to smart instrumentation.

PRE REQUISITES:

- Basic Circuit Theory

MODULE -I CONCEPTS OF MEASUREMENTS**7**

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

MODULE -II ELECTROMECHANICAL INSTRUMENTS**8**

Operating forces - Essentials of indicating instruments - Deflecting, damping, controlling torques - Moving Coil and Moving Iron Instruments - Single and three phase wattmeters and energy meters - Instrument Transformers.

MODULE - III BRIDGES AND POTENTIOMETERS**8**

D.C potentiometers and its applications - D.C Bridges -Wheat stone, Kelvin and Kelvin Double bridge - A.C bridges -Maxwell, Hay's and Schering bridges - Transformer ratio bridges - Self-balancing bridges.

MODULE -IV TRANSDUCERS AND DISPLAY INSTRUMENTS**8**

Classification of transducers – Selection criteria- Resistive, Capacitive, Inductive, Piezoelectric and Hall effect transducers - CRT - Cathode Ray Oscilloscope (CRO) - Measurement of phase and frequency using Lissajous patterns - LED, LCD Display.

MODULE -V DIGITAL INSTRUMENTATION**7**

Digital voltmeters - Digital multimeters - True RMS meters - auto-ranging meters - Digital energy meters - Digital frequency meter- Digital Storage Oscilloscope (DSO).

MODULE -VI SMART INSTRUMENTATION**7**

Elements of a Data Acquisition System (DAS) - Data loggers - Case study on PC based measurement systems - Smart sensors - Wireless instrumentation.

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. A.K. Sawhney, "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co, 2023.
2. Rajput R.K., "Electrical and Electronic Measurements and Instrumentation", S.Chand and Co., Fourth Edition, 2016.

REFERENCE BOOKS:

1. J. B. Gupta, "A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, 14th Edition 2014, Reprint 2024.
2. Doebelin E.O. and Manik D.N., "Doebelin's Measurement Systems", McGraw Hill Education Pvt. Ltd., Sixth Edition, 2017.
3. D.V.S. Murthy, "Transducers and Instrumentation", Prentice Hall India Learning Private Limited, 2nd Edition 2008
4. H.S. Kalsi, "Electronic Instrumentation and Measurements", McGraw Hill, Fourth Edition 2019.
5. Albert D. Helfrick, William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Pearson, Edition 1, 2016.

WEB RESOURCES:

1. <https://www.electricaleasy.com/2014/06/instrument-transformers-ct-and-pt.html>
2. <https://www.electrical4u.com/watt-hour-meter/>
3. <https://www.eeweb.com/digital-energy-meter/>

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/108105153>
2. https://onlinecourses.nptel.ac.in/noc25_ee82/preview
3. <https://www.electricalandcontrol.com/types-of-sensors-used-in-measurement-and-process-control/>
4. https://onlinecourses.nptel.ac.in/noc23_ee105/preview

OUTCOMES

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

1. Identify the factors affecting the performance of measuring systems like characteristics, standards, calibration and errors. (K3)
2. Apply the principles of electromechanical instruments for electrical measurements. (K3)
3. Utilize DC and AC bridges, potentiometers for electrical parameters estimation. (K3)
4. Apply the principles and selection criteria of various transducers and utilize CRO in measurement applications. (K3)
5. Apply the operating principles of digital instruments for accurate electrical measurements. (K3)

6. Make use of Data Acquisition, Data logger, PC-based measurement systems, smart sensors and wireless instrumentation in measurement applications.(K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	2	2	1	-	-	-	-	-	-	-	1	1
C02	2	2	2	1	-	-	-	-	-	-	-	2	1
C03	2	2	2	1	-	-	-	-	-	-	-	1	1
C04	2	2	2	1	-	-	-	-	-	-	2	1	1
C05	2	2	2	1	-	-	-	-	-	-	2	1	1
C06	2	2	2	1	-	-	-	-	-	-	2	1	1

SEMESTER - IV

24EIPC404 107106081 SDG NO. 4, 9	CONTROL SYSTEMS					L	T	P	CP	C
						3	1	0	4	3

OBJECTIVES:

- To Understand and model various physical systems using mathematical representations.
- To Analyze time-domain and frequency-domain responses of control systems.
- To Apply stability analysis techniques to determine system behavior.
- To Design compensators for feedback systems using frequency domain techniques.
- To Develop state-space representations and analyze system properties using state variable methods.
- To Apply appropriate control strategies to meet system performance requirements.

MODULE - I MATHEMATICAL MODELLING OF SYSTEM 8

Open loop and closed loop systems - Physical system - Linear and Non-Linear systems Transfer function Mathematical modeling of Electrical and Mechanical systems Analogous systems - Block diagram representation - Signal flow graphs and their properties Mason's gain formula.

MODULE - II TIME DOMAIN ANALYSIS 8

Standard test signals-Time response of first order and second order feedback control system to step input-Time domain specifications-Steady state error-Static error constants - Dynamic error coefficients - Introduction to P, PI, PID modes of feedback control.

MODULE - III FREQUENCY DOMAIN ANALYSIS 8

Frequency domain specifications - Correlation between frequency domain and time domain specifications Bode plot - Polar plot - Determination of closed loop response from open loop response.

MODULE - IV STABILITY ANALYSIS 8

Concepts of Stability: Necessary conditions for stability Routh Hurwitz stability criterion - Relative stability analysis. Root locus: Concepts of root - locus construction of root locus Determination of open loop gain for a specified damping of the dominant roots.

MODULE - V DESIGN OF FEEDBACK CONTROL SYSTEM 6

Design specifications: Lead, Lag and Lag-Lead compensators using Bode plot techniques.

MODULE - VI STATE VARIABLE METHODS 7

Concept of state variables – State models for linear and time invariant Systems – Solution of state and output equation in controllable canonical form – Concepts of controllability and observability – Effect of state feedback

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Benjamin C. Ku and Farid Golnaraghi, "Automatic Control Systems", 10th edition McGraw-Hill Education, 2017.
2. Nagarath, I.J. and Gopal, M., "Control Systems Engineering", 7th edition New Age International Publishers, 2017.

REFERENCES:

1. M.Gopal, "Control System-Principles and Design", Tata McGraw Hill, 4th Edition, 2012.
2. Richard C.Dorf and Bishop, R.H., "Modern Control Systems", Pearson Education, 13th impression 2017
3. John J.D., Azzo Constantine, H. and Houpis Stuart, N Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor & Francis Reprint, 2014
4. Katsuhiko Ogata, "Modern Control Engineering", PHI Learning Private Ltd, PEARSON 5th edition 2015.
5. NPTEL Video Lecture Notes on "Control Engineering" by Prof. S. D. Agashe, IIT Bombay.

WEB REFERENCES:

1. <https://nptel.ac.in/courses/108106098/>
2. <https://nptel.ac.in/courses/108101037/>

ONLINE RESOURCES:

1. <https://lecturenotes.in/notes/15854-note-for-control-system-engineering-cse-by-amity-kumar>
2. <https://lecturenotes.in/notes/23763-note-for-control-system-engineering-cse-by-suman-kumar-acharya>

OUTCOMES**Upon completion of the course, the student will be able to:**

1. Apply mathematical modelling techniques to represent Physical, mechanical and electrical Systems. (K3)
2. Analyse time- domain response of control Systems and determine time-domain Specification and Compute steady-state and dynamic errors using error constants and apply PID control actions (K3)
3. Analyze control systems in the frequency domain using Bode and polar plots and relate them to time-domain behavior. (K3)
4. Apply Routh-Hurwitz and Root Locus methods for system stability and gain margin evaluation. (K3)
5. Design Lead, Lag, and Lag-Lead compensators to meet given performance criteria (K3)
6. Formulate state-space models of control systems and evaluate controllability and observability (K3)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	2	-	-	-	-	-	-	-	-	-	3	2
C02	3	3	-	2	-	-	-	-	-	-	-	3	2
C03	3	3	2	2	-	-	-	-	-	-	-	3	2
C04	3	3	2	2	2	-	-	-	-	-	-	2	3
C05	3	3	2	3	2	-	-	-	-	-	-	2	3
C06	3	3	3	3	3	-	-	-	-	-	-	2	3

SEMESTER - IV

24HSNC401 - SDG NO. 4	NCC COURSE LEVEL 3					L	T	P	CP	C
						3	0	0	3	0

ARMY WING**PERSONALITY DEVELOPMENT 9**

PD 3 Group Discussion: Team Work 2

PD 4 Career Counselling, SSB Procedure & Interview Skills 3

PD 5 Public Speaking 4

BORDER & COASTAL AREAS 4

BCA 2 Security Setup and Border/Coastal management in the area 2

BCA 3 Security Challenges & Role of cadets in Border management 2

ARMED FORCES 3

AF 2 Modes of Entry to Army, CAPF, Police 3

COMMUNICATION 3

C 1 Introduction to Communication & Latest Trends 3

INFANTRY 3

INF 1 Organisation of Infantry Battalion & its weapons 3

MILITARY HISTORY 23

MH 1 Biographies of Renowned Generals 4

MH 2 War Heroes - PVC Awardees 4

MH 3	Study of Battles - Indo Pak War 1965, 1971 & Kargil	9
MH 4	War Movies	6

TOTAL: 45 PERIODS

NAVAL WING

PERSONALITY DEVELOPMENT 9

PD 3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5	Public Speaking	3

LEADERSHIP 7

L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
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DISASTER MANAGEMENT 13

DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1

ENVIRONMENTAL AWARENESS & CONSERVATION 3

EA 1	Environmental Awareness and Conservation	3
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GENERAL AWARENESS 4

GA 1	General Knowledge	4
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NAVAL ORIENTATION 6

AF 1	Armed Forces and Navy Capsule	3
EEZ 1	EEZ Maritime Security and ICG	3

ADVENTURE 1

AD 1	Introduction to Adventure Activities	1
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BORDER & COASTAL AREAS 2

BCA 1	History, Geography & Topography of Border/Coastal areas	2
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TOTAL: 45 PERIODS

AIR FORCE WING**PERSONALITY DEVELOPMENT 9**

PD 3	Group Discussion: Team Work	2
PD 4	Career Counselling, SSB Procedure & Interview Skills	3
PD 5	Public Speaking	4

BORDER & COASTAL AREAS 4

BCA 2	Security Setup and Border/Coastal management in the area	2
BCA 3	Security Challenges & Role of cadets in Border management	2

AIRMANSHIP 1

A 1	Airmanship	1
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BASIC FLIGHT INSTRUMENTS 3

FI 1	Basic Flight Instruments	3
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AERO MODELLING 3

AM 1	Aero Modelling Capsule	3
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GENERAL SERVICE KNOWLEDGE 2

GSK 4	Latest Trends & Acquisitions	2
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AIR CAMPAIGNS 6

AC 1	Air Campaigns	6
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PRINCIPLES OF FLIGHT 6

PF 1	Principles of Flight	3
PF 2	Forces acting on Aircraft	3

NAVIGATION 5

NM 1	Navigation	2
NM 2	Introduction to Met and Atmosphere	3

TOTAL :45 PERIODS

SEMESTER - IV

24EEPL401 - SDG NO. 4,8,9	CONTROL AND INSTRUMENTATION LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To understand the fundamentals of control systems and instrumentation principles.
- To model and analyse the behavior of control system with controllers and compensators.
- To develop skills on design and analyse stability of control system using simulation software.
- To understand and implement Analog-to-Digital (ADC) and Digital-to-Analog (DAC) converters for signal interfacing in control and instrumentation systems
- To gain practical knowledge in using transducers and signal conditioning circuits.
- To provide knowledge on instrumentation systems to form various types of bridges

LIST OF EXPERIMENTS:**CONTROL SYSTEM**

1. P,PI,PID Controllers
2. Stability Analysis- Simulation by Mathematical Development Tools -Bode Plot,Root Locus
3. Modelling of Systems- Machines
4. Design of Lag, Lead, Lag-Lead Compensators
5. Position Control System
6. Synchro Transmitter -Receiver and Characteristics

INSTRUMENTATION

7. Bridge Networks-AC Bridges- De-Sauty Bridge, Maxwell Bridge
DC Bridges- Wheatstone Bridge, Kelvin Bridge
8. Dynamics of Sensors / Transducers
a. Temperature b. Displacement c. Strain d. Flow
9. Power and Energy Measurement
10. Signal Conditioning
a. Instrumentation Amplifier b. Analog-Digital Converter
c. Digital-Analog Converter

TOTAL : 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:**CONTROL SYSTEM**

- | | |
|--|----------|
| 1. PID Controller simulation and learner kit | - 1 No |
| 2. Digital Storage Oscilloscope | - 1 Nos |
| 3. DC-Motor Generator setup | -1 No |
| 4. CRO 30 MHZ | - 2 Nos. |
| 5. DC Position control System Kit | - 1 No |
| 6. AC Synchro Transmitter & Receiver | - 1 No |
| 7. Digital multimeters | - 5 Nos |
| 8. Personal computers with control system simulation package | - 10 Nos |
| 9. Lag-Lead Compensator | - 1 No |
| 10. Voltmeter, Ammeter, Rheostat | - 5 No. |

MEASUREMENTS

- | | |
|---|----------|
| 1. R,L,C Bridge kit | -4 Nos |
| 2. Electric heater | - 2 Nos |
| 3. Thermistor, RTD Kit | - 1 No. |
| 4. LVDT 20mm core length movable type | - 1 No. |
| 5. Optical sensor | - 1 No. |
| 6. Strain Gauge Kit with Handy lever beam | - 1 No. |
| 7. 100gm weights | - 10 Nos |
| 8. Flow measurement Trainer kit | -1 No |
| 9. Energy meter | - 1 No |
| 10. Instrumentation Amplifier kit | - 1 No |
| 11. Analog - Digital converters | -1 No |

OUTCOMES

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

- Understand and Apply control theory principles to analyze and solve electrical engineering problems involving converters and compensators. (K3)
- Measure physical parameters using sensors and transducers effectively. (K3)
- Analyze the performance of first and second-order systems using time and frequency response. (K4)
- Experiment various controllers (P, PI, PID) and evaluate their performance using simulation Tool. (K3)
- Apply appropriate techniques to analyze the stability of control systems and verify the functionality of bridge networks. (K3)

6. Apply methods to analyze and design signal conditioning circuits for various electrical applications.(K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	2	2	2	-	-	-	-	-	-	1	-	2
C02	3	2	2	2	-	-	-	-	-	-	-	2	2
C03	3	3	2	3	3	-	-	-	-	-	1	-	2
C04	3	3	2	3	3	-	-	-	-	-	-	-	2
C05	3	3	2	3	3	-	-	-	-	-	-	-	2
C06	3	3	2	3	-	-	-	-	-	-	-	2	2

SEMESTER - IV

24EEPL402 - SDG NO. 4, 7, 11	ELECTRICAL MACHINES LABORATORY					L	T	P	CP	C
						0	0	4	4	2

OBJECTIVES:

- To obtain the performance characteristics of DC motor
- To obtain the characteristics of DC generators
- To determine the performance of static machine
- To determine the regulation of synchronous generator
- To obtain the characteristics of a synchronous and induction motor.
- To find the equivalent circuit parameters of three-phase induction motor

LIST OF EXPERIMENTS:

1. Open circuit and load characteristics of DC shunt generator - critical resistance and critical speed
2. Load characteristics of DC compound generators with differential and cumulative connections
3. Load test on DC shunt motor
4. Hopkinson's test on DC motor – generator set
5. Load test on single phase transformer
6. Sumpner's test on single phase transformers.
7. Regulation of three phase alternators by EMF and MMF methods.

8. Regulation of three phase alternator by ZPF and ASA methods
9. V and Inverted V curves of Three Phase Synchronous Motor.
10. Load test on three-phase induction motor.
11. No load and blocked rotor tests on three-phase induction motor
(Determination of equivalent circuit parameters).

TOTAL : 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

1. DC Shunt Motor with Loading Arrangement – 3nos
2. Single Phase Transformer – 4nos
3. DC Series Motor with Loading Arrangement – 1 No.
4. DC compound Motor with Loading Arrangement – 1 No.
5. DC Shunt Motor Coupled With DC Compound Generator – 2nos
6. DC Shunt Motor Coupled With DC Shunt Generator – 2nos
7. Tachometer -Digital/Analog – 8nos
8. Single Phase Auto Transformer – 4 nos
9. Single Phase Resistive Loading Bank – 2nos
10. DC Shunt Motor Coupled With Three phase Alternator – 4nos
11. Three Phase Induction Motor with Loading Arrangement – 2nos
12. Single Phase Induction Motor with Loading Arrangement – 2nos
13. Three Phase Auto Transformer – 3nos
14. Three Phase Resistive Loading Bank – 2nos

OUTCOMES

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

1. Analyze the performance of DC Motor by conducting direct and indirect tests. (K4)
2. Categorize the performance of DC Generator by conducting direct and indirect tests(K4)
3. Examine the performance of transformers by conducting direct and indirect tests. (K4)
4. Inspect the regulation of synchronous generator (K4)
5. Distinguish the performance characteristics of synchronous and induction motor (K4)
6. Simplify the equivalent circuit parameters of induction motor (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	2	2	2	1	-	-	-	1	-	-	-	2
C02	2	1	2	2	1	-	-	-	1	-	-	-	2
C03	2	1	1	2	-	-	-	-	1	-	-	-	2
C04	2	1	1	1	-	-	-	-	-	-	-	-	1
C05	2	1	1	2	-	-	-	-	-	-	-	-	1
C06	1	1	1	1	-	-	-	-	-	-	-	-	1

SEMESTER - IV

24EETP401 - SDG NO. 4	APTITUDE SKILLS					L	T	P	CP	C
						0	0	2	2	0

PROBLEM SOLVING TECHNIQUES USING C PROGRAMMING – PHASE 1**OBJECTIVES:**

- Build a strong foundation in C programming concepts and problem-solving techniques.
- Develop the ability to write efficient and modular code.
- Enhance understanding of data structures, memory management, and algorithms for optimized solutions.

MODULE - I FOUNDATIONS OF PROGRAMMING**12**

- Understanding Programming Languages: Why they are essential and their various types.
- Operators in C: Exploring assignment, arithmetic, relational, and logical operators.
- Tokens and Identifiers: Learning about keywords, naming conventions, and best practices.
- Control Structures in C: Choosing the right structure for efficient programming:
 - Selective Control (Decision-making statements)
 - Iterative Control (Loops for repetition)
 - Unconditional Control (Jump statements)

MODULE - II DATA TYPES, NUMBER SYSTEMS AND FUNCTIONS 12

- **Operators in Depth:** Understanding increment, decrement, and short-circuit operators.
- **Number Systems & Conversions:** Mastering different number systems, conversions, and format specifiers.
- **Data Types in C:** Exploring signed and unsigned types (int, float, char) and their usage.
- **Functions in C:**
- Importance of modular programming.
- Writing and using functions effectively.

MODULE - III POINTERS, ARRAYS, AND PROBLEM-SOLVING 21

- **Pointers in C:**
- Understanding memory management.
- How pointers enable direct hardware communication.
- **Arrays in C:**
- Efficiently storing multiple elements.
- Single-dimensional and multi-dimensional arrays.
- **Problem-Solving Techniques:**
- Tackling challenges related to arrays and strings.
- Optimizing algorithms for efficiency.

TOTAL: 45 PERIODS**REFERENCES:**

1. Let Us C – Yashavant Kanetkar - 16th Edition: 2017.
2. Programming in ANSI C – E. Balagurusamy-9th Edition: July 11, 2024.
3. The C Programming Language – Brian W. Kernighan and Dennis M. Ritchie - Second Edition (ANSI C): April 1988.
4. C: How to Program – Paul Deitel and Harvey Deitel - 9th Edition: March 27, 2024
5. Problem Solving and Program Design in C – Jeri R. Hanly and Elliot B. Koffman - 8th Edition exists with ISBN 978-0-13-401490-0

PHASE 2**(LIFE SKILLS, RANGER AND ROVER & BIS STANDARDS)****OBJECTIVES:**

- Explore core domain BIS standards related to Insulators, Cables and Power Capacitors.
- Implement strategies to learn career and managerial skills for career growth.

MODULE - I JEEVAN KAUSHAL 2.0 – CAREER SKILLS AND MANAGERIAL SKILLS

14

Group Discussion Skills - Meaning and Methods of Group Discussion - Procedure of Group Discussion - Group Discussion - Simulation - Group Discussion - Common Errors.

Managerial Skills - Basic Managerial Skills - Planning for effective management - How to organize teams? - Recruiting and retaining talent - Delegation of tasks - Learn to coordinate - Conflict management - Self- management Skills - Understanding self-concept - Developing self- awareness - Self-examination - Self-reflection and Introspection - Self-regulation.

Entrepreneurial Skills - Basics of Entrepreneurship - Meaning of entrepreneurship - Classification and types of entrepreneurship - Traits and competencies of entrepreneur -. Creating Business Plan - Problem identification and idea generation - Idea validation - Pitch making.

Managing Personal Finance - Budgeting - Setting personal goals - Estimate likely expenses Monitor spending to obtain the most value for the available funds - Saving and Investing - Advantages of saving money - Concept of present and future value of money.

MODULE - II RANGER AND ROVER

10

Scouting for Boys: Scout Craft, Campaigning.

Knots: Managing of rope, types of ropes and uses, Basic Knots: - Clove Hitch, Reef Knot, Fisherman knot, Sheet bend, Bowline, Sheep shank, whippings.

Growing Together: Understanding the growth context.

Intergenerational Dialogue: How to enhance learning and cooperation across generations.

MODULE - III INDIAN STANDARDS ON INSULATORS, CABLE AND POWER CAPACITORS

6

Insulators: Design characteristic of Overhead Insulators and overview of faults in transmission system. **Cables:** Introduction to selection, design and testing of Cables in distribution and transmission system. **Power Capacitors:** Working principle, Classification of Power Capacitors, Test methods, Indian Standards available on various types of Power Capacitors.

TOTAL: 30 PERIODS

REFERENCES:

1. Curriculum and Guidelines for Life Skills (Jeevan Kaushal) 2.0, UGC, New Delhi.
2. A World Built on Standards: A Textbook for Higher Education, Published by: Danish Standards Foundation, 2015.
3. SO / IEC Guide 59, BIS Standards Formulation Manual, 2nd Revision, 2022.

ONLINE RESOURCES

1. https://lms.scout.org/courses/show/214175?force_course_hub=true
2. https://lms.scout.org/courses/show/214194?force_course_hub=true
3. https://www.ugc.gov.in/pdfnews/4874522_Draft-Curriculum-for-Life-Skill-Jeevan-Kaushal.pdf (ugc.gov.in)

OUTCOMES

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

1. Make use of fundamentals of C programming for problem-solving. (K3)
2. Apply control structures, operators, and functions to write modular programs. (K3)
3. Apply pointers and arrays for efficient memory and data management. (K3)
4. Solve real-world problems by designing and optimizing algorithms. (K3)
5. Demonstrate career and managerial skills. (K2)
6. Summarize BIS standards for various electrical components. (K2)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	2	2	2	2	-	-	-	-	-	-	2	2	-
C02	2	2	2	2	1	-	-	-	1	-	2	2	-
C03	2	2	2	2	-	-	-	-	1	-	2	2	-
C04	2	2	2	2	1	-	-	-	1	-	2	2	-
C05	-	-	-	-	-	3	-	-	1	-	2	-	2
C06	2	-	2	2	2	2	-	-	-	-	2	2	2

SEMESTER - IV

24EEID401 - SDG NO. 4,11,15	INNOVATIVE DESIGN LAB - II	L	T	P	CP	C
		0	0	2	2	1

OBJECTIVES:

- To empower students to transform innovative ideas into viable venture blueprints through structured entrepreneurial exploration and opportunity framing.
- To provide experiential learning in adaptive product evolution by focusing on user-centric redesign, iterative testing, and technical refinement.
- To develop proficiency in assessing market traction, decoding customer behavior, and aligning product strategy with investment-readiness metrics.
- To instill a foundation of ethical entrepreneurship by integrating inclusive design principles, sustainability values, and responsible leadership.
- To enable data-driven innovation by leveraging field research, applying performance analytics, and integrating emerging technologies for solution optimization.
- To facilitate multidisciplinary problem-solving through advanced engineering integration, MVP systemization, and standards-compliant validation.

COURSE METHODOLOGY:

1. This initiative is designed to inculcate ethical principles of research and to get involved in a life-long learning process for the students, focusing on the practical execution and refinement of entrepreneurial ventures.
2. The project work must involve the continuous development, iterative enhancement, and potential launch of an entrepreneurial solution. It must also include appropriate elements of the following: compliance with advanced engineering standards, iterative design analysis, enhanced prototyping, robust experimentation, real-world user feedback collection, data correlation, and advanced software/hardware development for the solution.
3. Projects can be individual work or group projects, with a maximum of Three students. In case of a group project, each student must submit an individual project report clearly specifying their unique contributions to the collective work.

- On completion of the project, the student shall submit a detailed project report encompassing the evolution of their venture, technical implementation, market validation, and future roadmap. The project shall undergo a formal review process, after which the report will be evaluated. Students shall appear for a mandatory viva-voce examination on the project, approved jointly by the Coordinator and the respective project guide.

EVALUATION:

- First evaluation (Immediately after first internal examination): 20 marks (Focus on refined problem statement, advanced MVP design, and detailed development plan)
- Second evaluation (Immediately after second internal examination): 30 marks (Focus on prototype/MVP implementation, initial testing, and preliminary market validation results)
- Final evaluation (Last week of the semester): 50 marks (Focus on the complete refined solution, comprehensive market validation, growth strategy, final project report, and viva-voce)

Note: All three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Apply structured entrepreneurial exploration to convert innovative ideas into venture blueprints, incorporating user-centric and iterative design approaches. (K4)
- Assess customer behavior and market traction to align product strategies with ethical and sustainable entrepreneurship principles. (K5)
- Integrate multidisciplinary knowledge, field data, and emerging technologies to optimize and validate engineered solutions. (K6)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	3	2	-	-	-	-	2	-	-	-	2	2
C02	3	3	2	-	-	-	-	2	-	-	-	2	2
C03	3	3	2	-	-	-	-	2	-	-	-	2	2

Imagine the Future and Make it happen!



Together let's build a better world where there is **NO POVERTY** and **ZERO HUNGER**.

We have **GOOD HEALTH AND WELL BEING**, **QUALITY EDUCATION** and full **GENDER EQUALITY** everywhere.

There is **CLEAN WATER AND SANITATION** for everyone. **AFFORDABLE AND CLEAN ENERGY** which will help to create **DECENT WORK AND ECONOMIC GROWTH**. Our prosperity shall be fuelled

by investments in **INDUSTRY, INNOVATION AND INFRASTRUCTURE** that will help us to **REDUCE INEQUALITIES** by all means. We will live in **SUSTAINABLE CITIES AND COMMUNITIES**.

RESPONSIBLE CONSUMPTION AND PRODUCTION will help in healing our planet.

CLIMATE ACTION will reduce global warming and we will have abundant, flourishing **LIFE BELOW WATER**, rich and diverse **LIFE ON LAND**.

We will enjoy **PEACE AND JUSTICE** through **STRONG INSTITUTIONS** and will build long term **PARTNERSHIPS FOR THE GOALS**.



For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and **People like you.**

Together we can...

Sai Prakash Leo Mathru

Chairman & CEO - Sairam Institutions

We build a Better nation
through Quality education.



Sri

SAI RAM ENGINEERING COLLEGE

An Autonomous Institution

Affiliated to Anna University & Approved by AICTE, New Delhi

Accredited by **NBA** and **NAAC "A+"**
ISO 21001 : 2018 (EOMS) Certified by BIS
and **NIRF** ranked institution

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