Sri
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
MECHANICAL & AUTOMATION ENGINEERING

AUTONOMOUS
CURRICULUM AND
SYLLABUS
I - IV
SEMESTERS

REGULATIONS 2024
Academic Year 2024-25 onwards

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 MECHANICAL & AUTOMATION ENGINEERING

VISION

To develop a daedal mechanical and automation department to cater the ever evolving needs of automation of core engineering based on fundamental and extensive research.

MISSION

M1 – Prepare the mechanical and automation engineering graduates, for a successful career in engineering and technology through effective teaching-learning.

M2 – Amalgamate core engineering branches with recent trends of automation in vogue for a successful career in the dynamic industrial scenario.

M3 – Promote excellence in engineering and technology by motivating the students for higher studies.

M4 – Empower the learners by importing education that is compatible with the technological needs of the industry and thereby ensuring to contribute to the society.

M5 – Accentuate professionally competent engineers by developing analytical and research abilities, encouraging the culture of continuous learning by adopting new technologies.

AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2024

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	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	1	0	1	2	1
2	24ESID101	Idea Engineering Lab -I	0	0	2	2	1
ONLINE SUPPLEMENTARY							
		As recommended by BoS					
				Total		30	25

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24BSMA203	Differential Equations and its Applications	3	1	0	4	4
2	24HSEN201	Professional English	2	0	0	2	2
3	24BSPH202	Physics of Materials	3	0	0	3	3
4	24BSCY201	Chemistry for Environment and Sustainability	3	0	0	3	3
5	24ESCE201	Engineering Mechanics	3	0	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	24ESID201	Idea Engineering Lab - II	0	0	2	2	1
2	24ENTP201	Digital Dynamics	0	0	2	2	0
ONLINE SUPPLEMENTARY							
1	24ESMC201	MS Office (Mandatory - NC)	0	0	0	0	0
				Total		24	19

*only for NCC cadets, to be conducted beyond working hours

Recommended by
Board of Studies of MU dept.
Meeting No. 6 Dated: 1/6/24

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SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24BSMA304	Transforms and Numerical Methods	3	1	0	4	4
2	24MUPW301	Basic Manufacturing Processes with Laboratory	3	0	2	5	4
3	24ESEI302	Basic Electronics and Control System	3	0	0	3	3
4	24MUPC301	Thermodynamics and Fluid Mechanics	3	0	0	3	3
5	24MUPW302	Sensor in Automation with Laboratory	3	0	2	5	4
6	24HSMC301	Universal Human Values - II	3	0	0	3	3
7	24HSNC301	NCC course Level 2*	3*	0	0	3*	0
PRACTICALS							
1	24MUPL301	Computer Aided Drafting Laboratory	0	0	4	4	2
VALUE ADDITIONS - III							
1	24MUTP301	Aptitude skills	0	0	2	2	1
2	24MUID301	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		33	25

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24MUPC401	Fluid Power Automation	3	0	0	3	3
2	24MUPC402	Theory of Machines	3	0	0	3	3
3	24MUPC403	Robots and Systems in Smart Manufacturing	3	0	0	3	3
4	24MUPW401	CNC and Metrology with Laboratory	3	0	2	5	4
5	24CEPC405	Strength of Materials	3	0	0	0	3
6	24MGOExxx	Open Elective - 1**	3	0	0	3	3
7	24HSNC401	NCC course Level 3*	3	0	0	3*	0
PRACTICALS							
1	24MUPL401	SoM and Fluid power systems Laboratory	0	0	4	4	2
2	24MUPT401	Additive Manufacturing Laboratory with Theory	1	0	4	5	3
VALUE ADDITIONS - IV							
1	24MUTP401	Aptitude skills	0	0	2	2	0
2	24MUID401	Innovative Design Lab - II	0	0	2	2	1
ONLINE SUPPLEMENTARY							
		As recommended by BoS					
				Total		33	25

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SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24MUPC501	Machine Design	3	0	0	3	3
2	24ESPW501	Electrical Drives and Actuators with Laboratory	3	0	2	5	4
3	24MUEL5xx	Professional Elective - I	3	0	0	3	3
4	24MUEL5yy	Professional Elective - II	3	0	0	3	3
5	24XXOEXXX	Open Elective - II*	3	0	0	3	3
6	24MGMC501	Constitution of India	2	0	0	2	0
		PRACTICALS					
1	24MUPL501	Design and Simulation Lab	0	0	4	4	2
		VALUE ADDITIONS - V					
1	24MUTP501	Skill Enhancement	0	0	2	2	1
2	24MUID501	Prototype Development Lab - I	0	0	2	2	1
		ONLINE SUPPLEMENTARY					
		As recommended by BoS		**Total**		**27**	**20**

* Department Specific Cyber Security Course

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS L	T	P	CONTACT PERIODS	CREDITS
		THEORY					
1	24MUPC601	Mechanics and Control of Robotic Manipulators	3	0	0	3	3
2	24MUEL6xx	Professional Elective - III	3	0	0	3	3
3	24MUEL6yy	Professional Elective - IV	3	0	0	3	3
4	24MUEL6zz	Professional Elective - V	3	0	0	3	3
5	24HSMG501	Principles of Engineering Management	3	0	0	3	3
6	24xxOExxx	Open Elective - III	3	0	0	3	3
		PRACTICALS					
1	24MUPL601	Robotics Laboratory	0	0	4	4	2
		VALUE ADDITIONS - VI					
1	24MUTP601	Technical Skill	0	0	2	2	0
2	24MUID601	Prototype Development Lab - II	0	0	2	2	1
		ONLINE SUPPLEMENTARY					
		As recommended by BoS					
				Total		**26**	**21**

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SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24MUPC701	Mechatronics System Design	3	0	0	3	3
2	24ESEI701	PLC and Microcontroller	3	0	0	3	3
3	24MUEL7xx	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	24MUPL701	Automation Lab	0	0	4	4	2
2	24MUPJ701	Project work - Phase I	0	0	8	8	4
VALUE ADDITIONS - VII							
1	24MUTP701	Company Specific Skills	0	0	2	2	1
ONLINE SUPPLEMENTARY							
		As recommended by BoS					
				Total		28	21

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			CONTACT PERIODS	CREDITS
			L	T	P		
THEORY							
1	24MUEL8xx	Professional Elective – VII	3	0	0	3	3
PRACTICALS							
1	24MUPJ801	Project Work - Phase II	0	0	12	12	6
VALUE ADDITIONS - VIII							
1	24MUIN801	Internship	0	0	9	9	3
				Total		21	12

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INDUSTRY CONNECTED PROFESSIONAL ELECTIVES
Delphi TVS

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24MEIE501	Advanced Fuel Injection System - I	3	Energy Engineering
2	24MEIE601	Advanced Fuel Injection System - II	3	Energy Engineering

INDUSTRY CONNECTED PROFESSIONAL ELECTIVES
L&T

S. NO	COURSE CODE	COURSE TITLE	CREDIT	DOMAIN
1	24MEIE502	Design of Fire and Life Safety Systems	3	Building Utility Service
2	24MEIE503	Building Information Modelling in Construction	3	Inter-disciplinary
3	24MEIE504	Safety for Engineers	3	Inter-disciplinary
4	24MEIE505	Utility Systems for Industrial Facilities	3	Process Plant Engineering
5	24MEIE506	Ambience Control System Design	3	Building Utility Service
6	24MEIE507	Mechanical Service Engineering	3	Building Utility Service
7	24MEIE508	Engineering Strategies for Sustainability	3	Inter-disciplinary
8	24MEIE509	Power Plant Engineering - An Industrial Context	3	Power Plant Engineering
9	24MEIE601	Industrial Piping & Pipeline Engineering	3	Mechanical & Chemical Engineering
10	24MEIE602	Integrated Approach to Building Services	3	Building Utility Service
11	24MEIE603	Industrial Valves – Application, Manufacturing & Special Testing	3	Manufacturing Engineering
12	24MEIE604	Heavy Manufacturing and Elements of digitalization	3	Digital Manufacturing
13	24MEIE605	Robotics and Digitalization in Manufacturing	3	Digital Manufacturing
14	24MEIE606	Digital Technologies with CPS, IIOT & Cloud in Manufacturing	3	Digital Manufacturing
15	24MEIE607	Design & Simulation of Process Plant Equipment	3	Process Plant Engineering
16	24MEIE608	Technology and Processes in Heavy Manufacturing	3	Manufacturing Engineering
17	24MEIE609	Heat Exchanger: Design & Applications	3	Process Plant Engineering
18	24MEIE701	Collaborative Robotics in Manufacturing with AI, ML & IIOT	3	Digital Manufacturing
19	24MEIE702	Steam Generator & Auxiliary Systems	3	Power Plant Engineering
20	24MEIE703	Steam Turbine & Auxiliary Systems	3	Power Plant Engineering
21	24MEIE704	Project Management for Professionals	3	Inter-disciplinary

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Graduates will have sound technical acumen and leadership to become competent engineers leading to a successful career.

PEO 2: Graduates will pursue lifelong learning in generating innovative engineering solutions using fundamentals in basic science and complex problem-solving skills.

PEO 3: Graduates will strengthen entrepreneurial quality and self-employment in the program adopted..

PEO 4: Graduates will inculcate ethical responsibilities and render service towards peers, society and the nation without compromise.

PEO 5: Graduates will demonstrate commitment towards sustainable development for the betterment of the society ensuring ethical and moral values.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Capable of exhibiting the knowledge and skills in understanding the basic concepts of the Mechanical and Automation Engineering and improving the performance of manufacturing and production systems by implementing the latest technological advancements and excel as entrepreneurs.

PSO 2: Posses sound fundamentals of basic sciences so as to apply them for engineering problem analysis and research in multiple related spheres, showing passion for higher education and research in the chosen field.

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)	15	28	26
Engineering Sciences (ES)	9	18	15
Humanities and Social Sciences (HS)	8	13	13
Professional Electives (EL)	14	23	23
Program Core + Program Lab (PC+PL)	27	57	45
Program theory with Lab (PW) / Program Lab With Theory (PT)	7	15	11
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)	0	4	0
Total	100	225	168

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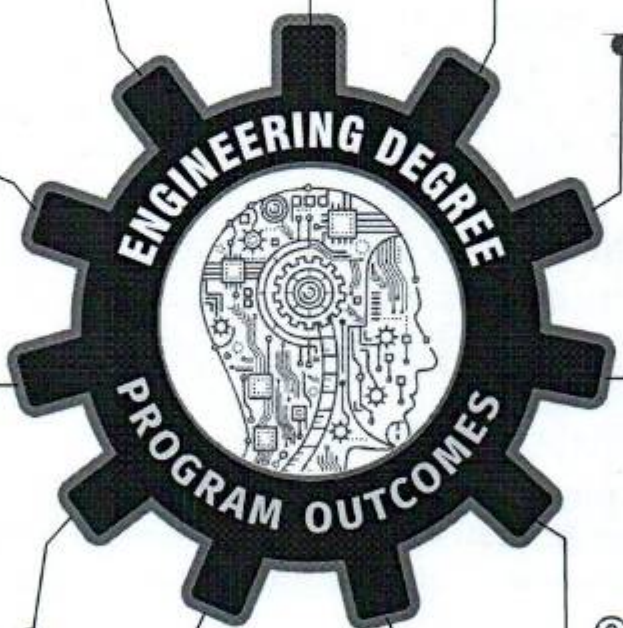
PROGRAMME OUTCOMES(POs)

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



01 Engineering knowledge
Apply math, science, computing, and engineering knowledge to solve complex engineering problems.

02 Problem Analysis
Identify and analyze complex problems using research to draw valid conclusions.

03 Design / Development of solutions
Design practical and innovative solutions considering safety, cost, culture, and the environment.

04 Investigate complex problems
Use research methods—experiments, modeling, and data analysis—to investigate complex problems.

05 Engineering Tool Usage
Apply modern engineering and IT tools for analysis and problem solving with awareness of their limits.

06 The Engineer and the World
Assess societal, environmental, legal, health, and cultural impacts of engineering solutions.

07 Ethics
Follow professional ethics, human values, diversity, inclusion, and legal responsibilities.

08 Individual & Teamwork
Work effectively as an individual and as a team member or leader in multidisciplinary groups.

09 Communication
Communicate clearly in writing and presentations for diverse technical and non-technical audiences.

10 Project Management and Finance
Apply management and financial principles to plan and execute projects effectively.

11 Life-long learning
Engage in independent lifelong learning and adapt to new technologies with critical thinking.

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SEMESTER - I

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

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MODULE - VI FOURIER SERIES **12**

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, 9th Edition, 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

COURSE OUTCOMES:

Upon completion of the course, the student should 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)

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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
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-
CO6	3	2	2	-	-	-	-	-	-	-	-

SEMESTER - I

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

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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

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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://wwPearson.com/english/catalogue/business-english/technical-english.html
2. https://ww.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)

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CO-PO, PSO Mapping:

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

SEMESTER - I

24BSPH101 - SDG NO. 4,7,9,11	ENGINEERING PHYSICS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To understand the basic concepts of mechanics and its use in engineering applications.
- To understand the concept of waves and lasers and its applications.
- To illustrate the various laws of electromagnetic waves and its applications.
- To apply the concepts of quantum mechanics to engineering studies.
- To understand the basics of crystal for engineering applications.
- To identify the basic principles involved in thermal physics and its 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, CO_2 laser – Basic applications of lasers in industry.

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Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

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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.

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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 Wiely & Sons. 8th Edition, 2005.

OUTCOMES:

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

1. Apply the concepts of stress, torsion, and bending to study the mechanical behavior of structural elements using theoretical and experimental methods. (K3)
2. Analyze wave phenomena and interference to study energy transfer, and evaluate laser principles with their industrial applications. (K4)
3. Examine Maxwell's equations and electromagnetic wave theory to analyze wave propagation, polarization and reflection-transmission phenomena in different media (K4)
4. Utilize the principles of quantum mechanics to explain black body radiation, matter waves, particle confinement in potential wells and tunneling phenomena. (K3)
5. Examine and compare the characteristics of various crystal structures, polymorphic forms, and crystal growth techniques. (K4)
6. Apply the principles of heat transfer to determine the thermal conductivity and explain the role of heat exchangers in refrigerators and solar water heaters. (K3)

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CO-PO, PSO Mapping:

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

SEMESTER - I

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

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.

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/08/2024

Recommended by Board of Studies of Department of Humanities & Sciences

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, Nerns't 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 Photo-sensitization.

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).

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MODULE - VI NANOCHEMISTRY 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.
8. Chemical and Electrochemical Energy Systems, R. Narayanan, B. Viswanathan, University Press India Limited.

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)

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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
CO1	3	2	3	-	-	2	-	-	-	-	-
CO2	3	3	3	-	-	2	-	-	-	-	-
CO3	3	2	3	-	2	-	-	-	-	-	-
CO4	3	2	3	-	-	1	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-
CO6	2	1	2	-	-	-	-	-	-	-	-

SEMESTER - I

24ESCS101 106105171 SDG NO. 4 & 9	PROBLEM SOLVING AND PROGRAMMING IN C	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- Interpret Mathematical problems using algorithms, flowchart and pseudocode.
- To understand 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.

Recommended by Board of Studies of ____ dept. Meeting No. 6 Dated: 31/05/2024

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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

Recommended by
Board of Studies of CSE dept.
Meeting No. 7 Dated: 30/5/24

CHAIRMAN
Board of Studies
Department of Computer Science and Engineering
Sri Sairam Engineering College

OUTCOMES:

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

1. Solve basic problems using algorithms, flowcharts, and pseudo code.(K3)
2. Analyze the various programming constructs for basic computational problems.(K4)
3. Implement simple C programs using arrays and strings. (K3)
4. Use functions, recursion, and pointers to perform calculations, searching, and sorting.(K3)
5. Apply structures and dynamic memory allocation in handling complex programming tasks. (K3)
6. Organize sequential and random file processing techniques to provide solutions for real-world computational problems. (K4)

CO-PO, PSO MAPPING:

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

SEMESTER - I

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

Recommended by
Board of Studies of MECH dept.
Meeting No. 8 Dated: 1/6/24

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Board of Studies
Mechanical Engineering

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	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	2	-	-	-	3
CO2	3	-	-	-	-	-	-	-	2	-	-	-	3
CO3	3	-	-	-	-	-	-	-	2	-	-	-	3
CO4	3	-	-	-	-	-	-	-	3	-	-	-	3
CO5	3	-	-	-	-	-	-	-	2	-	-	-	3
CO6	3	-	-	-	-	-	-	-	3	-	-	-	3

Recommended by
Board of Studies of MECH dept.
Meeting No. 8 Dated: 11/6/19

Board of Engineering
Mechanical Engineering

SEMESTER - I

24HSTA101 - SDG NO. 4	HERITAGE OF TAMILS	L	T	P	CP	C
		1	0	0	1	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, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT - III FOLK AND MARTIAL ARTS 3

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

UNIT - IV THINAI CONCEPT OF TAMILS 3

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

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

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

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).

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/05/2024

Chairman Board of Studies Department of Humanities & Sciences

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 பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு - II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை: 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - 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, ஒயிலொட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

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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 பண்ப்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு: 3

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

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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 Thinai 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	PSO1	PSO2
CO1	-	-	-	-	-	3	-	-	-	-	3	-	-
CO2	-	-	-	-	-	3	-	-	-	-	3	-	-
CO3	-	-	-	-	-	3	-	-	-	-	3	-	-
CO4	-	-	-	-	-	3	-	-	-	-	3	-	-
CO5	-	-	-	-	-	3	-	-	-	-	3	-	-
CO6	-	-	-	-	-	3	-	-	-	-	3	-	-

SEMESTER - I

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

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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. Apply the principles of elasticity and thermal physics to evaluate the various modulus of elasticity and conductivity of a bad conductor. (K3)
2. Explicate the properties of semi conductors by evaluating the band gap, I-V characteristics of solar cell and Hall effect of the materials. (K3)
3. 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)
4. Apply spectroscopic techniques, viscometry, synthesize nano particles, analyze the corrosion behaviour of materials in different environments. (K3)

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CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	-	-	2	-	-	-	-	-	2
CO2	3	3	-	-	2	-	-	-	-	-	2
CO3	3	3	-	-	2	-	-	-	-	-	2
Co4	3	3	-	-	2	-	-	-	-	-	2

SEMESTER - I

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

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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:

(a) Total marks obtained by each student.

(b) The highest marks in each subject and the marks of the student who secured it.

(c) 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: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. 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:

1. Apply basic constructs, arrays, strings,functions and recursion for executing C programming applications.(K3)
2. Analyze C programs involving pointers and structures.(K4)
3. Evaluate applications using sequential and random access files.(K5)

CO-PO, PSO MAPPING:

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

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SEMESTER - I

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

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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. Employ reading, writing, and listening skills to communicate clearly in academic and professional contexts.
2. Demonstrate confident oral communication and presentation skills using appropriate tools and techniques.
3. Interpret ethical, inclusive, and culturally aware communication in team and societal settings

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CO-PO, PSO MAPPING:

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

SEMESTER - I

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

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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

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OUTCOMES:

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

1. Analyse and apply the concepts of sustainability,Rural environment,Gram panchayat and various government schemes to design innovative practical solutions that address real life rural challenges. (K2)
2. Compare MDG's,SDG's and LSDG's to analyse village topology and identify specific development targets to propose innovative rural solutions. (K4)
3. Analyse the attainment levels of SDG's and write a reflective report on local community.(K4)
4. Formulate problem statement based on local community needs and propose innovative ideas for community development. (K4)
5. Perform an individual presentation of field observation by mapping them with relevant SDG's and justify their significance for rural development. (K4)

CO-PO, PSO MAPPING:

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

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SEMESTER - II

24BSMA203 - SDG NO. 4	DIFFERENTIAL EQUATIONS AND ITS APPLICATIONS	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- To solve second and higher order differential equations with constant and variable coefficients.
- To find the numerical solution of ordinary and partial differential equations.
- To solve first order partial differential equations, linear homogeneous and non homogeneous partial differential equations of second and higher order.
- To find the Fourier series solution for one dimensional wave equation, one and two dimensional heat equations.
- To obtain the numerical solution of partial differential equations.

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 types - System of simultaneous linear differential equations with constant coefficients.

MODULE - II NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 10

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

MODULE - III SOLUTIONS OF FIRST ORDER PARTIAL DIFFERENTIAL EQUATIONS 9

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

MODULE - IV SOLUTIONS OF LINEAR PARTIAL DIFFERENTIAL EQUATIONS 9

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

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MODULE - V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS10

Classification of Partial Differential Equations – Method of separation of variables – Fourier Series Solutions of one-dimensional wave equation – Transient state solution of one dimensional heat conduction equation – Steady state solution of two dimensional heat conduction equation.

MODULE - VI NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS 10

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. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Advanced Modern Engineering Mathematics, Glyn James, 3rd Edition, Pearson Education, 2010.
3. Numerical Methods for Scientific and Engineering Computation, M. K. Jain, S. R. K. Iyengar, R. K. Jain, 4th Edition, New age international Private Ltd. 2003.

REFERENCES:

1. Numerical methods, Kandasamy P, Thilagavathy, Dr. K. Gunavathy, 1st Edition, S. Chand & Company Ltd.. 2006.
2. Higher Engineering Mathematics, B.S. Grewal, 44th Edition, Khanna Publishers, 2010.
3. Applied Numerical Analysis, Gerald, C.F. and Wheatley, P. O., 7th Edition, Pearson Education, Asia, New Delhi, 2004.
4. Transforms and Partial Differential Equations, 3rd Edition Veerarajan T, McGraw Hill Education (India) Private Limited, 2016.

WEB REFERENCES

1. https://people.maths.ox.ac.uk/suli/nsodes.pdf
2. https://skim.math.msstate.edu/LectureNotes/NumerPDEs_Lecture.pdf
3. https://math.libretexts.org/Bookshelves/Differential_Equations/Differential_Equations_for_Engineers_(Lebl)/4%3A_Fourier_series_and_PDEs/4.07%3A_One_dimensional_wave_equation
4. https://ocw.mit.edu/courses/18-303-linear-partial-differential-equations-fall-2006/d11b374a85c3fde55ec971fe587f8a50_heateqni.pdf

ONLINE RESOURCES:

1. https://www.youtube.com/watch?v=NBcGLLU90fM&list=PLbMVogVj5nJSGlf9sluucwobyr_zz6gl
2. https://www.youtube.com/watch?v=B9l1fZLLW1E
3. https://www.youtube.com/watch?v=7JrMHsiSNWA&list=PLpklqhIbn1jq0ngwe94LpiZ8OG8eiNzC-
4. https://in.video.search.yahoo.com/search/video?fr=mcafee&ei=UTF-8&p=solution+of+one+dimensional +HEAT+equation+VIDEO&vm=r&type=E211IN714G0#id=2&vid=8e1235b2280eb002b6055c30955520cd&action=view

COURSE OUTCOMES:

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

1. Solve ordinary differential equations of second and higher order differential equations with constant and variable coefficients. (K3)
2. Apply various differential equation techniques to solve ordinary differential equations. (K3)
3. Determine the solution of first order partial differential equations. (K3)
4. Apply the concepts of partial differential equations in heat and wave equations. (K3)
5. Solve partial differential equations of second and higher order differential equations with constant coefficients. (K3)
6. Apply various partial differential equation techniques to solve partial differential equations. (K3)

CO-PO, PSO MAPPING:

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

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SEMESTER - II

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

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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_

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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
CO1	-	-	-	-	-	-	-	-	-	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	3	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	3	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	3	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	3	-	-
CO6	-	-	-	-	-	-	-	-	-	3	-	3	-	-

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SEMESTER - II

24BSPH202 - SDG NO.4	PHYSICS OF MATERIALS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To introduce the formation of alloy and phase diagrams.
- To interpret the properties of ferrous alloys and their uses.
- To familiarize with the magnetic properties of materials.
- To expose the dielectric and superconducting materials properties and application.
- To explicate the properties and applications of new engineering materials.
- To inculcate the idea of significance of nanostructures, properties and applications.

MODULE - I ALLOY FORMATION AND PHASE DIAGRAMS 8

Introduction to alloys - Solid solutions - Hume Ruthery's rule - types of alloying elements and their effects - Gibbs free energy and its application to alloy formation - Driving forces for alloy formation: enthalpy and entropy (Qualitative) - Definition and types of phase diagrams - Components, phases, and phase equilibrium - Construction and interpretation of binary phase diagrams: Isomorphous, Eutectic and Peritectic systems - Tie-line, Lever rule and its application in determining phase fractions.

MODULE - II FERROUS ALLOYS 7

Ferrous alloys: types, - Iron-carbon Diagram – Phases and phase transformation - microstructure of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels – factors influencing microstructure formation in ferrous alloys - effect of alloying elements on the iron-carbon system - T-T-T-diagram for eutectoid steel - pearlite, baintic and martensite transformations - tempering of martensite - Mechanical properties of ferrous alloys –hardness –Brinell and Vickers – fatigue.

MODULE - III MAGNETIC PROPERTIES OF MATERIALS 8

Magnetic dipole moments - atomic magnetic moments - magnetic permeability and susceptibility - Magnetic material classification: diamagnetism - paramagnetism - ferromagnetism - antiferromagnetism - Ferromagnetism: origin and exchange interaction - Domain Theory - M versus H behaviour - Hard and soft magnetic materials - applications – Ferrites and its applications.

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MODULE - IV DIELECTRIC AND SUPERCONDUCTING MATERIALS **7**

Dielectric materials - types of polarization - Langevin-Debye equation - frequency and temperature effects on polarization - dielectric breakdown - Ferroelectric materials - superconducting materials - properties - Type-I and Type-II superconductors - applications - Cryotron, SQUID and Magnetic Levitation.

MODULE - V NEW ENGINEERING MATERIALS **8**

Metallic glasses: types, glass forming ability of alloys, twin spinning process, and applications - shape memory alloys: phases shape memory effects, pseudo elastic - NiTi alloy, applications - Ceramics – mechanical, thermal, electrical, magnetic, optical properties and its applications, Composites: Classification, role of matrix and reinforcement- mechanical, thermal, electrical properties and its applications - Biomaterials and its application.

MODULE - VI NANO MATERIALS **7**

Introduction to Nanomaterials - Quantum Confinement and Size Effects - Quantum well, Quantum wire and Quantum dot - Synthesis methods for nanomaterials - top down - Ball Milling Method - bottom up – CVD - Electronic, mechanical, thermal, magnetic properties - Nanomaterials in Electronics and Photonics- solar cells, QD LED - Biomedical applications of Nanomaterials - biosensors.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. William D. Callister Jr., William D. Callister Jr., David G. Rethwisch, "Callister's Materials Science and Engineering", 10th edition, Global edition, John Wiley & Sons, 2019.
2. V.Raghavan, "Physical Metallurgy: Principles and Practice", PHI Learning, 2015.
3. S.O. Pillai "Solid State Physics", New Age International Publishers, 5th Edition, New Delhi, 2018.
4. C. Kittel, "Introduction to Solid State Physics", Wiley, 2019.
5. Palanisamy P.K. Materials Science. SCITECH publishers, 2015.

REFERENCES:

1. O.P.Kanna, "Materials science and Metallurgy", Dhanpat Raj Publications, 2nd edition, 2014.
2. Susan Troiler –Mckinstry and Robert E. Newnham, "Materials Engineering: Bonding, Structure, Structure – property relationship" Cambridge University Press, 2018.

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3. Ben Rogers, Jesse Adams and Sumita Pennathur, Nanotechnology: Understanding Small Systems, CRC Press, 2017.
4. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 2014 (ebook).
5. Nanomaterials – Handbook by Yury Gogotsi, CRC Press, Taylor & Francis group, 2006.

OUTCOMES:

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

1. Illustrate the concept of alloy formation, phase rule, application of Tie-line and Lever rule to determine the phase percentage in binary system (K3)
2. Infer the various phases, invariant phase reactions of the Iron-Carbon phase diagram, different microstructures and the impact of alloying elements in ferrous alloys (K3)
3. Recall the basics of different types of magnetic materials with understanding atomic interactions and magnetic domain physics and their practical uses (K3)
4. Elucidate the basic knowledge of dielectric and superconducting materials and their respective utilizations (K3)
5. Have an insight on new engineering materials such as metallic glasses, shape memory alloys, ceramics, composites, biomaterials and their applications (K3)
6. Recognize the fundamental concepts of nanomaterial, preparation methods, properties and its significant applications. (K3)

CO-PO MAPPING:

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

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SEMESTER - II

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

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 (CO_2, CH_4, N_2O, 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).

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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

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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. Mc Carty, 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
CO1	2	2	1	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-
CO6	3	3	-	2	1	-	-	-	-	-	-

SEMESTER - II

24ESCE201 SDG NO. 4, 9, 12	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the use scalar and vector analytical techniques for analysing forces.
- To introduce the equilibrium of rigid bodies, vector methods and free body diagram
- To learn the principles of friction, forces and to determine the apply the concepts of frictional forces at the contact surfaces of various engineering systems
- To develop basic dynamics concepts – force, momentum, work and energy.
- To predict the effect of force and motion in the course of carrying out the design functions of Engineering

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MODULE - I STATICS OF PARTICLES 7

Introduction – Units and Dimensions – Laws of Mechanics –Newton's laws- Lami's theorem- Parallelogram, triangular Law and polygon law of forces- Principle of transmissibility-Vectorial representation of forces – Fundamental vector operations of forces–Free body diagram- Equilibrium of a particle in 2 D – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces.

MODULE - II EQUILIBRIUM OF RIGID BODIES 9

Beams and Trusses - Moments and Couples - Vectorial representation– Scalar components of a moment – Varignon's theorem- Moment of a force about a point and about an axis- Single equivalent force-Types of supports –Action and reaction forces – types of equilibrium -Equilibrium of Rigid bodies in Two and Three dimensions.

MODULE - III FRICTION 7

Friction force – Types of friction-Laws of Coulomb friction – Simple contact friction-Two bodies in contact- Wedge friction, ladder friction- Rolling resistance.

MODULE - IV PROPERTIES OF SURFACES AND SOLIDS 8

Centroids and Centre of Mass and Volume – Simple and Composite areas and solids -Theorems of pappus - Moments of Inertia of composite areas – Parallel axis theorem and perpendicular axis theorem –Polar moment of inertia- Radius of gyration-Product of inertia-Principal moments of inertia of plane areas and composite areas – Principal axes of inertia-Mass moment of inertia –Prismatic, Cylindrical and spherical solids from first principle.

MODULE - V DYNAMICS-KINEMATICS 7

Displacement, Velocity and Acceleration – Relative motion - Curvilinear motion - Newton's laws of motion.

MODULE - VI DYNAMICS-KINETICS 7

D' Alembert's principle, Work Energy principle - Impulse and Momentum – Impact of elastic bodies. Rigid body motion-Translation and Rotation– General Plane motion of simple rigid bodies such as Cylinder, Disc or Wheel and Sphere.

TOTAL: 45 PERIODS

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TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing Company, New Delhi, 2004.
2. N.H Dubey, "Engineering Mechanics – Statics and Dynamics", McGraw Hill Education (India) Pvt Ltd.
3. Vela Murali, "Engineering Mechanics", Oxford University Press, 2010.

REFERENCES:

1. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
2. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
3. Irving H. Shames and Krishna MohanaRao. G., "Engineering Mechanics Statics and Dynamics", 4th Edition, Pearson Education 2006.
4. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
5. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
6. Dr.N.Kottiswaran, Engineering Mechanics (statics and Dynamics), Sri Balaji Publications, Erode.

WEB RESOURCES:

1. https://nptel.ac.in/courses/112/105/112105164/
2. https://nptel.ac.in/courses/112/103/112103109/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112/106/112106286/
2. https://nptel.ac.in/courses/112/103/112103108/
3. https://nptel.ac.in/courses/112/106/112106180/
4. https://www.coursera.org/learn/engineering-mechanics-statics

OUTCOMES:

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

1. Interpret the concepts of laws of mechanics, vector operations, systems of Forces and equilibrium of particles in spaces. (K3)
2. Solve the engineering problems based on the concepts moment and couples, support and its types and equilibrium of rigid bodies in 3 dimensions. (K3)

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3. Illustrate about Friction, its types, laws of friction, wedge and ladder friction. (K2)
4. Apply the concepts of centroid, centre of gravity, polar moment of inertia and principal moment of inertia for prisms, cylinder and spherical solids. (K3)
5. Solve engineering problems based on the concepts of relative motion and curvilinear motion. (K3)
6. Apply the concepts of Newton's law of motion, work energy method, impulse and momentum and rigid body motion in engineering problems. (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - II

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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

S. Ramakrishnan
Chairman
Board of Studies
Department of Humanities & Sciences

தமிழர் மரபு

அலகு - I நெசவு மற்றும் பானைத் தொழில்நுட்பம்: 3

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

அலகு - II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க கொலத்தில் 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 குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் ___ பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

அலகு - V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: 3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூ லகம் - 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. பொருநை - ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
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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	PSO1	PSO2
CO1	3	-	-	-	-	3	-	-	-	-	3	-	-
CO2	3	-	-	-	-	3	-	-	-	-	3	-	-
CO3	3	-	-	-	-	3	-	-	-	-	3	-	-
CO4	3	-	-	-	-	3	-	-	-	-	3	-	-
CO5	3	-	-	-	-	3	-	-	-	-	3	-	-
CO6	3	-	-	-	-	3	-	-	-	-	3	-	-

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

Chairman
Board of Studies
Department of Humanities & Sciences

SEMESTER - II

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

Recommended by
Board of Studies of H&S dept.
Meeting No. 6 Dated: 31/05/2024

Chairman
Board of Studies
Department of Humanities & Sciences

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, 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

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

Recommended by Board of Studies of H&S dept. Meeting No. 6 Dated: 31/10/2019

Chairman Board of Studies Department of Humanities & Sciences

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

1. Residential house wiring using switches, fuse, indicator, lamp, and energy meter.
2. Fluorescent lamp wiring.
3. Staircase wiring.

Recommended by
Board of Studies of MECH dept.
Meeting No. 8 Dated: 1/6/24

CHAIRMAN
Board of Studies
Mechanical Engineering

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.

Recommended by
Board of Studies of MECH dept.
Meeting No. 8 Dated: 1/6/19

CHAIRMAN
Board of Studies
Mechanical Engineering

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

Recommended by
Board of Studies of MECH dept.
Meeting No. 8 Dated: 1/6/24

CHAIRMAN
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Mechanical Engineering

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]

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Board of Studies of MECH dept.
Meeting No. 8 Dated: 1/6/24

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Mechanical Engineering

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
CO1	3	2	1	-	-	-	-	-	-	1	-	3	2
CO2	3	2	1	-	-	-	-	-	-	1	-	3	2
CO3	3	2	1	-	-	-	-	-	-	1	-	3	2
CO4	3	1	1	-	-	-	-	-	-	1	-	3	2
CO5	2	-	-	-	-	-	2	-	-	-	-	2	2
CO6	2	-	-	-	-	-	2	-	-	-	-	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 of SDGs and implementation strategy

MODULE-1 BASICS OF DESIGN THINKING IN ELECTRICAL AND ELECTRONIC COMPONENTS **4**

- 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**

- Study of sensors and transducers
- Study of embedded protocols, IOT Protocols & Embedded C
- Demonstration of Robotics & Drone models

MODULE-3 BASICS OF MECHANICAL ENGINEERING **4**

- Study of Mechanical Modeling using Fusion 360
- Demonstration of 3D Scanner,3D Printer, Laser Cutter &RD Works Software
- Study of Slicer Software & Master Cam Software

MODULE 4 ALIGNMENT AND MAPPING OF IDEAS **4**

- **Project Title:** Justification of SDG and SAP - Problem Statement & Solution

MODULE-5 ENTREPRENEURSHIP SKILLS **4**

- Startup Awareness
- Entrepreneurship Opportunities
- Mock Presentations
- Innovation
- Novelty
- Feasibility
- Presentation Skills

MODULE-6 SCOUT for SDG IDEATHON **12**

Evaluation Stages:

- First Round

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- Second Round
- 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. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.

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

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 the Basics of Mechanical Modeling (K2)
4. Interpret the mapping of SDGs to ideas. (K4)
5. Illustrate the ideas in the Ideathon event emphatically .(K4)

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CO-PO, PSO MAPPING:

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

SEMESTER - II

24ENTP201 - SDG NO. 4	DIGITAL DYNAMICS	L	T	P	CP	C
		1	0	1	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

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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 **7**

Remote work and virtual teams
Authenticity in digital interactions
Engaging content creation
Tools and 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

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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. Apply online communication techniques and collaboration skills (K3)
2. Enumerate the principles of digital ethics in online interactions (K2)
3. Understand the importance of Bureau of Indian Standards (BIS). (K2)

CO-PO, PSO Mapping:

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

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SEMESTER - III

24BSMA304 - SDG NO. 4	TRANSFORMS AND NUMERICAL METHODS	L	T	P	CP	C
		3	1	0	4	4

OBJECTIVES:

- Determine Laplace transform for various functions and basic properties
- Solving differential equations using Laplace transforms
- 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 discipline
- To introduce basic concepts of python for using the software to find the numerical solution.

MODULE - I 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 and integrals – Transform of Periodic functions.

MODULE - II INVERSE LAPLACE TRANSFORMS **9**

Partial fraction method – using properties - Convolution theorem - Initial and Final value theorem - Solution of second order linear ordinary differential equations with constant coefficients.

MODULE - III NUMERICAL SOLUTIONS OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS **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.

MODULE - IV INTERPOLATION **9**

Newton's forward and backward difference interpolation - Lagrange's and Newton's divided difference interpolations.

MODULE - V NUMERICAL DIFFERENTIATION AND INTEGRATION 9

Approximation of derivatives using interpolation polynomials – Solution of single integrations using Trapezoidal, Romberg method, Simpson's 1/3 & 3/8 rules - Solution of Double integration using Trapezoidal, Simpson's 1/3 rules.

MODULE - VI PYTHON AND ITS NUMERICAL IMPLEMENTATION 9

Variables, Data types, Input/Output – Control structures: if, for, while - Functions and basic error handling - Introduction to Jupyter Notebook / Google Colab or any IDE – Python libraries for numerical computing – NumPy, SciPy, matplotlib, SymPy – Solving an algebraic / transcendental equation (scipy.optimize.bisect, scipy.optimize.newton) – Interpolating temperature data from a dataset (scipy.interpolate.lagrange, interp1d) - Differentiating a dataset to find velocity from displacement (numpy.gradient) - Integrating a function to find area under curve (scipy.integrate.trapz, scipy.integrate. simps).

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Numerical Analysis, Burden, R.L and Faires, J.D, 9th Edition, Cengage Learning, 2016.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 9th edition, John Wiley & Sons, 2006.
3. Higher Engineering Mathematics, Ramana B.V, Tata McGraw Hill Publishing Company, New Delhi, 2017.

REFERENCES:

1. Higher Engineering Mathematics, Dass H. K. and Er. Rajnish Verma, 3rd Edition, S. Chand, 2014.
2. Numerical Methods in Engineering and Science, Grewal B. S. and Grewal J. S., 10th edition, Khanna Publishers, New Delhi, 2015.
3. A Textbook of Engineering Mathematics, N. P. Bali and Manish Goyal, 9th edition, Laxmi Publications, 2016.
4. Applied Numerical Analysis, Gerald. C.F. and Wheatley. P.O, 7th edition, Pearson Education India, 2007.

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WEB RESOURCES:

1. https://www.vyssotski.ch/BasicsOfInstrumentation/LaplaceTransform.pdf
2. https://www.sjsu.edu/me/docs/hsu-Chapter%206%20Laplace%20transform.pdf
3. https://www.maths.gla.ac.uk/~cc/2x/2005_2xnotes/2x_chap5.pdf
4. https://www.lkouniv.ac.in/site/writereaddata/siteContent/20200403225057191 2siddharth_bhatt_engg_Interpolation.pdf
5. https://www.lkouniv.ac.in/site/writereaddata/siteContent/20200403225057191 2siddharth_bhatt_engg_Numerical_Differentation_and_Integration.pdf

ONLINE RESOURCES:

1. https://www.youtube.com/watch?v=c9NibpoQjDk
2. https://www.youtube.com/watch?v=2LyY4t0Gfvs
3. https://www.youtube.com/watch?v=AlysepirN3w
4. https://archive.nptel.ac.in/courses/111/107/111107105/#
5. https://nptel.ac.in/courses/105105043

COURSE OUTCOMES

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

1. Apply Laplace transform techniques to solve engineering problems involving elementary, periodic, and piecewise functions. (K3)
2. Apply inverse Laplace transform techniques and related theorems to solve second-order linear differential equations. (K3)
3. Apply iterative and direct numerical methods to solve algebraic, transcendental, and linear systems of equations. (K3)
4. Apply Newton's and Lagrange's interpolation techniques to estimate values from discrete data. (K3)
5. Apply numerical techniques to approximate derivatives and evaluate definite single and double integrals. (K3)
6. Implement Python programming fundamentals and apply numerical computing libraries (NumPy, SciPy, matplotlib, SymPy) to solve engineering problems including equation solving, data interpolation, numerical differentiation, and integration using appropriate computational methods. (K3)

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CO – PO, PSO MAPPING:

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

SEMESTER - III

24MUPW301 - SDG NO. 4,9,12,13	BASIC MANUFACTURING PROCESSES WITH LABORATORY	L	T	P	CP	C
		3	0	2	5	4

OBJECTIVES:

- To implement the basics and in depth knowledge about Manufacturing Technology.
- To know the various basic Manufacturing processes used in industry for converting raw materials into finished products.
- To understand the concept and basic mechanics of metal cutting, working of standard machine tools.
- To study the working principles of plastic molding.
- To understand the concepts of non-traditional machining processes.

MODULE - I METAL CASTING AND JOINING PROCESSES **8**

Sand Casting – Type of patterns – Pattern Materials – Pattern allowances – Cores – Types. – Principle of special casting processes – Shell, Investment, Pressure die casting, Centrifugal Casting. Defects in Sand casting process-remedies. Gas welding process – Arc welding – TIG, MIG, SAW, PAW – Resistance welding Process – Types - Weld defects and remedies.

MODULE - II METAL DEFORMATION PROCESSES **8**

Hot working and cold working of metals – Forging processes – Typical forging operations. Rolling of metals - Types of Rolling. Drawing and Extrusion – Principles and types. Sheet metal characteristics – Shearing, bending and drawing operations – Stretch forming operations.

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MODULE - III THEORY OF METAL CUTTING AND MACHINES **8**

Mechanics of chip formation – Forces in machining – Types of chip – cutting tool materials – cutting fluids. Lathe construction – specification – operations – taper turning methods – Capstan and turret lathes – automatic lathes - semi-automatic – Single spindle – Multi spindle. Drilling – Reaming – Boring – Tapping – Milling – operations – types of milling cutter – Gear shaping processes – Finishing of gears.

MODULE - IV ABRASIVE PROCESS AND BROACHING **7**

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centreless grinding and internal grinding – Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines.

MODULE - V MANUFACTURE OF PLASTIC COMPONENTS **7**

Types and characteristics of plastics – Molding of thermoplastics & Thermosetting polymers – working principles and typical applications – injection molding – Plunger and screw machines – Compression molding, Transfer Molding – Typical industrial applications – Introduction to blow molding – Rotational molding – Film blowing – Extrusion.

MODULE - VI ADVANCED MACHINING PROCESSES **7**

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining – Ultrasonic Machining. (AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications

TOTAL : 45 PERIODS

LIST OF EXPERIMENTS **15 PERIODS**

1. Fabricating simple structural shapes using Gas Metal Arc Welding machine.
2. Preparing green sand moulds with cast patterns.
3. Taper Turning and Eccentric Turning on circular parts using lathe machine.
4. Knurling, external and internal thread cutting on circular parts using lathe machine.
5. Drilling and Reaming using vertical drilling machine.
6. Milling contours on plates using vertical milling machine.
7. Cutting spur and helical gear using milling machine.
8. Generating gears using gear hobbing machine.

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9. Grinding components using cylindrical and centerless grinding machine.
10. Grinding components using surface grinding machine.

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Kalpak Jian. S, "Manufacturing Engineering and Technology", Pearson Education India, 7th Edition, 2018.
2. N Khurmi R.S Khurmi. "A Textbook of Workshop Technology: Manufacturing Processes", S Chand & Company, 16th Edition, 2021.

REFERENCE BOOKS

1. Hajra Choudhary S.K and Hajra Choudhury. AK., "Elements of workshop Technology", volume I and II, Media promoters and Publishers Private Limited, Mumbai, 2008.
2. Rao. P.N "Manufacturing Technology - Metal Cutting and Machine Tools", 3rd Edition, Tata McGraw-Hill, New Delhi, 2013.
3. Winston. A. Knight, Geoffrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools" CRC Press, 3rd Edition.
4. David A. Stephenson, John S. Agapiou. "Metal Cutting Theory and Practice" Taylor & Francis publisher, 2006
5. Vijay Kumar Jain. "Advanced Machining Processes" Allied publishers Pvt. Ltd, 2009.

WEB RESOURCES:

1. https://nptel.ac.in/courses/112/107/112107144/
2. https://nptel.ac.in/courses/112/105/112105127/
3. https://nptel.ac.in/courses/112/107/112107084/
4. https://nptel.ac.in/courses/112/106/112106153/
5. https://nptel.ac.in/courses/112/107/112107090/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112/107/112107145/
2. https://nptel.ac.in/courses/112/105/112105126/
3. https://nptel.ac.in/courses/112/104/112104195/
4. https://nptel.ac.in/courses/112/107/112107219/
5. https://nptel.ac.in/courses/112/107/112107083/
6. https://nptel.ac.in/courses/112/107/112107215/
7. https://nptel.ac.in/courses/112/107/112107250/

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Meeting No. 6 Dated: 1/6/24

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8. https://nptel.ac.in/courses/112/104/112104290/
9. https://nptel.ac.in/courses/112/103/112103248/

OUTCOMES

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

1. Apply the knowledge of different casting and metal joining processes. (K3)
2 Interpret the characteristics, process details and applications of bulk deformation in metals. (K3)
3 Analyze the various tools, equipment, and machinery required for basic manufacturing processes. (K4)
4 Apply suitable molding technique for manufacturing of plastics components. (K3)
5 Develop the different metal removing, finishing and super finishing for component production. (K3)
6 Compare mechanical energy-based non-traditional machining processes and justify their applications for advanced materials. (K4)

CO – PO, PSO MAPPING:

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

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SEMESTER - III

24ESEI302 - SDG NO. 3, 4, 11	BASIC ELECTRONICS AND CONTROL SYSTEM	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To understand the concepts of Electronics devices and Circuits.
- To understand concepts related to analog and digital signal conditioning.
- To understand various systems and derive mathematical model of a system.
- To study time response of closed loop control systems.

MODULE - I SEMICONDUCTOR DIODES 7

Types of Materials - Silicon & Germanium- N type and P type materials - Structure, peration and Characteristics of Diodes - PN, Zener. Transistors - Bipolar Junction Transistor (NPN and PNP in CE, CB, CC configuration).

MODULE - II TRANSISTORS 7

Construction, Principle of Operation, Working and Characteristics of Field Effect Transistors - JFET, MOSFET, Thyristors - SCR and UJT.

MODULE - III OPERATIONAL AMPLIFIER AND ITS APPLICATIONS 7

Ideal Op-Amp –Block diagram, Inverting and Non-inverting amplifier, Instrumentation Amplifier, Differentiator, Integrator, Oscillator- Wein Bridge, Hartley and Crystal Oscillators.

MODULE - IV ELECTRONIC SIGNAL CONDITIONING CIRCUITS 8

Standard analog signals, sample and hold circuit, peak detector, ADC (Successive Approximation, Flash, Ramp, dual slope) and DAC (R/2R, Weighted resistors) their types and specifications

MODULE - V SYSTEMS AND THEIR REPRESENTATION 8

Basic elements in control systems- Open and closed loop system, Transfer function and Electrical analogy of mechanical translational and rotational systems- Block diagram reduction and Signal Flow graph.

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MODULE - VI TIME RESPONSE ANALYSIS OF SYSTEMS 8

Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Gupta S, "Electronic Devices & Circuits", DhanpatRai Publicaions.
2. Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age International Publishers, 2017

REFERENCE BOOKS

1. Boylestad and Nashelsky, "Electronic Devices and Circuit", Pearson Publisher, 2015
2. Ramakant Gayakwad, "Op-amp and Linear Integrated Circuits" , Fourth edition, PHI Pearson Education
3. Roy Choudhry, D,Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2018, Fifth Edition
4. Salivahanan, S & V.S. KanchanaBhaskaran, —Linear Integrated Circuits||, TMH,2nd Edition,4th Reprint, 2016
5. Benjamin C. Kuo, "Automatic Control Systems", Wiley, 2014

WEB RESOURCES:

1. https://www.newworldencyclopedia.org/entry/Electronic_engineering
2. https://www.tutorialspoint.com/control_systems/control_systems_useful_resources.htm

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/117103063
2. https://nptel.ac.in/courses/107106081

OUTCOMES

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

1. Describe the operation and characteristics of various semiconductor devices and BJT. (K2)
2. Illustrate the working of various configurations of transistors and thyristors. (K2)
3. Analyse the configuration of operational amplifiers and oscillator circuits (K2)

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4. Explain the concepts related to analog and digital conditioning. (K2)
5. Derive the mathematical model of electrical, mechanical systems and determine/reduce the transfer function for the system using block diagram reduction and signal flow graph methods (K3).
6. Derive the time domain behavior of I &II order systems (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - III

24MUPC301 - SDG NO. 4,7,12,15	THERMODYNAMICS AND FLUID MECHANICS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To understand the basics laws of thermodynamics.
- To understand the second law of thermodynamics
- To understand the laws of energy conversion cycles and various air standard cycles.
- To knowledge in Fluid Properties and Statics.
- To understand the concept of fluid kinematics and Dynamics.
- To learn about the flows in fluid, fluid losses and dimensional analysis.

MODULE - I BASICS OF THERMODYNAMICS AND FIRST LAW OF THERMODYNAMICS 8

Thermodynamics – Microscopic and macroscopic point of view – Systems, properties, process, path, cycle. Thermodynamic equilibrium – Zeroth law of Thermodynamics – internal energy, enthalpy, specific heat capacities CV and CP, Relationship between CV and CP. First law of Thermodynamics – Application to closed and open systems – Steady Flow Energy Equation (SFEE) – Simple problems.

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MODULE - II SECOND LAW OF THERMODYNAMICS **7**

Limitations of First law of thermodynamics, Cyclic devices, Directional constraints. Thermal Energy reservoirs. Heat engines, refrigerators/heat pump, Statements – Kelvin- Planck & Clausius, Mathematical interpretations with efficiency, COP, Ton of Refrigeration, Equivalence of statements with illustrations, Perpetual motion machine of second kind (PMMSK/PMM-II). Reversibility and irreversibility – causes and conditions. Carnot Theorems, Absolute temperature scale.

MODULE - III MODELLING OF BASIC ENERGY CONVERSION CYCLES **8**

Air standard assumptions, Overview of reciprocating engines, Air standard cycles for reciprocating engines – Otto, Diesel & dual, Criteria for comparison & comparative analysis, Derivation for efficiency, Mean effective pressure (MEP) & Carnot efficiency, calculation of Heat transfer at mean temperature.

MODULE - IV FLUID PROPERTIES AND FLUID STATICS **7**

Fluid Definition and Classification – Properties of fluids: Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Compressibility, Bulk Modulus, Capillary and Surface Tension – Fluid statics: Concept of fluid static pressure – Pascal's law –Absolute and Gauge pressures – Manometers: Types and Pressure measurement – Concept of Buoyancy and Floatation.

MODULE - V FLUID KINEMATICS AND FLUID DYNAMICS **7**

Fluid Kinematics: Types of fluid flow – Continuity equation in two and three dimensions – Velocity and Acceleration of fluid particle – Velocity potential function and Stream function. Fluid dynamics: Euler's equation along a streamline –Bernoulli's equation and applications – Venturi meter, Orifice meter and Pitot tube.

MODULE - VI FLOW THROUGH PIPES AND DIMENSIONAL ANALYSIS **8**

Viscous flow: Shear stress, pressure gradient relationship – Flow of viscous fluid through circular pipe – Flow through pipes: Loss of head due to friction – Minor head losses – Hydraulic gradient and Total energy lines – Flow through pipes in series and in parallel – Power transmission through pipes. Dimensional analysis: Buckingham's pi theorem.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Nag P.K., Engineering Thermodynamics, 5th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2013.

Recommended by
Board of Studies of MU dept.
Meeting No. 6 Dated: 1/6/...

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2. Bansal R.K., Fluid Mechanics and Hydraulic Machines, 9th Edition, Laxmi Publications, New Delhi, 2015.

REFERENCE BOOKS

1. R.K.Rajput, "A Text Book Of Engineering Thermodynamics", Fifth Edition, Lakshmi Publications, 2017.
2. Cengel Yunus A. and Boles Michael A., Thermodynamics: An Engineering Approach, 7th Edition, McGraw-Hill, New York, 2011.
3. Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2016.
4. Frank M. White., Fluid Mechanics, 7th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2009.
5. R.K. Rajput, "Fluid Mechanics and Hydraulic Machines", S.Chand & Company Ltd, 2010.

WEB RESOURCES:

1. https://www.mcgoodwin.net/pages/thermodynamics.pdf
2. https://nptel.ac.in/courses/112105266
3. https://nptel.ac.in/courses/112/104/112104118/
4. https://nptel.ac.in/courses/112/104/112104117/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112/102/112102255/
2. https://nptel.ac.in/courses/112/105/112105123/
3. https://nptel.ac.in/courses/101/104/101104063/
4. https://nptel.ac.in/courses/112/105/112105171/
5. https://nptel.ac.in/courses/105/101/105101082/
6. https://nptel.ac.in/courses/112/105/112105183/

OUTCOMES

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

1. Apply the fundamental principles of thermodynamics to analyze energy interactions in closed and open systems using the First Law of Thermodynamics and the Steady Flow Energy Equation (SFEE). (K3)
2. State and apply the second laws of thermodynamics for various thermal systems (K3)
3. Select suitable thermal systems for various thermal applications. (K3)
4. Apply the principles of fluid properties and statics to solve practical engineering problems and analyze real-world applications. (K3)

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5. Compare and contrast the different types of flows in a fluid motion, principles of continuity, momentum and energy as applied to fluid motions. (K3)
6. Develop a range of analytical fluid flow and apply dimensional analysis to predict physical parameters that impact the effectiveness. (K3).

CO – PO, PSO MAPPING:

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

SEMESTER - III

24MUPW302 - SDG NO. 4 & 9	SENSORS IN AUTOMATION WITH LABORATORY	L	T	P	CP	C
		3	0	2	5	4

OBJECTIVES:

- To understand the concepts of measurement technology
- To learn the various sensors used to measure various physical parameters.
- To learn the fundamentals of signal data acquisition and communication systems used in automation system development.

MODULE - I INTRODUCTION **8**

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors –Sensor Output Signal Types.

MODULE - II POSITION, MOTION AND RANGING SENSORS **8**

Position and Displacement sensors - Potentiometers, Resolver, Encoders, Inductive, Capacitive, LVDT, RVDT. Motion Sensors - Accelerometer, GPS, Bluetooth, Range Sensors - Ultrasonic Ranging, Laser Range Sensor (LIDAR).

MODULE - III FORCE, MAGNETIC AND HEADING SENSORS 7

Strain Gauge, Load Cell, Magnetic Sensors - types, principle, requirement and advantages: Magneto resistive, Hall Effect, Current sensor. Heading Sensors - Compass, Gyroscope and Inclinometers.

MODULE - IV PRESSURE AND TEMPERATURE SENSORS 7

Pressure - Diaphragm, Bellows, Piezoelectric - Tactile sensors. Temperature - IC, Thermistor, RTD, Thermocouple.

MODULE - V OPTICAL, ACOUSTIC AND SMART SENSORS 7

Photo conductive cell, photo voltaic, Photo resistive, LDR - Fiber optic sensors. Acoustic Sensors - flow and level measurement, Radiation Sensors - Smart Sensors, MEMS.

MODULE - VI DAQ SYSTEMS AND APPLICATIONS 8

Data Acquisition: Single channel and multi-channel data acquisition - Data logging - Applications - Automobile, Home appliances, Manufacturing, Environmental monitoring.

TOTAL : 45 PERIODS

LABORATORY EXPERIMENTS: **TOTAL: 15 PERIODS**

1. Displacement versus output voltage characteristics of a potentiometric transducer.
2. Characteristics of Strain gauge and Load cell.
3. Characteristics of LVDT and Photoelectric transducer.
4. Characteristic and Step response of RTD.
5. Characteristic and Step response of Thermocouple.
6. Characteristic and Thermistor.
7. Measurement of Angular displacement using resistive and capacitive transducer.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 7th Edition, 2019.
2. Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, Dhanpat Rai& Co, New Delhi, 2017.

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REFERENCE BOOKS:

1. Sujatha, C., Dyer, S.A., "Survey of Instrumentation and Measurement", John Wiley & Sons, Canada, 2004.
2. Hans Kurt Tönshoff (Editor), Ichiro, "Sensors in Manufacturing" Volume 1, Wiley-VCH April 2001.
3. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 1999.
4. Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi, 2011.
5. Richard Zurawski, "Industrial Communication Technology Handbook" 2nd edition, CRC Press, 2015

WEB RESOURCES:

1. https://electronics-tutorials.ws/io/io

ONLINE RESOURCES:

1. https://instrumentationtools.com/tag/sensors-and-transducers-nptelpdf/
2. https://swayam.gov.in/nd1_noc19_ee41/preview
3. https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf

OUTCOMES

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

1. Apply the understanding of static and dynamic characteristics of transducers to analyze sensor performance and evaluate their impact on measurement accuracy (K3)
2. Apply the working principles of various position, motion, and range sensors to select suitable sensors for various engineering systems. (K3)
3. Apply the operating principles of force, magnetic, and heading sensors to practical measurement problems in mechanical systems. (K3)
4. Demonstrate the principles of various pressure and temperature sensors (K3)
5. Apply the concepts of optical, acoustic, and smart sensors, including MEMS, for sensing light, sound, and environmental parameters in smart system design. (K3)
6. Identify the suitable DAQ systems with different sensors for real time applications (K3)

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CO – PO, PSO MAPPING:

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

SEMESTER - III

24HSMC301 - SDG NO. 4 & 9	UNIVERSAL HUMAN VALUES – II UNDERSTANDING HARMONY	L	T	P	CP	C
		3	0	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

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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 ofresources 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

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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)

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CO – PO, PSO MAPPING:

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

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

GENERAL AWARENESS **4**

GA 1 General Knowledge 4

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ARMED FORCES 6

AF 1	Armed Forces, Army, CAPF, Police	6

ADVENTURE 1

AD 1	Introduction to Adventure Activities	1

BORDER & COASTAL AREAS 2

BCA 1	History, Geography & Topography of Border/Coastal areas	2

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

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

GENERAL AWARENESS 4

GA 1	General Knowledge	4

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

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

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

GENERAL AWARENESS **4**

GA 1 General Knowledge 4

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 Actitivities 1

BORDER & COASTAL AREAS **2**

BCA 1 History, Geography & Topography of Border/Coastal areas 2

TOTAL: 45 PERIODS

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SEMESTER - III

24MUPL301 - SDG NO. 4,8,9,12	COMPUTER AIDED DRAFTING LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To impact the students with necessary computer aided modeling skills using standard CAD packages.
- To acquire the knowledge of CAD software and its features
- To familiarize the students with Indian Standards on drawing practices.
- To impact knowledge of thread forms, fasteners, keys, joints and couplings.
- To make the students understand and interpret drawings of machine components leading to preparation of assembly drawings manually and using CAD packages.

LIST OF EXPERIMENTS USING SOFTWARE CAPABLE OF DRAFTING AND MODELLING:

1. Creation of simple figures like polygon and general multi-line figures.
2. Drawing of curves like parabola, spiral, involute using B-spline or cubic-spline.
3. Drawing front view, top view and side view of objects from the given pictorial view.
4. Drawing of a simple steel truss.
5. Drawing isometric projection of simple objects.
6. Creation of 3D models of simple objects and obtaining 2D multi-view drawings from 3D model.
7. Creating 3D features (Extrude & Revolve)
8. Drawing of 3D working tools like Hole, Round and Chamfer.
9. Creating of 3D Piston models using 3D software.
10. Develop a 3D drawing of Universal Joint using 3D software.

LIST OF EQUIPMENTS:

1. IBM Server, Intel Xeon 5506, (Quad Core- NEHELAM) – 1.
2. Dell Optiplex 3040 Desktop, 6th Gen Intel Core i5 Processor with suitable graphics facility 4GB Ram, 1TB Hard Disk.
3. Licensed software for Drafting and Modeling- 30 Licenses
4. Laser Printer or Plotter - to print/Plot drawings.

TOTAL : 45 PERIODS

OUTCOMES

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

1. Apply fundamental AutoCAD commands to create, modify, annotate, and plot 2D technical drawings effectively. (K3)
2. Construct basic 3D models and generate plots for simple objects using AutoCAD tools. (K3)
3. Develop part and assembly drawings in accordance with standard engineering drawing conventions. (K4)

CO – PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	1	-	2	-	-	-	1	2	1	2	2
CO2	2	-	3	-	3	-	-	-	1	2	1	2	2
Co3	2	-	3	-	3	-	-	-	1	2	1	2	2

SEMESTER - III

24MUTP301 - SDG NO. 4	APTITUDE SKILLS - I	L	T	P	CP	C
		0	0	2	2	1

APTITUDE & COGNITIVE SKILLS – PHASE 1

OBJECTIVES:

- 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 and Strengthen 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

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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 Examinations – R.S. Aggarwal
2. A Modern Approach to Logical Reasoning – R.S. Aggarwal
3. High School English Grammar & Composition – Wren & Martin
4. Word Power Made Easy – Norman Lewis.
5. Fast Track Objective Arithmetic – Rajesh Verma

LIFE SKILLS,RANGER AND ROVER & BIS STANDARDS – PHASE 2

OBJECTIVES:

- Familiarize the team and leadership skills.
- Gain Scouting spirit.
- Understand the standards relevant to Mechanical.

MODULE - I JEEVAN KAUSHAL 2.0 – TEAM SKILLS AND LIFE SKILLS 12

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.

Brainstorming: Basics and the process – Effective technique for ideation – Types – Importance and Benefits

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

Leadership Skills: Leadership concept - Leadership skills – Leadership moralities – Leadership models

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.

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MODULE - III INTRODUCTION OF STANDARDS & TECHNICAL DRAWINGS **8**

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.

Technical Drawings: Types of projections; representation of lines, view, sections and cuts. Standardized representation of threads, fasteners, welds, bearings, springs and related components. Limits, fits and tolerances, dimensional and geometric tolerances, surface finish symbols.

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://www.cambridgeenglish.org/learning-english
2. https://lms.scout.org/course_items/show/1172182?course_id=214307#course-item-id=1172182
3. https://lms.scout.org/courses/show/214123?force_course_hub=true

OUTCOMES

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

1. Apply quantitative aptitude for solving numerical problems [K3]
2. Describe logical reasoning to tackle emotional challenges. [K2]
3. Use verbal communication and comprehension skills through grammar and language exercises. [K3]
4. Apply critical thinking and problem-solving skills in various cognitive scenarios. [K3]
5. Interpret language nuances in diversified situations and exhibit scouting spirits amidst communities. [K2]
6. Explain the fundamental concepts, processes, and significance of

standardization and interpret standardized technical drawings and symbols used in engineering design. (K2)

CO – PO, PSO MAPPING:

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

SEMESTER - III

24MUID301 - SDG NO. 4,8,9,12	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)

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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
CO1	3	3	2	-	-	-	-	2	-	-	-	2	2
CO2	3	3	2	-	-	-	-	2	-	-	-	2	2
Co3	3	3	2	-	-	-	-	2	-	-	-	2	2

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SEMESTER - IV

24MUPC401 - SDG NO. 3, 4, 11	FLUID POWER AUTOMATION	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To make the students to learn the basic concepts of hydraulics and pneumatics and their controlling elements in the area of manufacturing process.
- To train the students in designing the hydraulic and pneumatic circuits using various design procedures.

MODULE - I INTRODUCTION TO FLUID POWER PRINCIPLES 7

Introduction to Fluid Power Automation: Definition; Basics of Hydraulics – Pascal's Law – Principles of flow; properties of fluids; Benefits and Impact of Automation on Manufacturing and Process Industries. Hydraulic & Pneumatic Comparison – ISO symbols for fluid power elements, Hydraulic, pneumatic – Selection criteria.

MODULE - II HYDRAULIC SYSTEM AND COMPONENTS 7

Source of Hydraulic power: pumping theory –pump classification - Gear pump, vane pump, piston pump, construction and working of pumps- pump performance - Variable displacement pump. Linear Hydraulic actuators – Types of hydraulic cylinders-single acting, double acting, Special Types like Tandem and Telescopic, mounting details, cushioning –accumulators and their types.

MODULE - III PNEUMATIC SYSTEM AND COMPONENTS 7

Pneumatics: Properties of air - Perfect Gas Laws – Pneumatic actuator types linear and rotary- Compressor - Filters, Regulator, Lubricator Unit - Muffler- Air control Valves, Quick Exhaust Valves

MODULE - IV FLUID POWER CONTROL ELEMENTS 7

Direction, Flow and pressure control valves – Types, Construction and Operation –Servo and Proportional valves–Solenoid valves- Applications – Accessories: Reservoirs, Pressure Switches – Applications.

MODULE - V CIRCUIT DESIGN 8

Basic Hydraulic Circuits: Meter in, Meter out and Bleed off circuits; Intensifier circuits, Regenerative Circuit, Counter balance valve circuit and sequencing circuits. Pneumatic Circuit Designing: Design of Pneumatic sequencing

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circuits using Cascade method and Shift register method (up to 3 cylinders), Design of Pneumatic circuits for Pick and Place applications.

MODULE - VI DESIGN AND CONTROL OF ELECTRO-PNEUMATIC SYSTEMS 9

Design of Electro-Pneumatic Circuits using single solenoid and double solenoid valves; with and without grouping; Design of Pneumatic circuits using PLC Control (ladder programming only) up to 2 cylinders, with applications of Timers and Counters and concept of Flag and latching.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications', 7th Edition, Pearson Education Limited, 2013.
2. Bolton, W., "Mechatronics, Electronic control systems in Mechanical and Electrical Engineering", 6th Edition, Pearson Education, 2015.

REFERENCES:

1. Dudbey. A., Peace, "Basic Fluid Power", 2nd Edition, Prentice Hall Inc, 1986.
2. Fitch, E.C., and Suryaatmadyn, J.B., "Introduction to fluid logic", McGraw Hill, 1978.
3. Herbert R. Merritt, "Hydraulic control systems", John Wiley & Sons, Newyork, 1967.
4. Peter Rohner, "Fluid Power Logic Circuit Design", McmelanPrem, 1994.

WEB RESOURCES:

1. http://link.springer.com/content/pdf/bfm%3A978-1-349-16126-3%2F1.pdf
2. https://yuken-usa.com/pdf/special/Basic_Hydraulic_And_Components_(Pub._ES-100-2)_.pdf

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112105206
2. https://www.iitp.ac.in/~athakur/courses/MH501/ModuleIV/Hydraulic%20Systems.pdf
3. https://nptel.ac.in/courses/112105206
4. https://www.haenchen-hydraulic.com/media/pdf/en/en_preview-book-hydraulic-systems.pdf?m=1582719423&

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OUTCOMES

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

1. Choose the basic automation techniques for small manufacturing set-ups. (K3)
2. Explain the working principles of fluid power components such as pumps and motors. (K3)
3. Design pneumatic and hydraulic circuits of moderate complexity. (K3)
4. Analyze the operation of control and regulation elements in pneumatic and hydraulic systems. (K4)
5. Demonstrate the application of electrical and electronic controls in fluid power circuits. (K3)
6. Design the electro pneumatic circuits using solenoid valves and PLC control. (K4)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

24MUPC402 - SDG NO. 4, 9	THEORY OF MACHINES	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- Understand the fundamental concepts of mechanisms.
- Understand the functions of cams, gears, and flywheel.
- Impart knowledge on design of mechanisms and dynamic loads acting on the mechanism.
- Give an insight on the concepts of balancing, vibration and speed governing devices.

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MODULE - I MECHANISMS AND KINEMATICS 7

Introduction, mechanisms and machines, terminology, planar mechanism - Kinematic diagram and inversion, Mobility, Coincident joints, Grubbler and Grashoff's law, Four bar, single and double slider mechanisms and their inversions. Introduction to Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

MODULE - II GEARS AND GEAR TRAINS 8

Gear terminology, law of gearing- nomenclature of spur & helical gears – interference – requirement of minimum number of teeth in gears. Simple, Compound and reverted gear trains -determination of speed and torque in epicyclic gear trains.

MODULE - III KINEMATIC ANALYSIS OF CAMS 7

Types of cams, Types of followers. Displacement, Velocity and acceleration time curve for cam profiles. Follower motions including SHM, Uniform acceleration and retardation and Cycloidal motion.

MODULE - IV BALANCING 8

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing of Multi-cylinder Inline, V-engines – Partial balancing in engines – Balancing machines.

MODULE - V VIBRATION 7

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multirotor systems – geared shafts – critical speed of shafts.

MODULE - VI MECHANISMS FOR CONTROL 8

Governors – Types: Centrifugal governors – Gravity controlled and spring controlled governors – Characteristics – Effect of friction – Controlling force curves. Gyroscopes –Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Rattan S.S, "Theory of Machines", Tata McGraw Hill Publishing Company Ltd., New Delhi, 4thEdition, 2014.

2. Khurmi, R. S., Gupta, J. K.,"Theory of Machines", S.Chand Publisher, 14th Edition, 2020.

REFERENCE BOOKS

1. Sadhu Singh, "Theory of Machines:Kinematics and Dynamics", Pearson Education, 3rd Edition, 2011.
2. John Joseph Uicker, Pennock,G. R., Joseph Edward Shigley, 'Theory of Machines and Mechanisms', Oxford University Press, 2003.
3. Amitabha Ghosh and Mallick, 'Theory of Machines and Mechanisms', East West Press, 3rdEdition 2020.
4. Thomas Bevan, "Theory of Machines", CBS Publication, 3rd Edition,2005.
5. Singh, V.P.,"Mechanical Vibrations", Dhanpat Rai Publications (P) Ltd, 3rd Edition, 2011.

WEB RESOURCES:

1. https://www.tutorialspoint.com/theory-of-machines/index.asp
2. https://mechanicalbasics.com/theory-of-machines/
3. https://en.wikipedia.org/wiki/Outline_of_machines?utm_source=chatgpt.com

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/112/104/112104121/
2. https://archive.nptel.ac.in/courses/112/106/112106270/
3. https://archive.nptel.ac.in/courses/112/105/112105268/
4. https://archive.nptel.ac.in/courses/112/104/112104114/

OUTCOMES

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

1. Solve problems related to the motion of planar mechanisms using kinematic diagrams and laws. (K3)
2. Calculate speed and torque in different gear train configurations using gear ratio principles. (K3)
3. Construct displacement, velocity, and acceleration diagrams for cam-follower systems using standard motion curves. (K3)
4. Analyze techniques for balancing rotating and reciprocating systems to control vibration (K4)
5. Solve problems involving free, forced, and damped vibrations in single-degree-of-freedom mechanical systems. (K3)

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6. Examine the working principles of governors and gyroscopes to analyze system stability and control. (K4)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

24MUPC403 - SDG NO. 3, 4, 11	ROBOTS AND SYSTEMS IN SMART MANUFACTURING	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To get a knowledge of working on Industrial robots and their load handling capacity, applications in machine cells and FMS.
- To do a detailed analysis about robotization and its economics with an application of robots in various industrial operations.
- To familiar with construction and working of material handling system.
- To learn software usage, automation in material handling and storage.
- To impart the knowledge on robotic simulation and programming.
- To obtain the knowledge on various type of robot welding and multiple operations.

MODULE - I INTRODUCTION OF ROBOTICS IN MATERIAL HANDLING APPLICATIONS 8

Types of industrial robots - Load handling capacity - general considerations in Robotic material handling-material transfer - machine loading and unloading - CNC machine tool loading - Robot centered cell.

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MODULE - II SELECTION OF ROBOTS AND INDUSTRIAL IMPLEMENTATIONS 8

Factors influencing the choice of a robot - robot performance testing - economics of robotization - Impact of robot on industry and society. Application of Robots in continuous arc welding - Spot welding - Spray painting -assembly operation - cleaning - robot for underwater applications.

MODULE - III MATERIAL HANDLING EQUIPMENTS 8

Concepts of material handling - principles and considerations in material handling systems design - conventional material handling systems - industrial trucks - monorails - rail guided vehicles - conveyor systems -cranes and hoists.

MODULE - IV ADVANCED MATERIAL HANDLING, STORAGE AND AUTOMATION SYSTEMS 7

Advanced material handling systems - automated guided vehicle systems - automated storage and retrieval systems (ASRS) - bar code technology - radio frequency identification technology -Introduction to Automation Plant design software.

MODULE - V ROBOTIC PROGRAMMING FOR INDUSTRIAL NEEDS 7

Motion control, Types of motion control, Programmable and flexible control facility –Introduction-Types- Flex Pendant-Lead through programming, Operating mode of robot, Jogging-Types, programming for robotic operations.

MODULE - VI ROBOTIC APPLICATIONS IN MULTIPLE FIELDS 7

Application of robot in manufacturing: Robots for box fabrication, robots for microelectronic welding and soldering – Applications in nuclear, aerospace and ship building, case studies for simple and complex applications.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Richard D Klafter, Thomas Achmielewski, Mickael Negin , "Robotic Engineering – An Integrated Approach", Prentice Hall India, New Delhi, 2006.
2. Mikell P Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing", Pearson Education, New York, 2021.

REFERENCE BOOKS:

1. Pires J N, Loureiro A, Bolmsjo G, "Welding Robots: Technology, System Issues and Application", Springer, London, 2010.

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2. Parmar R S, "Welding Processes and Technology", Khanna Publishers, New Delhi, 2nd Edition, 2013.
3. John A. piotrowski, William T. Randolph, "Robotic welding: A Guide to Selection and Application, Welding Division, Robotics International of SME", Publications Development Dept., Marketing Division, 1987.
4. Mikell P Groover, Mitchel Weiss, Roger N Nagel, N.G.Odrey, Ashish Dutta, "Industrial Robotics (SIE): Technology, Programming and Applications", 2nd Edition, McGraw Hill Education India Pvt Ltd, 2017.
5. Yoram Koren, "Robotics for Engineers", McGraw-Hill, 1987.

WEB RESOURCES:

1. https://www.manufacturingtomorrow.com/article/2018/05/5-ways-robotics-are-being-used-in-smart-manufacturing/11568
2. https://robotnik.eu/smart-factories-robots/
3. https://www.slideshare.net/nabil130290/selection-of-robot
4. https://www.automationworld.com/factory/robotics/article/21133266/robots-how-to-choose-the-right-one
5. https://www.motoman.com/en-us/applications

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112107298
2. https://nptel.ac.in/courses/112107289
3. https://nptel.ac.in/courses/112104293

OUTCOMES

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

1. Discover about the usage of Industrial Robots and its considerations in Material handling, FMS, machine loading and machine centers. (K3)
2. Relate the robotization in terms of economics and categorize robots in welding, assembly and spray painting. (K4)
3. Utilize material handling equipment effectively in various industrial processes. (K3)
4. Infer various software advancements in material handling like automated storage and retrieval, data handling and plant automation (K4)
5. Develop robot programming for various industrial applications and to model simulation for industrial robotic applications. (K3)
6. Identify the various applications of robots in multiple industrial scenarios. (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

24MUPW401 – SDG NO. 4,8,9,12,16	CNC AND METROLOGY WITH LABORATORY	L	T	P	CP	C
		3	0	2	5	4

OBJECTIVES:

- To study the basic concepts of CNC and constructional features of CNC.
- To learn the basics of CNC programming concepts to develop the part programme for Machine centre and turning centre
- To Generate CNC programs for popular CNC controllers
- To learn basic concepts of linear, angular and transmission elements.
- To provide the knowledge of the advancement in metrology

MODULE - I INTRODUCTION **7**

Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, types of control systems, CNC controllers, characteristics, interpolators, CNC Machine building, structural details, configuration and design, different kinds of guideways.

MODULE - II DRIVES AND WORK HOLDING DEVICES **7**

Spindle drives – DC shunt motor, 3 phase AC induction motor, feed drives –stepper motor, servo principle, DC and AC servomotors, Axis measuring system – synchro, synchro-resolver, gratings, types of fringe gratings, encoders, work holding devices for rotating and fixed work parts

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MODULE - III CNC PROGRAMMING **8**

Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, programming for machining centre and turning centre (controllers such as Fanuc, Heidenhain, Sinumerik), generation of CNC codes

MODULE - IV LINEAR AND ANGULAR MEASUREMENTS **8**

Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchangeability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications

MODULE - V MEASUREMENT OF TRANSMISSION ELEMENTS AND TOLERANCE ANALYSIS **7**

Measurement of Screw threads - Single element measurements – Pitch Diameter, Lead, Pitch. Measurement of Gears – purpose – Analytical measurement – Runout, Pitch variation, Tooth profile, Tooth thickness. Tolerancing– Interchangeability, Tolerance representation, Terminology, Limits and Fits

MODULE - VI ADVANCES IN METROLOGY **8**

Basic concept of lasers, Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer – Applications, Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Applications.

TOTAL : 45 PERIODS

LIST OF EXPERIMENTS: **TOTAL : 15 PERIODS**

MANUAL PART PROGRAMMING

1. CNC Machining Centre
   - i) Linear Cutting.
   - ii) Circular cutting.
   - iii) Cutter Radius Compensation.
   - iv) Canned Cycle Operations.
2. CNC Turning Centre
   - i) Straight, Taper and Radial Turning.
   - ii) Thread Cutting.
   - iii) Rough and Finish Turning Cycle.
   - iv) Drilling and Tapping Cycle.

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3. Calibration and use of linear measuring instruments – Vernier caliper, micrometer, Vernier height gauge,
4. Calibration and use of measuring instruments depth micrometer, Comparators.
5. Measurement of angles using a bevel protractor, sine bar and autocollimator.
6. Measurement of transmission elements - screw thread parameters – Three wire method.
7. Measurement of gear parameters
8. Measurement of features in a prismatic component using Coordinate Measuring Machine (CMM).

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Michael Fitzpatrick, Machining and CNC Technology, McGraw-Hill Education; 4th edition, 2018.
2. Jain R.K. "Engineering Metrology", Khanna Publishers, 22nd Edition, 2022.

REFERENCE BOOKS:

1. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India,7th Edition, 2018.
2. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2018.
3. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education ,6th Edition, 2013.
4. Berry Leathan – Jones, "Introduction to Computer Numerical Control", Pitman, London, 1987.
5. Radhakrishnan P, "Computer Numerical Control Machines and Computer Aided Manufacturer", New Central Book Agency, 2018.

WEB RESOURCES:

1. https://www.matweb.com

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112/106/112106138/
2. https://nptel.ac.in/courses/112/106/112106179/
3. https://nptel.ac.in/courses/112/104/112104250/
4. https://nptel.ac.in/courses/112/103/112103261/
5. https://nptel.ac.in/courses/112/106/112106140/
6. https://nptel.ac.in/courses/112/107/112107242/
7. https://nptel.ac.in/courses/112/107/112107259/

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OUTCOMES

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

1. Determine the fundamentals of CNC machines(K3)
2. Examine the various drives and Work holding devices used in CNC Machine tools. (K3)
3. Structure the programs for CNC machine tools(K4)
4. Explain the concepts of linear measurements applicable to various metrological instruments(K4)
5. Analyze the concepts of angular measurement as applied to various metrological instruments (K4)
6. Evaluate advancements in metrology through experimental investigation (K5)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

24CEPC405 105104160 SDG NO. 4, 9	STRENGTH OF MATERIALS	L	T	P	CP	C
		3	0	0	3	3

OBJECTIVES:

- To calculate stresses and deformations in simple and compound bars under axial loads.
- To determine thermal stresses in bars and analyze principal stresses
- To solve problems involving stress and deformation in thin and thick pressure vessels.
- To analyze torsion problems in shafts and calculate stresses in helical springs
- To draw shear force and bending moment diagrams and compute bending stresses in beams
- To calculate beam deflections and determine buckling loads for columns.

MODULE - I STRESS, STRAIN & DEFORMATIONS OF SOLIDS 8

Definition of Stress and Strain – Tension, Compression and Shear Stresses. Stress-Strain relationship and Hooke's law. Deformation of simple bars and compound bars. Elastic constants and their relations.

MODULE - II THERMAL STRESSES AND ANALYSIS OF STATE OF STRESS 7

Thermal stresses – Bars in Series and Bars in Parallel. Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

MODULE - III THIN AND THICK SHELLS 7

Stresses and deformation in thin and thick cylinders subjected to internal pressure. Stresses and deformation in thin and thick spherical shells subjected to internal pressure.

MODULE - IV TORSION AND SPRINGS 7

Torsion Equation - Deformation in solid and hollows shafts, Stepped shafts. Stresses and deflection in closed coil helical springs with axial load.

MODULE - V STRESSES IN BEAMS 8

Transverse loading on beams – Shear force and bending moment diagram – Cantilever, simply supported and over hanging beams. Theory of simple bending – bending stress distribution.

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Meeting No. 89 Dated: 6/8/25

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MODULE - VI DEFLECTION OF STRUCTURAL ELEMENTS **8**

Computation of slope and deflection in beams – Double Integration method, Macaulay's method.

Column - Computation of buckling load using Euler's Equation and Rankine Formula.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Ferdinand P. Beer and E. Russell Johnston Jr., "Mechanics of Materials", 7th Edition in S.I. Units, McGraw Hill Education (India) Pvt. Ltd., 2017.
2. Bansal, R.K., "A Text Book of Strength of Materials", Laxmi Publications (P) Ltd. New Delhi, 2024.

REFERENCES:

1. Rajput, R.K., "A Textbook of Strength of Materials (Mechanics of Solids) SI Units, 7/e (LPSPE)", S. Chand Publications, 2022.
2. Jindal U.C., "Strength of Materials", 2nd Edition, Pearson India Education, 2018.
3. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2016.
4. Hibbeler, R.C., "Mechanics of Materials", Pearson India Education, 2017.

WEB RESOURCES:

1. http://ocw.mit.edu/courses/mechanical-engineering
2. http://nitc.ac.in/index.php/?url=users/view/270/12/3

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/105/106/105106116/
2. https://nptel.ac.in/courses/112/106/112106141/
3. https://nptel.ac.in/courses/105/106/105106172/
4. https://nptel.ac.in/courses/112/107/112107146/
5. https://nptel.ac.in/courses/112/107/112107147/

OUTCOMES

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

1. Apply the concepts of stress and strain to determine the deformation of deformable bodies. (K3)
2. Determine the stresses developed due to thermal response and in inclined plane due to axial load. (K3)

3. Compute the Stresses and deformation of thin and thick vessels subjected to internal pressure. (K3)
4. Calculate the dimensions and deformation of cylindrical member's subjected to torsional load. (K3)
5. Compute the stresses and dimensions of the structural member subjected to transverse load. (K3)
6. Determine the deflection in structural member subjected to transverse load and Axial Load. (K3)

CO – PO, PSO MAPPING:

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

Recommended by
Board of Studies of Civil dept.
Meeting No. 98 Dated: 4/6/25

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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

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

GENERAL AWARENESS **4**

GA 1 General Knowledge 4

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
BORDER & COASTAL AREAS		**2**
BCA 1	History, Geography & Topography of Border/Coastal areas	2
		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
BASIC FLIGHT INSTRUMENTS		**3**
FI 1	Basic Flight Instruments	3
AERO MODELLING		**3**
AM 1	Aero Modelling Capsule	3
GENERAL SERVICE KNOWLEDGE		**2**
GSK 4	Latest Trends & Acquisitions	2
AIR CAMPAIGNS		**6**
AC 1	Air Campaigns	6
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

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Meeting No. 6 Dated: 1/6/24

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SEMESTER - IV

24MUPL401 - SDG NO. 4,9,12,13	SOM AND FLUID POWER SYSTEMS LABORATORY	L	T	P	CP	C
		0	0	4	4	2

OBJECTIVES:

- To enable the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the mechanical properties of materials under externally applied loads
- To enable the students to have a clear understanding of the losses in pipe flow
- To understand the flow measurements.
- To analyses the Performance of various Pumps and Turbines
- To know Microprocessor programming
- To design, model and analyse basic Electrical, Hydraulic & Pneumatic Systems

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Determination of friction factor for a given set of pipes.
9. Conducting experiments and drawing the characteristic curves of centrifugal pump/submergible pump
10. Conducting experiments and drawing the characteristic curves of reciprocating pump.
11. Conducting experiments and drawing the characteristic curves of Gear pump.
12. Stepper motor interface.
13. Traffic light interface.
14. Speed control of DC motor.
15. Study of various types of transducers.
16. Study of hydraulic, pneumatic and electro-pneumatic circuits.
17. Modelling and analysis of basic hydraulic, pneumatic and electrical circuits using Software.

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18. Study of PLC, Design and Development of Colour Sorting Conveyor system, Pick and place conveyor system using sensors and PLC.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Universal Tensile Testing machine with double shear attachment – 40 Ton Capacity.
2. Torsion Testing Machine (60 NM Capacity).
3. Impact Testing Machine (300 J Capacity).
4. Brinell Hardness Testing Machine.
5. Rockwell Hardness Testing Machine.
6. Spring Testing Machine for tensile and compressive loads (2500 N).
7. Pipe Flow analysis setup.
8. Centrifugal pump/submergible pump setup.
9. Reciprocating pump setup.
10. Gear pump setup.
11. Basic Pneumatic Trainer Kit with manual and electrical controls/ PLC Control each.
12. Basic Hydraulic Trainer Kit.
13. Hydraulics and Pneumatics Systems Simulation Software.

TOTAL : 45 PERIODS

OUTCOMES

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

1. Explain and perform different destructive testing's such as Tension test, Shear test, Impact test, Hardness test to estimate the strength under externally applied loads with due consideration to safety. (K3)
2. Estimate the elastic constants of the given specimen through Deflection testing and spring testing with standard values. (K3)
3. Analyze fluid flow characteristics using flow measuring devices by calculating flow rate, frictional and minor losses in pipes, and demonstrate control system operations using PLCs and microcontrollers (K4)

CO – PO, PSO MAPPING:

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

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SEMESTER - IV

24MUPT401 - SDG NO. 4,9,12	ADDITIVE MANUFACTURING LABORATORY WITH THEORY	L	T	P	CP	C
		1	0	4	5	3

OBJECTIVES:

- To expose and train students in various Additive Manufacturing (AM) techniques for producing physical components across industrial applications.
- To familiarize students with software tools and data processing methods that support product development and prototyping.
- To enable students to apply concepts of vat polymerization in the fabrication of components.
- To provide understanding and application of powder bed fusion and direct energy deposition processes.
- To impart knowledge on the principles and applications of binder jetting and material jetting processes.
- To introduce the sheet lamination process, including Laminated Object Manufacturing (LOM), and evaluate its role in AM.

MODULE - I INTRODUCTION TO ADDITIVE MANUFACTURING 2+8

Overview - Need and Development of Additive Manufacturing (AM) Technology: Rapid Prototyping - Rapid Tooling – Rapid Manufacturing. AM Process Chain - Classification - Benefits.

List of Experiments

1. Introduction to Additive Manufacturing.
2. Generating STL files from the CAD Models & Working on STL files.

MODULE - II DESIGN FOR ADDITIVE MANUFACTURING (DFAM) 2+8

Concepts and Objectives - AM Unique Capabilities - Part Consolidation - Topology Optimization - DFAM for Part Quality Improvement. Data Processing - CAD Model Preparation

List of Experiments

1. Processing the CAD data in open source software.
2. Simulation in Catalyst Software for optimizing build-time and material consumption.

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MODULE - III VAT POLYMERIZATION **2+8**

Photo polymerization - Stereo lithography Apparatus (SLA) - Materials - Process –Advantages - Limitations- Applications. Digital Light Processing (DLP) - Materials – Process - Advantages - Applications.

List of Experiments

1. Fabricating physical part on SLA 3D printer for the automotive applications.
2. Fabricating physical part on SLA 3D printer for manufacturing applications.

MODULE - IV POWDER BED FUSION **2+8**

Powder Bed Fusion: Selective Laser Sintering (SLS): Process – Powder Fusion Mechanism – Process Parameters – Typical Materials and Application.

List of Experiments

1. 3D Modeling & NC Code Generation–Flange of Flange Coupling
2. 3DModeling & NC Code Generation – Tapper Key & Shaft of Flange Coupling

MODULE - V DIRECT ENERGY DEPOSITION **2+8**

Selective Laser Melting (SLM) and Electron Beam Melting (EBM): Materials – Process - Advantages and Applications. Beam Deposition Process: Laser Engineered Net Shaping (LENS) - Process -Material Delivery - Process Parameters -Materials -Benefits -Applications.

List of Experiments

1. 3D Modeling & NC Code Generation –Hex Nut &Bolt of Flange Coupling
2. 3D Printing of Fork, Centre Block & Key of Universal Coupling

MODULE - VI OTHER ADDITIVE MANUFACTURING PROCESSES & POST PROCESSING TECHNIQUES **2+8**

Binder Jetting: Three Dimensional Printing - Materials -Process - Benefits and Limitations. Material Jetting: Multi-jet Modeling- Materials - Process - Benefits. Sheet Lamination Process: Laminated Object Manufacturing (LOM)

List of Experiments

1. Removing the supports & post processing (cleaning the surfaces).
2. Evaluating the quality of the fabricated part in terms of surface finish and dimensional accuracy.

TOTAL : 45 PERIODS

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TEXT BOOKS:

1. Andreas Gebhardt and Jan-Steffen Hotter, "Additive Manufacturing: 3DPrinting for Prototyping and Manufacturing", Hanser publications, United States, 2015
2. Ian Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", 2ndedition, Springer, United States, 2015.

REFERENCE BOOKS:

1. Amit Bandyopadhyay and Susmita Bose, "Additive Manufacturing", 1st Edition, CRC Press., United States, 2015.
2. Andreas Gebhardt, "Understanding Additive Manufacturing: RapidPrototyping, Rapid Manufacturing", Hanser Gardner Publication, Cincinnati., Ohio, 2011.
3. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer., United States, 2006.
4. Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press., United States, 2011.
5. Milan Brandt, "Laser Additive Manufacturing: Materials, Design, Technologies, and Applications", Woodhead Publishing., United Kingdom, 2016.

WEB RESOURCES:

1. https://www.sculpteo.com/en/3d-printing/3d-printing-technologies/
2. https://all3dp.com/1/types-of-3d-printers-3d-printing-technology/
3. https://3dprinting.com/what-is-3d-printing/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/107/103/107103081/
2. https://www.coursera.org/learn/3d-printing-software
3. https://nptel.ac.in/courses/112/104/112104225/

OUTCOMES

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

1. Discover about the usage of AM for various manufacturing industries. (K3)
2. Apply the principles of Design for Additive Manufacturing (DFAM) (K3)
3. Apply the steps involved in transforming a concept into a final product using Additive Manufacturing (AM) technology. (K3)

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4. Demonstrate the working principles and practical applications of vat polymerization and material extrusion processes. (K3)
5. Apply the techniques of powder bed fusion and direct energy deposition in relevant manufacturing scenarios. (K3)
6. Apply binder jetting, material jetting, and sheet lamination processes to appropriate materials by evaluating their procedures, benefits, and limitations. (K3)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

24MUTP401 - SDG NO. 4	APTITUDE SKILLS - II	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
2. Programming in ANSI C – E. Balagurusamy
3. The C Programming Language – Brian W. Kernighan and Dennis M. Ritchie
4. C: How to Program – Paul Deitel and Harvey Deitel
5. Problem Solving and Program Design in C – Jeri R. Hanly and Elliot B. Koffman

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LIFE SKILLS, RANGER AND ROVER & BIS STANDARDS - PHASE 2

OBJECTIVES:

- Implement strategies to learn career and managerial skills for career growth.
- Understand the standards relevant to Mechanical.

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 entrepreneurships - 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 STANDARDS AND APPLICATIONS OF MECHANICAL TESTING AND FERROUS & NON-FERROUS METALS 6

Mechanical testing of metals: Brief introduction of Indian standards on destructive testing of metals. Important test methods explained in brief like scope, principle of test, test piece dimensions, method of test, representation of the results and report of the test. Test covered are tensile test, hardness tests- Vickers, Brinell, Rockwell and Charpy impact test

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Applications of ferrous and non-ferrous metals: Brief introduction of important standards on ferrous and non-ferrous products. Examples of various applications of ferrous and non-ferrous metals. i.e. Steel Tubes & Pipes, Structural steel, wear and abrasion resistant steel, Weathering steel, Galvanized steel, automotive steel, precoated and painted steel, stainless steel, low nickel stainless steel, alloy steel, cold heading steel, aluminium for castings, EC grade aluminium, copper rods for electrical purpose, Copper sheets, non-ferrous metals standards for trade on exchanges etc . Terminology standards offerrous and non-ferrous metals.

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

OUTCOMES

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

1. Understand and apply the fundamentals of C programming for problem-solving. (K2)
2. Utilize control structures, operators, and functions to write modular programs. (K2)
3. Implement pointers and arrays for efficient memory and data management. (K2)
4. Solve real-world problems by designing and optimizing algorithms. (K2)
5. Demonstrate career and managerial skills. (K2)
6. Explain the principles of standardized mechanical testing methods and illustrate the applications of ferrous and non-ferrous metals in accordance with relevant Indian standards. (K2)

CO – PO, PSO MAPPING:

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

SEMESTER - IV

24MUID401 - 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.

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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.
4. 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:

1. First evaluation (Immediately after first internal examination): 20 marks (Focus on refined problem statement, advanced MVP design, and detailed development plan)
2. Second evaluation (Immediately after second internal examination): 30 marks (Focus on prototype/MVP implementation, initial testing, and preliminary market validation results)
3. 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:

1. Apply structured entrepreneurial exploration to convert innovative ideas into venture blueprints, incorporating user-centric and iterative design approaches. (K4)
2. Assess customer behavior and market traction to align product strategies with ethical and sustainable entrepreneurship principles. (K5)

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3. 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
CO1	3	3	2	-	-	-	-	2	-	-	-	2	2
CO2	3	3	2	-	-	-	-	2	-	-	-	2	2
Co3	3	3	2	-	-	-	-	2	-	-	-	2	2

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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.**

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Sai Prakash Leo Muthu

Chairman & CEO - Sairam Institutions

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