Sri

SAI RAM INSTITUTE OF TECHNOLOGY

An Autonomous Institution

West Tambaram, Chennai - 44

www.sairamit.edu.in

Approved by AICTE, New Delhi
Affiliated to Anna University

DEPARTMENT OF MECHANICAL ENGINEERING

AUTONOMOUS

CURRICULUM AND

SYLLABUS I - IV

SEMESTERS

REGULATIONS 2020

Academic Year 2020-21 onwards

SRI SAIRAM INSTITUTE OF TECHNOLOGY

VISION

To be identified as a "Centre of Excellence" with high standards of Knowledge Dissemination and Research opportunities and to transform the students to imbibe qualities of technical expertise of international standards and high levels of ethical values, who in turn shall contribute to the advancement of society and human kind.

MISSION

We shall dedicate and commit ourselves to attain and maintain excellence in Technical Education through commitment and continuous improvement of infrastructure and equipment and provide an inspiring environment for Learning, Research and Innovation for our students to transform them into complete human beings with ethical and social values.

QUALITY POLICY

We at Sri Sai Ram Institute of Technology are committed to build a better nation through Quality Education with team spirit. Our students are enabled to excel in all values of Life and become Good Citizens. We continually improve the System, Infrastructure and Services to satisfy the Students, Parents, Industry and Society.

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

Establish the department with high quality education and to create opportunities for research and development in the field of Mechanical engineering and to create innovative, entrepreneurial and successful mechanical engineers together with human values, and ethically strong to serve the society.

MISSION

The Department imparts high quality technical knowledge and provides research environment with well-established and continuously improving infrastructure and laboratories, to keep up with the development across the globe, while training the students successfully to establish themselves in the society through the social and ethical learning.

AUTONOMOUS CURRICULUM AND SYLLABI
Regulations 2020

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA101	Engineering Mathematics-I	3	1	0	4	4
2	20HSEN101	Technical English-I	3	0	0	3	3
3	20BSPH101	Engineering Physics	3	0	0	3	3
4	20BSCY101	Engineering Chemistry	3	0	0	3	3
5	20ESCS101	Problem solving and Programming in C	3	0	0	3	3
6	20ESGE101	Engineering Graphics	1	2	0	3	3
PRACTICAL							
7	20BSPL101	Physics and Chemistry Lab	0	0	3	3	1.5
8	20ESPL101	Programming in C lab	0	0	3	3	1.5
VALUE ADDITIONS - I							
9	20TPHS101	Skill Enhancement	0	0	2	2	1
10	20HSMG101	Personal Values	2	0	0	2	0
TOTAL						**29**	**23**

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA201	Engineering Mathematics-II	3	1	0	4	4
2	20HSEN201	Technical English-II	3	0	0	3	3
3	20ESIT201	Python Programming with Lab	3	0	2	5	4
4	20BSCY201	Environmental Science and Engineering	3	0	0	3	3
5	20ESEE201	Electrical Technology with Lab	3	0	2	5	4
6	20BSPH202	Physics of Materials	3	0	0	3	3
PRACTICAL							
7	20ESGE201	Engineering Practices Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - II							
8	20TPHS201	Skill Enhancement	0	0	2	2	1
9	20HSMG201	Interpersonal Values	2	0	0	2	0
		TOTAL				**31**	**23.5**

SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
		THEORY					
1	20ESCE201	Engineering Mechanics	3	0	0	3	3
2	20MEPC301	Manufacturing Processes	3	0	0	3	3
3	20MEPC302	Basic Thermal Sciences	3	1	0	4	4
4	20MEPC303	Engineering Metallurgy	3	0	0	3	3
5	20BSMA303	Partial Differential Equations and Probability Theory	3	1	0	4	4
6	20CEPC306	Fluid Mechanics and Machinery	3	0	0	3	3
		PRACTICAL					
7	20MEPL301	Manufacturing Processes Laboratory	0	0	3	3	1.5
8	20MEPL302	Computer Aided Drafting Laboratory	0	0	3	3	1.5
		VALUE ADDITIONS - III					
9	20METE301	Live-in Lab I	0	0	2	2	1
10	20METP301	Skill Enhancement	0	0	2	2	1
		TOTAL				**27**	**25**

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
		THEORY					
1	20MEPC401	Measurement and Control Systems	3	0	0	3	3
2	20MEPC402	Metrology, Measurements and Computer Aided Inspection	3	0	0	3	3
3	20MEPC403	Computer Aided Design and Manufacturing	3	0	0	3	3
4	20MEPC404	Applied Thermal Sciences	3	0	0	3	3
5	20BSMA403	Statistics and Numerical Methods	3	1	0	4	4
6	20CEPC405	Strength of Materials	3	0	0	3	3
		PRACTICAL					
7	20MEPL401	Metrology and Measurements Laboratory	0	0	3	3	1.5
8	20CEPL403	Strength of Materials and Fluid Mechanics & Machinery Laboratory	0	0	3	3	1.5
		VALUE ADDITIONS - IV					
9	20METE401	Live-in Lab II	0	0	2	2	1
10	20METP401	Skill Enhancement	0	0	2	2	1
		TOTAL				**29**	**24**

SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
		THEORY					
1	20MEPC501	Automotive Systems	3	0	0	3	3
2	20MEPC502	Robotics	3	0	0	3	3
3	20MEPC503	Theory of Machines	3	0	0	3	3
4	20MEPC504	Design of Machine Elements	3	1	0	4	4
5	20XXELXXX	Professional Elective-I	3	0	0	3	3
		PRACTICAL					
6	20MEPL501	3D Modeling and Computer Aided Manufacturing Laboratory	0	0	3	3	1.5
7	20MEPL502	Kinematics and Dynamics Laboratory	0	0	3	3	1.5
8	20HSPL501	Communication and Soft Skills Laboratory	0	0	2	2	1
9	20METE501	Live-in Lab III	0	0	4	4	2
		VALUE ADDITIONS - V					
10	20METP501	Skill Enhancement	0	0	2	2	1
		TOTAL				**30**	**23**

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
		THEORY					
1	20MEPC601	Design of Transmission Systems	3	0	0	3	3
2	20MEPC602	Heat Transfer	3	0	0	3	3
3	20MEPC603	Mechatronics	3	0	0	3	3
4	20XXELXXX	Professional Elective-II	3	0	0	3	3
5	20XXOEXXX	Open Elective-I	3	0	0	3	3
		PRACTICAL					
6	20MEPL601	Thermal Science Laboratory	0	0	3	3	1.5
7	20MEPL602	Mechatronics and Robotics Laboratory	0	0	3	3	1.5
8	20MEPJ601	Innovative Design and Fabrication Project	0	0	2	2	1
		VALUE ADDITIONS - VI					
9	20METP601	Skill Enhancement	0	0	2	2	1
10	20MGMC301	Constitution of India	2	0	0	2	0
		TOTAL				**27**	**20**

SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20HSMG601	Principles of Engineering Management	3	0	0	3	3
2	20MEPC701	Finite Element Analysis	3	0	0	3	3
3	20MEPW701	3D Printing and Sustainable Design with Lab	3	0	2	5	4
4	20XXELXXX	Professional Elective-III	3	0	0	3	3
5	20XXOEXXX	Open Elective-II	3	0	0	3	3
PRACTICAL							
6	20MEPL701	Computer Aided Simulation and Analysis Laboratory	0	0	3	3	1.5
7	20MEPJ701	Project Phase-I	0	0	4	4	2
VALUE ADDITIONS - VII							
8	20METP701	Skill Enhancement	0	0	2	2	1
TOTAL						**26**	**20.5**

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20XXELXXX	Professional Elective - IV	3	0	0	3	3
PRACTICAL							
2	20MEPJ801	Project Phase - II	0	0	8	8	4
TOTAL						**11**	**7**

CREDIT DISTRIBUTION

Category	BS	ES	HS	EL	PC+PL	PW	OE	TE	PJ	TP	IS	MC	TOTAL
Credit	29.5	10	20	12	66.5	4	6	4	7	7	3	Y	169
Percentage	17.46	5.92	11.83	7.10	39.35	2.37	3.55	2.37	4.14	4.14	1.78	-	100

*IS-Internship

PROFESSIONAL ELECTIVES - I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT
			L	T	P		
1	20MEEL501	Gas Dynamics and Jet Propulsion	3	0	0	3	3
2	20MEEL502	Power Plant Technology	3	0	0	3	3
3	20MEEL503	Alternative Fuels	3	0	0	3	3
4	20MEEL504	Thermal Environmental Engineering	3	0	0	3	3
5	20MEEL505	Environmental & Energy Management	3	0	0	3	3
6	20MEEL506	Applied Hydraulics and Pneumatics	3	0	0	3	3
7	20MEEL507	Robot Kinematics And Dynamics	3	0	0	3	3
8	20MEEL508	Mechanical Behaviour of Materials	3	0	0	3	3
9	20MEEL509	Product Design and Development	3	0	0	3	3
10	20MEEL510	Non Traditional Machining Techniques	3	0	0	3	3
11	20MEEL511	Material Joining Techniques	3	0	0	3	3
12	20MEEL512	Precision Manufacturing	3	0	0	3	3
13	20MEEL513	Metal Additive Manufacturing Processes	3	0	0	3	3
14	20MEEL514	Process Planning and Cost Estimation	3	0	0	3	3
15	20MEEL515	Industrial Engineering	3	0	0	3	3
16	20MGEL801	Intellectual Property Rights	3	0	0	3	3
17	20HSMG301	Professional Ethics and Values	3	0	0	3	3

PROFESSIONAL ELECTIVES - II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT
			L	T	P		
1	20MEEL601	Renewable Energy Sources	3	0	0	3	3
2	20MEEL602	Turbo Machines	3	0	0	3	3
3	20MEEL603	Design of Pressure Vessels and Piping	3	0	0	3	3
4	20MEEL604	Energy Efficiency and Sustainability	3	0	0	3	3
5	20MEEL605	Energy Conservation in Industries	3	0	0	3	3
6	20MEEL606	IOT for Mechanical & Manufacturing Industry	3	0	0	3	3
7	20MEEL607	Programming for Robotics	3	0	0	3	3
8	20MEEL608	Automotive Infotronics	3	0	0	3	3
9	20MEEL609	Product Life Cycle Management	3	0	0	3	3
10	20MEEL610	Micro Electro Mechanical Systems (MEMS)	3	0	0	3	3
11	20MEEL611	Non Destructive Testing and Evaluation	3	0	0	3	3
12	20MEEL612	Materials Characterization	3	0	0	3	3
13	20MEEL613	Green Manufacturing Systems and Strategies	3	0	0	3	3
14	20MEEL614	Lean and Agile Manufacturing	3	0	0	3	3
15	20MEEL615	Logistics & Supply Chain Management	3	0	0	3	3
16	20MGEL601	Total Quality Management	3	0	0	3	3

PROFESSIONAL ELECTIVES - III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT
			L	T	P		
1	20MEEL701	Computational Fluid Dynamics	3	0	0	3	3
2	20MEEL702	Refrigeration, Air Conditioning and Cryogenic Systems	3	0	0	3	3
3	20MEEL703	Biogas Engineering	3	0	0	3	3
4	20MEEL704	Energy Conservation and Waste Heat Recovery	3	0	0	3	3
5	20MEEL705	Hybrid Vehicles	3	0	0	3	3
6	20MEEL706	Computer Integrated Manufacturing Systems	3	0	0	3	3
7	20MEEL707	Industrial Robotics And Material Handling Systems	3	0	0	3	3
8	20MEEL708	Artificial Intelligence for Robotics	3	0	0	3	3
9	20MEEL709	Design for Manufacturing	3	0	0	3	3
10	20MEEL710	Virtual Prototyping	3	0	0	3	3
11	20MEEL711	Tool Design	3	0	0	3	3
12	20MEEL712	Composite Materials and Mechanics	3	0	0	3	3
13	20MEEL713	Wear, Corrosion and Surface Protection of Materials	3	0	0	3	3
14	20MEEL714	Project Planning and Management	3	0	0	3	3
15	20MEEL715	Six Sigma Quality	3	0	0	3	3
16	20MGEL701	Economics for Engineers	3	0	0	3	3
17	20HSMG601	Statistical Quality Control and Reliability Engineering	3	0	0	3	3

PROFESSIONAL ELECTIVES - IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT
			L	T	P		
1	20MEEL801	Advanced Internal Combustion Engines	3	0	0	3	3
2	20MEEL802	Microrobotics	3	0	0	3	3
3	20MEEL803	Smart Manufacturing	3	0	0	3	3
4	20MEEL804	Polymer Materials and their Processing	3	0	0	3	3
5	20MEEL805	Industrial Safety and Maintenance Engineering	3	0	0	3	3
6	20MEEL806	Theory of Vibrations and Noise Control	3	0	0	3	3
7	20MEEL807	Systems Engineering	3	0	0	3	3
8	20MEEL808	Machine Vision Systems & Imaging Techniques	3	0	0	3	3
9	20MEEL809	Fatigue Design & Analysis	3	0	0	3	3
10	20MGEL703	Entrepreneurship Development	3	0	0	3	3

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Successfully complete or pursue graduate education in mechanical engineering and related fields, participate in professional development and/or industrial training courses, and/or obtain engineering certification.

PEO2 Participate in research and development, and other creative and innovative efforts in science, engineering, and technology, and/or pursue entrepreneurial endeavors.

PEO3 Exchanging and applying knowledge to create new opportunities that advance our society and solve a variety of technical and societal problems.

PEO4 Retain the intellectual curiosity that motivates lifelong learning and allows for a flexible response to the rapidly evolving challenges.

PEO5 Conduct themselves in a responsible, professional and ethical manner.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1 An ability to identify, analyze and solve engineering problems relating to mechanical systems together with allied engineering streams.

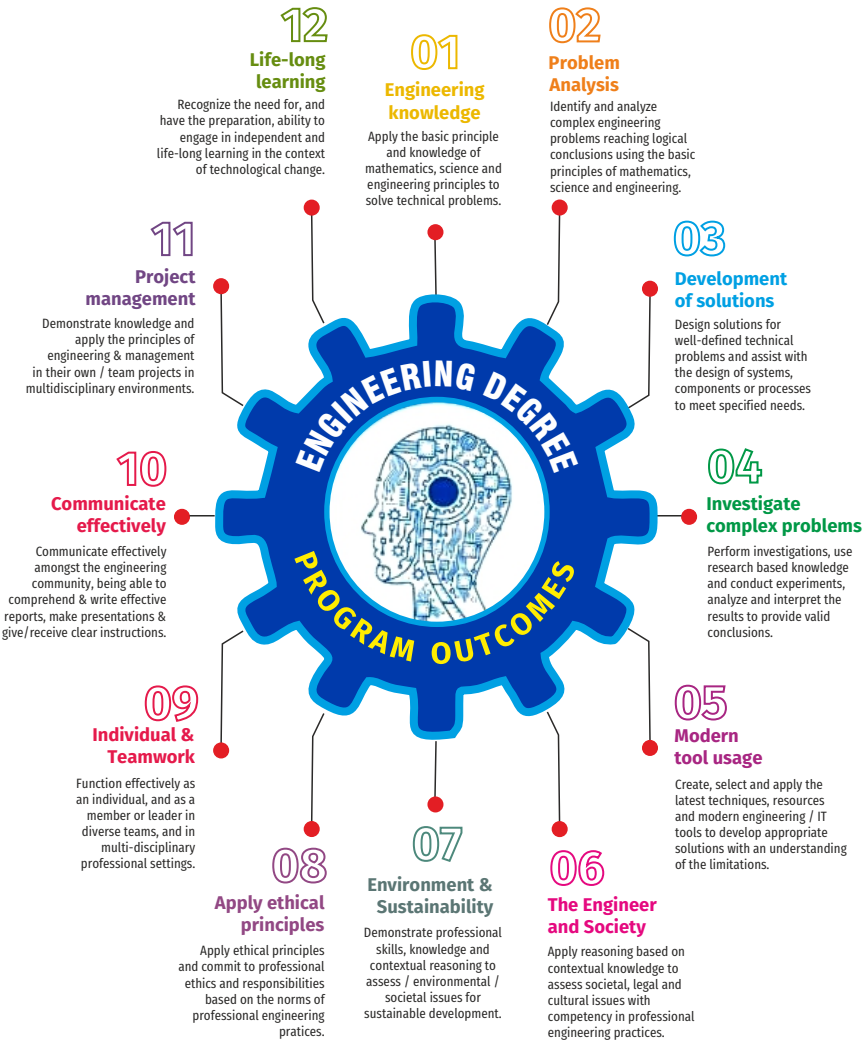
PSO2 An ability to build the nation, by imparting technological inputs and managerial skills to become Technocrats and Entrepreneurs, build the attitude of developing new concepts on emerging fields and pursuing advanced education.

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)	17.46	31	29.5
Engineering Sciences(ES)	11.83	25	20
Humanities and Social Sciences (HS)	5.92	12	10
Professional Electives(EL)	7.10	12	12
Program Core+Program Lab (PC+PL)	39.35	80	66.5
Program theory with Lab (PW)	2.37	5	4
Open Electives (OE)	3.55	6	6
Talent Enhancement (TE)	2.37	8	4
Project (PJ)	4.14	14	7
Training & Placement (TP)	4.14	14	7
Internships/Seminars (IS)	1.78	-	3
Mandatory Courses (MC)	NA	06	NA
Total number of Credits		**213**	**169**

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 the basic principle and knowledge of mathematics, science and engineering principles to solve technical problems.

02 Problem Analysis
Identify and analyze complex engineering problems reaching logical conclusions using the basic principles of mathematics, science and engineering.

03 Development of solutions
Design solutions for well-defined technical problems and assist with the design of systems, components or processes to meet specified needs.

04 Investigate complex problems
Perform investigations, use research based knowledge and conduct experiments, analyze and interpret the results to provide valid conclusions.

05 Modern tool usage
Create, select and apply the latest techniques, resources and modern engineering / IT tools to develop appropriate solutions with an understanding of the limitations.

06 The Engineer and Society
Apply reasoning based on contextual knowledge to assess societal, legal and cultural issues with competency in professional engineering practices.

07 Environment & Sustainability
Demonstrate professional skills, knowledge and contextual reasoning to assess / environmental / societal issues for sustainable development.

08 Apply ethical principles
Apply ethical principles and commit to professional ethics and responsibilities based on the norms of professional engineering pratices.

09 Individual & Teamwork
Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary professional settings.

10 Communicate effectively
Communicate effectively amongst the engineering community, being able to comprehend & write effective reports, make presentations & give/receive clear instructions.

11 Project management
Demonstrate knowledge and apply the principles of engineering & management in their own / team projects in multidisciplinary environments.

12 Life-long learning
Recognize the need for, and have the preparation, ability to engage in independent and life-long learning in the context of technological change.

SEMESTER - I

20BSMA101 SDG NO. 4 & 9	ENGINEERING MATHEMATICS-I	L	T	P	C
		3	1	0	4

OBJECTIVES:

The intent of this course is

- The intent of the course is to understand, gain the knowledge of matrix algebra.
- To introduce the concepts of limits, continuity, derivatives and maxima and minima.
- To acquaint the concept of improper integrals and the properties of definite integrals.
- To provide understanding of double integration, triple integration and their application.
- To introduce the concept of sequence and series and impart the knowledge of Fourier series.

UNIT I MATRICES 12

Symmetric, skew symmetric and orthogonal matrices; Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem(excluding proof) – Reduction of a Quadratic form to Canonical form using Orthogonal Transformation - Nature of Quadratic forms.

UNIT II DIFFERENTIAL CALCULUS 12

Limit, continuity, Differentiation rules - Maxima and Minima of functions of one variable, partial derivatives, Taylor's series for functions of two variables, Jacobian, Maxima & Minima of functions of several variables, saddle points, Method of Lagrange multipliers.

UNIT III INTEGRAL CALCULUS 12

Evaluation of definite and improper integral - Techniques of Integration- Substitution rule - Integration by parts, Integration of rational functions by partial fraction, Integration of irrational functions - Applications of definite integrals to evaluate surface areas and volumes of revolution.

UNIT IV MULTIPLE INTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

UNIT V SEQUENCES AND SERIES 12

Introduction to sequences and series – power series – Taylor's series – series for exponential, trigonometric, logarithmic, hyperbolic functions – Fourier series – Half range Sine and Cosine series – Parseval's theorem.

TOTAL: 60 PERIODS

TEXTBOOKS:

1. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
2. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.

REFERENCES:

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic Geometry", 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
3. T. Veerarajan, "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
4. N.P. Bali and Manish Goyal, "A text-book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.
5. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2014.

WEB REFERENCES:

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

ONLINE RESOURCES:

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

OUTCOMES:

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

1. Understand the concepts of symmetric, skew symmetric, orthogonal matrices, properties of Eigen values and eigen vectors, the nature of a

quadratic form, sequences and series, power series representation of functions, series representation of exponential, trigonometric logarithmic and hyperbolic functions. (K2)

2. Compute the eigen values, eigen vectors of a matrix, diagonalize the quadratic form using orthogonal transformation and find the inverse and higher powers of a matrix using Cayley Hamilton theorem. (K3)
3. Calculate the limit, derivative, partial derivatives, Jacobians of simple functions and evaluate integrals of single variable using the rules of integration. (K3)
4. Determine the Taylor series representation of functions of one variable and two variables and evaluate maxima and minima of functions of one variable, two variables and several variables. (K3)
5. Evaluate double integrals using change of order technique, double and triple integrals using change of variables technique and calculate surface areas and volume of solids of revolution. (K3)
6. Compute the Fourier series, Sine and Cosine series representation of functions defined in a period and use Fourier series and Parseval's theorem to find the value of infinite series. (K3)

CO - PO MAPPING :

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

SEMESTER - I

20HSEN101 SDG NO. 4	TECHNICAL ENGLISH - I	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop the basic LSRW skills of the students
- To encourage the learners to adapt to listening techniques
- To help learners develop their communication skills and converse fluently in real contexts

- To help learners develop general and technical vocabulary through reading and writing tasks
- To improve the language proficiency for better understanding of core subjects

UNIT I INTRODUCTION 9

Listening – short texts – formal and informal conversations - **Speaking** – basics in speaking – speaking on given topics & situations – recording speeches and strategies to improve - **Reading –** critical reading – finding key information in a given text – shifting facts from opinions - **Writing –** free writing on any given topic – autobiographical writing - **Language Development** – tenses – voices- word formation: prefixes and suffixes – parts of speech – developing hints

UNIT II READING AND LANGUAGE DEVELOPMENT 9

Listening - long texts - TED talks - extensive speech on current affairs and discussions -Speaking – describing a simple process – asking and answering questions - **Reading** comprehension – skimming / scanning / predicting & analytical reading – question & answers – objective and descriptive answers –identifying synonyms and antonyms - process description - **Writing** instructions – **Language Development** – writing definitions – compound words - articles – prepositions

UNIT III SPEAKING AND INTERPRETATION SKILLS 9

Listening - dialogues & conversations - **Speaking** – role plays – asking about routine actions and expressing opinions - **Reading** longer texts & making a critical analysis of the given text - **Writing** – types of paragraph and writing essays – rearrangement of jumbled sentences - writing recommendations - **Language Development** – use of sequence words - cause & effect expressions - sentences expressing purpose - picture based and newspaper based activities – single word substitutes

UNIT IV VOCABULARY BUILDING AND WRITING SKILLS 9

Listening - debates and discussions – practicing multiple tasks – self introduction – **Speaking** about friends/places/hobbies - **Reading** -Making inference from the reading passage – Predicting the content of the reading passage - **Writing** – informal letters/e-mails - **Language Development** - synonyms & antonyms - conditionals – if, unless, in case, when and others – framing questions.

UNIT V LANGUAGE DEVELOPMENT AND TECHNICAL WRITING 9

Listening - popular speeches and presentations - Speaking - impromptu speeches & debates - **Reading** - articles – magazines/newspapers **Writing** – essay writing on technical topics - channel conversion – bar diagram/ graph – picture interpretation - process description - **Language Development** – modal verbs - fixed / semi-fixed expressions – collocations

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Board of Editors. Using English: A Coursebook for Undergraduate Engineers and Technologists. Orient Blackswan Limited, Hyderabad: 2015.
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai, 2011.

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://swayam.gov.in/nd1_noc19_hs31/preview
2. http://engineeringvideolectures.com/course/696

ONLINE RESOURCES:

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

OUTCOMES:

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

1. Comprehend conversations and talks presented in English (K2)
2. Speak fluently in informal and formal contexts (K1)
3. Read articles of any kind and be able to comprehend (K2)
4. Write technical concepts in simple and lucid style (K2)
5. Prepare informal letters and e-mails efficiently (K3)

6. Present technical concepts and summaries in correct grammar and vocabulary (K1)

CO - PO MAPPING :

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

SEMESTER - I

20BSPH101 SDG NO. 4	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To educate and enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology

UNIT I CRYSTAL PHYSICS 9

Single crystalline, Polycrystalline and Amorphous materials - single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal - Miller indices - Interplanar distance - Powder diffraction method - Debye Scherer formula - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - packing factor for SC, BCC, FCC and HCP structures - Polymorphism and allotropy - Diamond and Graphite structure (qualitative) - Growth of single crystals: Solution and Melt growth Techniques.

UNIT II PROPERTIES OF MATTER 9

Elasticity - Stress - strain diagram and its uses - Poisson's ratio - Relationship between three moduli of elasticity (qualitative) - Factors affecting elastic modulus and tensile strength - 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 - stress due to bending in beams.

UNIT III QUANTUM PHYSICS **9**

Black body radiation - Planck's theory (derivation) - Compton effect: theory - wave particle duality - electron diffraction - progressive waves - wave equation - concept of wave function and its physical significance - Schrödinger's wave equation - Time independent and Time dependent equations - particle in a box (one dimensional motion) - Tunneling (qualitative) - scanning tunneling microscope.

UNIT IV LASERS AND FIBER OPTICS **9**

Lasers: population of energy levels, Einstein's A and B coefficients derivation - pumping methods - resonant cavity, optical amplification (qualitative) - three level and four level laser - CO_2 laser - Semiconductor lasers: Homojunction and Heterojunction.

Fiber optics: Principle, Numerical aperture and Acceptance angle - Types of optical fibers (material, refractive index, mode) - Losses associated with optical fibers - Fiber Optical Communication system (Block diagram) - Fiber optic sensors: pressure and displacement.

UNIT V THERMAL PHYSICS **9**

Transfer of heat energy - thermal expansion of solids and liquids - bimetallic strips - thermal conduction, convection and radiation - heat conduction in solids (qualitative) - thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) - thermal insulation - applications: heat exchangers, refrigerators and solar water heaters.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. D.K. Bhattachary & 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& P.G. Kshirshagar, "A textbook of Engineering Physics", S. Chand & Co Ltd. 2016.

REFERENCES:

1. D. Halliday, . Resnick & J. Walker, "Principles of Physics", Wiley, 2015.
2. R.A. Serway, & J.W. Jewett, "Physics for Scientists and Engineers", Cengage

Learning, 2010.
3. N.K. Verma," Physics for Engineers", PHI Learning Private Limited, 2014.
4. P.A. Tipler & G. Mosca "Physics for Scientists and Engineers", W.H.Freeman, 2020.
5. Brijlal and Subramanyam, "Properties of Matter", S. Chand Publishing, 2018.
6. Shatendra Sharma & Jyotsna Sharma, "Engineering Physics", Pearson, 2018.

OUTCOMES :

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

1. Understand the basics of crystals, structures and crystal growth techniques (K3)
2. Select a right choice of materials based on their properties for potential applications / acquire fundamental knowledge on elasticity and its applications relevant to the field of engineering (K3)
3. Apply the advanced physics concepts of quantum theory to characterize the matter (K4)
4. Understand the basic concepts in laser and its types and fiber optics (K3)
5. Acquire adequate knowledge on the fundamental concepts of thermal properties of materials (K2)
6. Evaluate the applications of powder diffraction method, optical fibers in sensors, quantum mechanical tunneling and thermal materials in expansion joints and heat exchangers (K4)

CO - PO MAPPING :

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

SEMESTER - I

20BSCY101 SDG NO. 4,6&7	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques
- To illustrate the principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials
- To categorize types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels
- To demonstrate the principles and generation of energy in batteries, nuclear reactors, solar cells, windmills and fuel cells
- To recognize the applications of polymers, composites and nano-materials in various fields

UNIT I WATER TECHNOLOGY AND SURFACE CHEMISTRY 9

Water Technology : Introduction – Hard water and Soft water. Hardness of water – types – expression of hardness (numerical problems). Boiler troubles – scale and sludge, priming and foaming, caustic embrittlement and boiler corrosion. Treatment of boiler feed water – Internal treatment (carbonate, phosphate, calgon, colloidal and sodium aluminate conditioning). External treatment – Ion exchange process, Zeolite process –Domestic water treatment (break point chlorination) –Desalination of brackish water – Reverse Osmosis.

Surface Chemistry: Adsorption – types – adsorption of gases on solids – adsorption of solutes from solution – applications of adsorption –role of adsorbents in catalysis and pollution abatement.

UNIT II ELECTROCHEMISTRY AND CORROSION 9

Electrochemistry: Cells – types (electrochemical and electrolytic cell) Redox reaction – single electrode potential (oxidation potential and reduction potential) – measurement and applications –Nernst equation (derivation and problems) – electrochemical series and its significance.

Corrosion: Causes, factors and types – chemical and electrochemical corrosion (galvanic, differential aeration). Corrosion control – material selection and design aspects, cathodic protection methods (sacrificial anodic and impressed current cathodic method) and corrosion inhibitors. Paints: Constituents and its functions. Electroplating of Copper and electroless plating of Nickel.

UNIT III FUELS AND COMBUSTION 9

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 gases (LPG). Biofuels – Gobar gas and Biodiesel.

Combustion of Fuels: Introduction – calorific value – higher and lower calorific values- theoretical calculation of calorific value – flue gas analysis (ORSAT Method).

UNIT IV ENERGY SOURCES AND STORAGE DEVICES 9

Energy sources: Nuclear fission – nuclear fusion – differences between nuclear fission and fusion – nuclear chain reactions – nuclear energy – light water nuclear power plant – breeder reactor – solar energy conversion – solar cells – wind energy.

Storage devices: Batteries – types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium–ion–battery), fuel cells – H_2 -O_2 fuel cell and super capacitors.

UNIT V POLYMERS AND NANOMATERIALS 9

Polymers: Classification – types of polymerization – mechanism (Free radical polymerization) –Engineering polymers: Nylon–6, Nylon–6,6, Teflon, Kevlar and PEEK – preparation, properties and uses – Plastic and its types – Conducting polymers – types and applications. Composites – definition, types, polymer matrix composites – FRP.

Nanomaterials: Introduction – Nanoparticles, Nanoclusters, Nanorods, Nanotubes (CNT: SWNT and MWNT) and Nanowires – Properties (surface to volume ratio, melting point, optical and electrical), Synthesis (precipitation, thermolysis, hydrothermal, electrodeposition, chemical vapour deposition, laser ablation, sol-gel process) 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" DhanpatRai Publishing Company (P) LTD, New Delhi, 2015.
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

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.

OUTCOMES

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

1. Identify the origin of water resources and develop innovative methods to produce soft water for industrial use and potable water at cheaper cost. (K2)
2. Recognize the basic design of adsorption systems and its industrial applications and the basics concepts of electrochemistry to understand battery technology. (K2)
3. Apply the principles of electrochemistry to corrosion process and the applications of protective coatings to overcome the corrosion. (K3)
4. Disseminating the knowledge about the chemistry of fuels and combustion and its application in various levels. (K2)
5. Acquire the basics of non-conventional sources of energy and understand the principles and the reaction mechanism of batteries and fuel cells.. (K3)
6. Illustrate the synthesis and applications of polymers, composites and nano-materials. (K2)

CO – PO MAPPING:

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

SEMESTER - I

20ESCS101 SDG NO. 4&9	PROBLEM SOLVING AND PROGRAMMING IN C	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT I INTRODUCTION TO PROGRAMMING AND ALGORITHMS FOR PROBLEM SOLVING 10

The Basic Model of Computation, Programming Paradigms- Program Development Life Cycle - Algorithm –Pseudo Code – Flow Chart - Programming Languages - Compilation - Linking and Loading - Testing and Debugging - Documentation - Control Structures – Algorithmic Problem Solving- Problems Based on Sequential, Decision Making - Branching and Iteration.

UNIT II BASICS OF C PROGRAMMING 8

Structure of C program - C programming: Data Types – Storage Classes - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions – Input / Output Statements - Assignment Statements – Decision making Statements - Switch Statement - Looping Statements – Pre-Processor Directives - Compilation Process

UNIT III ARRAYS AND STRINGS 9

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

UNIT 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 – 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.

UNIT V STRUCTURES and FILE PROCESSING 9

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.

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. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2012.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "C How to Program", Seventh edition, Pearson Publication.
2. Jeri R. Hanly & Elliot B. Koffman, "Problem Solving and Program Design in C", Pearson Education, 2013.
3. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
6. Kanetkar Y, "Let us C", BPB Publications, 2007.
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/programming_books/gnu_c_programming_tutorial
2. https://nptel.ac.in/courses/106105171
3. https://swayam.gov.in/nd1_noc19_cs42/preview

OUTCOMES:

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

1. Develop efficient algorithms for solving a problem. (K2)
2. Use the various constructs in C to develop simple applications. (K3)
3. Design and Implement applications using Array & Strings. (K3)
4. Develop applications using Functions and Pointers. (K6)
5. Design and Develop applications using Structures. (K3)
6. Design and Develop applications using Files. (K4)

CO- PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	1	1	-	2	2	-	3	2	3
CO2	3	3	3	3	2	-	1	1	2	2	3	3	2	3
CO3	3	3	3	3	2	1	1	1	2	-	3	-	3	2
CO4	3	3	3	3	2	1	-	1	2	2	3	3	1	2
CO5	3	3	3	3	2	1	1	1	2	2	3	3	2	1
CO6	3	3	3	3	2	1	1	1	2	2	3	3	3	2

SEMESTER - I

20ESGE101 SDG NO. 4,6,7, 9, 12,14 &15	ENGINEERING GRAPHICS	L	T	P	C
		1	2	0	3

OBJECTIVES:

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

CONCEPTS AND CONVENTIONS (Not for Examination) **3**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning- Projection of Points

UNIT I PLANE CURVES AND FREEHAND SKETCHING **6+9**

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

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF LINES AND PLANE SURFACE **6+9**

Orthographic projection- principles-Principal planes- Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method- Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS **6+9**

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

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

Sectioning of prisms, pyramids, cylinder and cone in simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and truncated solids in vertical position – Prisms, pyramids cylinder and cone.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS **6+9**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinder, cone- Perspective projection of simple solids-Prisms, pyramids and cylinder by visual ray method.

TOTAL: 78 PERIODS

TEXT BOOKS:

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
2. T. Jeyapoovan, "Engineering Graphics using AUTOCAD", Vikas Publishing House Pvt Ltd, 7th Edition.

REFERENCES:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
3. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
4. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
5. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
6. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
7. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

WEB REFERENCES:

1. https://nptel.ac.in/courses/112/103/112103019/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/105/104/105104148/

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods

OUTCOMES:

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

1. Relate thoughts and ideas graphically in a neat fashion and ability to perform sketching of engineering curves used in engineering practices, multiple views of objects. (K1)
2. Understand the concepts of orthographic projections for basic geometrical constructions. (K2)
3. Acquire the knowledge of orthographic projection in three dimensional object. (K2)
4. Develop knowledge about Sectioning and apply interior shapes of solids. (K3)
5. Analyze the concepts of design in developing various 3 dimensional projections. (K4)
6. Build a strong foundation to analyze the design in various dimensions. (K4)

CO - PO , PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	2	2	-	2	2	2
CO2	3	2	2	-	-	-	-	-	2	2	-	2	2	2
CO3	3	2	2	-	-	-	-	-	2	2	-	2	2	2
CO4	3	2	2	-	-	-	-	-	2	2	-	2	2	2
CO5	3	2	2	-	-	-	-	-	2	2	-	2	2	2
CO6	3	2	2	-	-	-	-	-	2	2	-	2	2	2

SEMESTER - I

20BSPL101 SDG NO. 4	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	3	1.5

PHYSICS LABORATORY

OBJECTIVES:

- To acquaint the students with practical knowledge of physics principles in various fields such as optics, thermal physics and properties of matter for developing basic experimental skills
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis

LIST OF EXPERIMENTS (Any 5 Experiments)

1. Determination of Young's modulus by non-uniform bending method.
2. Determination of rigidity modulus –Torsion pendulum.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4. (a) Determination of wavelength and particle size using Laser.
   (b) Determination of acceptance angle in an optical fiber.
5. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of specific resistance of a given coil of wire – Carey Foster's bridge.
7. Determination of wavelength of mercury spectrum – spectrometer grating.
8. Determination of band gap of a semiconductor.
9. Determination of Hall coefficient by Hall Effect experiment.
10. Determination of solar cell characteristics.

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS / 6 (max.) STUDENTS PER EXPERIMENT

1. Young's modulus by non-uniform bending method-experimental set-up – 12 sets
2. Rigidity modulus - Torsion pendulum experimental set-up – 12 sets
3. Ultrasonic Interferometer to determine velocity of sound and compressibility of liquid – 6 sets
4. (a) Experimental set-up to find the wavelength of light, and to find particle size using Laser – 6 sets
   (b) Experimental set-up to find acceptance angle in an optical fiber – 6 sets
5. Lee's disc method- experimental set up to find thermal conductivity of a bad conductor – 6 sets
6. Experimental set-up to find specific resistance of a coil of wire-Carey Foster's Bridge – 6 sets
7. Experimental set-up to find the wavelength of mercury spectrum-spectrometer grating – 6 sets
8. Experimental set-up to find the band gap of a semiconductor – 12 sets
9. Experimental set-up to find the Hall coefficient by Hall Effect Experiment – 6 sets
10. Experimental set-up to study characteristics of solar cells – 6 sets

TEXTBOOKS:

1. J.D. Wilson& C.A. Hernandez Hall "Physics Laboratory Experiments" Houghton Mifflin Company, New York, 2010.
2. M.N. Srinivasan, S. Balasubramanian &R. Ranganathan, "Practical Physics", S. Chand & Sons educational publications, New Delhi, 2011.
3. R. Sasikumar, "Practical Physics", PHI Learning Pvt. Ltd., New Delhi, 2011.

CHEMISTRY LABORATORY

(Any five experiments to be conducted)

OBJECTIVES:

- To acquaint the students with practical knowledge of the basic concepts of chemistry, the student faces during the course of their study in the industry and engineering field
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis
- To understand and develop experimental skills for building technical competence

LIST OF EXPERIMENTS (Any five experiments to be conducted)

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water samples.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Determination of strength of given hydrochloric acid using pH meter.
6. Conductometric titration of strong acid vs strong base.
7. Estimation of iron content of the given solution using potentiometer.
8. Estimation of iron content of the water sample using spectrophotometer (1, 10- Phenanthroline / thiocyanate method).
9. Estimation of sodium and potassium present in water using flame photometers.
10. Determination of molecular weights of polymers using Ostwald's Viscometer.

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS / 6 (MAX.) STUDENTS PER EXPERIMENT.

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample - 6 sets
2. Determination of total, temporary & permanent hardness of water by EDTA method - 6 sets
3. Determination of DO content of water sample by Winkler's method - 6sets
4. Determination of chloride content of water sample by argentometric method – 6 sets
5. Determination of strength of given hydrochloric acid using pH meter - 6 sets
6. Conductometric titration of strong acid vs strong base - 6 sets
7. Estimation of iron content of the given solution using potentiometer - 6 sets
8. Estimation of iron content of the water sample using spectrophotometer (1,10- Phenanthroline / thiocyanate method) - 2 sets
9. Estimation of sodium and potassium present in water using flame photometer - 2 sets
10. Determination of molecular weights of polymer using Ostwald's Viscometer. - 6 sets

TOTAL: 30 PERIODS

TEXTBOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8th edition, 2014).

OUTCOMES:

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

1. Apply the principles of thermal physics and properties of matter to evaluate the properties of materials and to determine the physical properties of liquid using ultrasonic interferometer. (K1)
2. Understand measurement technique and usage of new instruments in optics for real time application in engineering. (K2)
3. Apply the knowledge of semiconductor materials to evaluate the band gap and Hall coefficient of materials and to study the characteristics of solar cell for engineering solutions. (K3)
4. Apply the different techniques of quantitative chemical analysis to generate experimental skills in building technical competence.(K2)
5. Apply basic techniques used in chemistry laboratories for water

analyses/purification and estimates the ions/metal ions present in domestic/industry wastewater. (K2)

6. Utilize the fundamental laboratory techniques for analyses such as volumetric titrations, conductometric, potentiometric and spectroscopy. (K2)

CO- PO MAPPING :

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

SEMESTER - I

20ESPL101 SDG NO. 4&9	PROGRAMMING IN C LABORATORY	L	T	P	C
		0	0	3	1.5

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 leap year or not? (Hint: not every centurion year 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 Armstrong number or not?
6. Write a program tocheck 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 display array elements using two dimensional arrays.
10. Write a program to perform swapping using function.
11. Write a program to display all prime numbers between two intervals using functions.
12. Write a program to reverse a sentence using recursion.
13. Write a program to get the largest element of an array using the function.
14. Write a program to concatenate two string.
15. Write a program to find the length of String.
16. Write a program to find the frequency of a character in a string.
17. Write a program to store Student Information in Structure and Display it.
18. 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.
19. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
20. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler 30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

OUTCOMES:

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

1. Solve some simple problems leading to specific applications. (K3)
2. Demonstrate C programming development environment, compiling, debugging, linking and executing a program. (K3)
3. Develop C programs for simple applications making use of basic constructs, arrays and strings. (K4)

4. Develop C programs involving functions and recursion. (K4)
5. Develop C programs involving pointers, and structures. (K6)
6. Design applications using sequential and random access file. (K4)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	1	1	1	2	2	3	3	2	3
CO2	3	3	3	3	2	1	-	1	2	2	3	3	1	3
CO3	3	3	-	3	2	-	1	1	-	2	-	3	3	2
CO4	3	3	3	3	2	1	1	1	2	2	3	3	1	3
CO5	3	3	3	-	2	-	1	-	2	2	3	-	2	1
CO6	3	3	3	3	2	1	1	1	2	-	3	3	3	2

SEMESTER - I

20TPHS101 SDG NO. 4&5	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To enrich social network ethics
- To develop and enhance browsing culture
- To understand the concepts of networking
- To promote self professionalism
- To acquire knowledge about various digital identification procedures

UNIT I SOCIAL NETWORK ETIQUETTES **6**

Introduction to social network – Social Networking Etiquettes - Pros and Cons - Usage of Facebook, Instagram, WhatsApp , Telegram, Youtube, Evolution of Android and IOS, Introduction to Linkedin & Benefits. (Practicals – Official Mail id- Linkedin Id Creation, Linkedin Profile Bulilding , Facebook Id and Creation and Modifying the existing FB ID)

UNIT II BROWSING CULTURE **6**

Introduction to browsing – Search Engines-Google - Bing -Yahoo!-AOL -MSN –DuckDuckGo ,browsers, phishing – Cookies - URL – https:// extensions , browsing history, Incognito mode- VPN – Pros and Cons – Book mark.

UNIT III NETWORKING **6**

Basics of networking - LAN, MAN, WAN, Introduction to network topologies, Protocols , IP Commands (Command line prompt), Define online complier and editor (Practicals – Find Your System IP,Ping Command, Firewall Fortinet, Basic DOS Commands)

UNIT IV PROFESSIONALISM **6**

Dress Code, Body Language, Appropriate Attire ,Communication Skills, Interview preparation – Introducing yourself - How to greet Superiors, Importance of Eye Contact During conversation.

UNIT V DIGITAL IDENTIFICATION **6**

Introduction to NAD - Importance of Aadhar, PAN Card, Passport, Bank Account, Bar Code, QR scan, Payment Gateway (Gpay, Phone Pe, UPI, BHIM, Paytm), Mobile Banking (Practicals - NAD registration Step by Step, Linking bank account with netbanking , Register for payment gateway).

TOTAL : 30 PERIODS

WEB REFERENCES :

Unit I: Social Network Etiquettes:

1. https://sproutsocial.com/glossary/social-media-etiquette/
2. https://www.shrm.org/resourcesandtools/tools-and-samples/hr-qa/pages/socialnetworkingsitespolicy.aspx
3. https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02711/full
4. https://medium.com/@sirajea/11-reasons-why-you-should-use-telegram-instead-of-whatsapp-ab0f80fbfa79
5. https://buffer.com/library/how-to-use-instagram/
6. https://www.webwise.ie/parents/what-is-youtube/
7. https://www.androidauthority.com/history-android-os-name-789433/
8. https://www.mindtools.com/pages/article/linkedin.htm

Unit II: Browsing Culture:

1. https://sites.google.com/site/bethanycollegeofteacheredn/unit--ict-connecting-with-world/national-policy-on-information-and-communication-technology-ict/accessing-the-web-introduction-to-the-browser-browsing-web
2. https://www.wordstream.com/articles/internet-search-engines-history
3. https://www.malwarebytes.com/phishing/
4. https://www.adpushup.com/blog/types-of-cookies/

5. https://www.eff.org/https-everywhere
6. https://www.sciencedirect.com/topics/computer-science/browsing-history\
7. https://www.vpnmentor.com/blog/pros-cons-vpn/
8. https://www.tech-wonders.com/2016/10/use-hush-private-bookmarking-extension-chrome.html

Unit III:Networking

1. https://www.guru99.com/types-of-computer-network.html
2. https://www.studytonight.com/computer-networks/network-topology-types
3. https://www.cloudflare.com/learning/network-layer/what-is-a-protocol/
4. https://www.howtogeek.com/168896/10-useful-windows-commands-you-should-know/
5. https://paiza.io/en

Unit IV : Professionalism

1. https://career.vt.edu/develop/professionalism.html
2. https://englishlabs.in/importance-dress-code/
3. https://www.proschoolonline.com/blog/importance-of-body-language-in-day-to-day-life
4. https://www.thespruce.com/etiquette-of-proper-attire-1216800
5. https://shirleytaylor.com/why-are-communication-skills-important/
6. https://www.triad-eng.com/interview-tips-for-engineers/
7. https://www.indeed.co.in/career-advice/interviewing/interview-question-tell-me-about-yourself
8. https://toggl.com/track/business-etiquette-rules/

Unit V: Digital Identification

1. https://nad.ndml.in/nad-presentation.html
2. https://www.turtlemint.com/aadhaar-card-benefits/
3. https://www.bankbazaar.com/pan-card/uses-of-pan-card.html
4. https://www.passportindex.org/passport.php
5. https://consumer.westchestergov.com/financial-education/money-management/benefits-of-a-bank-account
6. https://en.wikipedia.org/wiki/QR_code

7. https://www.investopedia.com/terms/p/payment-gateway.asp
8. https://www.paisabazaar.com/banking/mobile-banking/

OUTCOMES:

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

1. Learn and apply social network ethics. (K3)
2. Understand the browsing culture. (K2)
3. Analyze the networking concepts . (K4)
4. Develop self professionalism. (K3)
5. Gain hands-on experience in various digital identification procedures. (K2)
6. Analyse and apply the different digital payment gateway methods. (K4)

CO- PO MAPPING :

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

SEMESTER - I

20HSMG101 SDG NO. 4&5	PERSONAL VALUES	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Values through Practical activities

UNIT I SELF CONCEPT **6**

Understanding self Concept – Identify Yourself – Who am I – an individual, engineer, citizen – Attitude – Measuring Behaviour – Change of Behaviour – Personality – Characteristics in personal, professional life.

UNIT II INDIVIDUAL VALUES **6**

Personal Values – Attributes –Courage – Creativity, Honesty, Perfection, Simplicity, Responsibility – Measuring personal values

UNIT III MORAL VALUES **6**

Moral – Understanding right and wrong – Positive thoughts – Respect to others – Doing good to society.

UNIT IV PHYSICAL AND MENTAL WELL-BEING **6**

Health – Physical fitness –Mental vigour – Diet management – Yoga – Meditation – Peaceful life – Happiness in life

UNIT V DECISION MAKING **6**

Goal Setting – Decision making skill – Overcome of Barriers – Success – Mental strength and weakness

TOTAL: 30 PERIODS

Note:

Each topic in all the above units will be supplemented by practice exercises and classroom activities and projects.

REFERENCE BOOKS:

1. Barun K. Mitra, "Personality Development and Soft Skills", Oxford University Press, 2016.
2. B.N.Ghosh, "Managing Soft Skills for Personality Development" McGraw Hill India, 2012.

OUTCOMES:

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

1. Become an individual in knowing the self. (K4)
2. Acquire and express Personal Values, Spiritual values and fitness. (K4)
3. Practice simple physical exercise and breathing techniques. (K2)
4. Practice Yoga asana which will enhance the quality of life. (K1)
5. Practice Meditation and get benefitted. (K1)
6. Understanding moral values and need of physical fitness. (K2)

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	-	-	-	-	-	2	2	3	3	1	1	1
CO2	-	-	-	-	-	2	2	3	3	1	1	1
CO3	-	-	-	-	-	2	2	3	3	1	1	1
CO4	-	-	-	-	-	2	2	3	3	1	1	1
CO5	-	-	-	-	-	2	2	3	3	1	1	1
CO6	-	-	-	-	-	2	2	3	3	1	1	1

SEMESTER - II

20BSMA201 SDG NO. 4	ENGINEERING MATHEMATICS - II	L	T	P	C
		3	1	0	4

OBJECTIVES:

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

UNIT I VECTOR CALCULUS 12

Gradient and Directional derivatives - Divergence and Curl- Vector identities - Irrotational and Solenoidal vector fields - Line integral over a plane curve - Surface integral - Volume integral – Gauss divergence, Green's and Stoke's theorems - Verification and application in evaluating line, Surface and volume integrals.

UNIT II 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.

UNIT III COMPLEX DIFFERENTIATION 12

Analytic functions- Necessary and sufficient conditions for analyticity in cartesian and polar coordinates (without proof) - Properties - Harmonic conjugate - construction of analytic functions- Conformal mapping - Mapping by functions $w = z+a, w=az, w=1/z, w=z^2$ - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Contour integrals, Cauchy- Goursat theorem (without proof) - Cauchy Integral formula (without proof) - Taylor's series - Zeroes of Analytic functions - Singularities - Laurent's Series - Residues – Cauchy Residue theorem (without proof) – Application of Residue theorem for evaluation of real integrals – use of circular contour and semicircular contour(without poles on real axis).

UNIT V LAPLACE TRANSFORM 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 – Initial and Final value

theorems – Convolution theorem – Transform of Periodic functions – Application of solution of linear second order ordinary differential equations with constant coefficients.

TEXT BOOKS:

1. Ramana.B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
2. Erwin Kresizg, "Advance Engineering Mathematics", 9th Edition, John Wiley &Sons, 2006.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma, "Higher Engineering Mathematics", S.Chand Private Ltd., 2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2010.
3. Peter V.O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. E.A.Coddinton, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.
5. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th Edition, 2014.
6. N.P.Bali and Manish Goyal, "A text Book of Engineering Mathematics", Laxmi Publications, Reprint 2008.

WEB COURSES:

1. https://nptel.ac.in/courses/122107036/
2. https://nptel.ac.in/courses/111105134/
3. https://ocw.mit.edu/courses/mathematics/18-04-complex-variables-with-applications-spring-2018/
4. https://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall-2007/
5. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/

ONLINE RESOURCES:

1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/lecture-1-introduction/
2. http://www.nptelvideos.com/course.php?id=90

COURSE OUTCOMES:

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

1. Compute the derivatives of scalar point, vector point functions and evaluate line, surface and volume integrals of vector point functions using Stokes, Greens, and Gauss divergence theorems. (K3)
2. Solve Ordinary differential equations of second and higher order with constant coefficients, variable coefficients and simultaneous linear differential equations. (K3)
3. Construct an analytic function and find the harmonic conjugate, apply the properties of analytic functions to check for harmonic and orthogonal functions and find the images of regions, straight lines and points in the Z-plane under the mappings

   $w = z + a, w = az, w = \frac{1}{z}, w = z^2$ and bilinear transformation. (K3)
4. Find the Taylor's series about a point and Laurent's series in an annular region of analytic functions and Evaluate integrals of analytic functions and real integrals over circular and semicircular contour using Cauchy Goursat theorem, Cauchy integral formula and Cauchy Residue theorem. (K3)
5. Find the Laplace transforms of simple and periodic functions by applying the definition and theorems on Laplace transforms. (K3)
6. Determine the Inverse Laplace transform using the theorems, the method of partial fractions, Convolution and solve linear second order ordinary differential equations with constant coefficients using Laplace transforms. (K3)

CO - PO, PSO MAPPING:

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

SEMESTER - II

20HSEN201 SDG NO. 4	TECHNICAL ENGLISH - II	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To strengthen the listening skills for comprehending and critically analyzing passages
- To enhance students' ability with multiple strategies and skills for making technical presentations
- To participate in group discussions for developing group attitude
- To develop skills for preparing effective job application
- To write effective technical reports

UNIT I LANGUAGE DEVELOPMENT **9**

Listening – Listening conversations involving two participants – multiple participants – **Speaking** – conversation methods in real life occurrences using expressions of different emotions and imperative usages – **Reading** passages and short stories - **Writing** – preparation of checklist – extended definition – **Language Development** – tenses - subject - verb agreement

UNIT II VOCABULARY BUILDING **9**

Listening – listening formal and informal conversation and participative exercises – **Speaking** - creating greetings/wishes/excuses and thanks – **Reading** – articles/novels-**Writing** summary of articles and concise writing identifying new words – homonyms, homophones, homographs – one-word substitutions – easily confused words - creating SMS and using emoticons - sharing information in social media. **Language Development** - reported speeches – regular and irregular verbs - idioms & phrases

UNIT III WRITING TECHNICAL REPORTS **9**

Listening – listening conversation – effective use of words and their sound aspects, stress, intonation & pronunciation – **Speaking** - practicing telephonic conversations – observing and responding. **Reading** – regular columns of newspapers/magazines - **Writing** – reports – feasibility, accident, survey and progress - preparation of agenda and minutes – **Language Development** - using connectives – discourse markers

UNIT IV TECHNICAL WRITING **9**

Listening – Model debates & documentaries - **Speaking** – expressing agreement/disagreement, assertiveness in expressing opinions – **Reading**

biographies/autobiographies – **Writing** – note-making – formal letters – inviting guests – acceptance/declining letters - **Language Development** – degrees of comparison - numerical adjectives – embedded sentences

UNIT V GROUP DISCUSSION AND JOB APPLICATION 9

Listening – Listening - classroom lectures – recommending suggestions & solutions – **Speaking** – participating in group discussion – learning GD strategies – **Reading** – journal articles - Writing – Job application – cover letter - résumé preparation – **Language Development** – purpose statement – editing – verbal analogies.

TOTAL: 45 PERIODS

TEXT BOOKS :

1. Board of editors. Fluency in English: A Course book for Engineering and Technology. Orient Blackswan, Hyderabad 2016.
2. Ashraf Rizvi. M, Effective Technical Communication. 2nd ed. McGraw Hill, New Delhi, 2018.

REFERENCES

1. Bailey, Stephen. Academic Writing: A Practical Guide for Students. Routledge, New York,2011.
2. Raman, Meenakshi and Sharma, Sangeetha. Technical Communication Principles and Practice. Oxford University Press, New Delhi, 2014.
3. Muralikrishnan& Mishra Sunitha, Communication skills for Engineers 2nd ed. Pearson, Tamilnadu, India 2011. P. Kiranmai and Rajeevan, Geetha. Basic Communication Skills, Foundation Books, New Delhi, 2013.
4. Suresh Kumar, E. Engineering English. Orient Blackswan, Hyderabad, 2015
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://freevideolectures.com/course/3250/introduction-to-film-studies/10

ONLINE RESOURCES

1. https://www.ef.com/wwen/english-resources/

2. https://www.smilesforlearning.org/gclid=EAIaIQobChMI49DF9bnd6AIVSY6PCh1d_gV9EAAYASAAEgIBPvD_BwE.

OUTCOMES:

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

1. Acquire the ability to speak effectively in real life situations (K1)
2. Adapt group behaviour and execute the role as a contributing team member (K1)
3. Employ active and passive vocabulary in oral and written communication (K2)
4. Share opinions and suggestions effectively in conversations, debates and discussions (K2)
5. Prepare winning job applications (K3)
6. Write technical reports convincingly (K3)

CO - PO MAPPING:

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

SEMESTER - II

20ESIT201 SDG NO. 4	PYTHON PROGRAMMING WITH LABORATORY	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To Develop Python Programs with Conditionals and Loops
- To Use Python Data Structures – Lists, Tuples, Dictionaries, Sets
- To Define Python Functions and Work with Modules and Packages
- To Work with Python Classes, Objects and Handling Exceptions

UNIT I BASICS OF PYTHON PROGRAMMING 9

Python Interpreter and Interactive Mode - Features – History of Python – Literals – Variables and Identifiers – Data Types – Input Operation – Comments – Reserved Words – Indentation – Operators and Expressions – Operator Precedence– Operations on Strings – Other Data types – Type Conversion - Illustrative Programs: Use of various Operators, Evaluation of expressions, String Operations.

UNIT II DECISION CONTROL STATEMENTS 9

Conditionals: Boolean Values and Operators, Conditional (if) - Alternative (if-else) - Chained Conditional (if-elif-else) - Iteration: state - while - for - break - continue - pass - Illustrative Programs: Exchange the Values of Two Variables - Circulate the values of N Variables - Distance Between Two Points - Square Root - GCD - Exponentiation - Sum and Array of Numbers.

UNIT III STRING, LISTS, TUPLES, DICTIONARIES, SETS 9

Strings: String Slices - Immutability - String functions and methods - String Module - Lists: List Operations - List Slices - List methods - List Loop - Mutability - Aliasing - Cloning lists - List Parameters - Tuples: Tuple Assignment - Tuple as return value - Dictionaries: Operations and Methods - Advanced List Processing - List Comprehension - Sets: Creating Sets – Operations and Methods – Set Comprehension - Illustrative programs: Linear Search - Binary Search - Selection Sort - Insertion Sort - Merge Sort - Histogram.

UNIT IV FUNCTIONS, MODULES AND PACKAGES 9

Functions - Function Definition and Use - Flow of Execution - Parameters and Arguments - Fruitful Functions: Return values - Parameters - Local and Global Scope - Function Composition - Recursion - Modules – from-import Statement – Name of Module – Making your own modules - Packages - Standard Library Modules – globals(), locals() and reload() - Illustrative programs: Fibonacci Series using functions - Arithmetic Operations using Module - Area of different shapes using Packages.

UNIT V CLASSES, OBJECTS AND EXCEPTION HANDLING 9

Classes and Objects – Defining Classes – Creating Objects – Data Abstraction and Hiding through Classes - init() method – Class Variables and Object Variables – Introduction to Errors and Exception Handling – Handling Exceptions – Multiple Except Blocks – else Clause – Raising Exceptions – Built-in and User-defined Exceptions – Finally Block.

LIST OF EXPERIMENTS 15

1. Write a Python program to perform
   a. Linear Search
   b. Binary Search
2. Write a Python program to perform Selection Sort.
3. Write a Python program to sort the given numbers using Insertion Sort.
4. Write a Python program to do sorting using Merge sort.
5. Write a Python program to find first n prime numbers.
6. Write a Python program to Multiply two matrices.
7. Write a Python program to create Student class and instantiate its Object.
8. Write a Python License verification process using Exception handling.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. ReemaThareja. "Python Programming Using Problem Solving Approach", Oxford University Press 2018.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, O'Reilly Publishers, 2016.

REFERENCES:

1. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" Revised and updated for Python 3.2, Network Theory Ltd., 2011.
2. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2013.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-Disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
6. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2013.
7. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

WEB REFERENCES:

1. http://greenteapress.com/wp/think-python/
2. www.docs.python.org
3. https://nptel.ac.in/courses/106/106/106106182/

OUTCOMES:

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

1. Describe the syntax, semantics and control flow statements of Python programming. (K2)
2. Implement simple programs using control structures in Python. (K3)
3. Explain the methods to create and manipulate strings, lists, dictionaries, tuples and sets. (K2)
4. Articulate the concepts of functions, modules and packages in Python. (K2)
5. Implement simple programs using Python Data types and functions. (K3)
6. Apply the concepts of Exception handling, classes and objects. (K3)

CO - PO, MAPPING :

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

SEMESTER - II

20BSCY201 SDG NO. 1-17	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the nature and facts about environment
- To find and implement scientific, technological, economic and political solutions to environmental problems
- To study the interrelationship between living organism and environment
- To provide the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 10

Definition, scope and importance of environment – need for public awareness – Ecosystem: concept of an ecosystem – structure and functions of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – food chains, food webs and ecological pyramids – ecological succession. Introduction to biodiversity definition: genetic, species and ecosystem diversity – values of biodiversity. Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – man-wildlife conflicts – endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies. Disaster management: floods, earthquake, cyclone and landslides – nuclear accidents and holocaust – case studies. Field study of local polluted site – Urban / Rural / Industrial /Agricultural.

UNIT III NATURAL RESOURCES 9

Forest resources: Use and over – exploitation, deforestation, case studies – Water resources: Use and over- utilization of surface and ground water – dams-benefits and problems, conflicts over water – Mineral resources: Environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, case studies – Energy resources: Growing energy needs, use of alternate energy sources - renewable and non renewable energy sources – Land resources: land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

From unsustainable to sustainable development – Sustainable Development Goals – Water conservation: rain water harvesting, watershed management – Climate change: global warming, chemical and photochemical reactions in the atmosphere – acid rain, ozone layer depletion – environmental ethics: Issues and possible solutions – 12 Principles of green chemistry – Environmental

Legislation & Laws: Environment (Protection) Act – 1986 Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments - scheme of labelling of environmentally friendly products (Ecomark) – Issues involved in enforcement of environmental legislation - central and state pollution control boards, role of non-governmental organization – Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 8

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – Environmental Impact Assessment(EIA) - role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

TEXTBOOKS:

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.

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., Hydrabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India Pvt. Ltd., Delhi, 2014.
4. Rajagopalan. R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.

OUTCOMES:

Upon successful completion of this course, student should be able to

1. Understand the relationship between the environment and human activities to maintain the ecological balance. (K1)
2. Identify societal issues and implement suitable technological solutions to eradicate. (K3)
3. Acquire skills for scientific problem solving related to environmental pollution and Disaster Management. (K3)
4. Disseminate the need for the natural resources and its application to meet the modern requirements. (K2)

5. Aware of environmental issues and Protection Acts to achieve the Sustainable Development Goals. (K2)
6. Recognize the need for population control measures and the environmental based value.education concepts for attaining an eco-friendly environment. (K2)

CO - PO MAPPING :

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

SEMESTER - II

20ESEE201 SDG NO. 4 & 9	ELECTRICAL TECHNOLOGY WITH LABORATORY	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To impart knowledge on Electric circuit laws.
- To impart the Construction and working principles of Electrical Machines.
- To introduce about the Electrical drives and its applications.

UNIT I ELECTRICAL CIRCUITS **9**

Basic Circuit Components - Ohms Law - Kirchoff's Law – Steady State Solution of DC Circuits - Nodal Analysis, Mesh Analysis - Thevinin's Theorem - Norton's Theorem - Maximum Power Transfer Theorem - Linearity and Superposition Theorem - Introduction to AC Circuits – Single Phase and Three - Phase Circuits - Power and Power Factor

UNIT II TRANSFORMER & DC MACHINE **9**

Construction – Principle of Operation – EMF Equation pf Transformer – DC Machine – Construction and Working – Types of DC Motor – Principle and Operations – Types of DC Motor – Torque Equation.

UNIT III AC MACHINES **9**

Construction and Principles of Operation of; Synchronous Machines -Three Phase and Single Phase Induction Motors – Torque Equation - Characteristics of Three Phase and Single Phase Induction Motor.

UNIT IV STARTING METHODS & ELECTRICAL BRAKING **9**

Need for Starters - Types of DC Motor Starters – Typical Control Circuits for Shunt and Series Motors - Three Phase Squirrel Cage and Slip Ring Induction Motors – Electrical Braking.

UNIT V ELECTRICAL DRIVES **9**

Basic Elements – Types of Electric Drives – Factors Influencing the Choice of Electrical Drives – Heating and Cooling Curves – Loading Conditions and Classes of Duty - Applications.

LIST OF EXPERIMENTS: **15**

1. Verification of Circuit Laws
2. Verification of Network Theorems
3. Load test on DC Shunt motor
4. Load test on DC Series motor
5. Speed control of DC shunt motor (Armature, Field control)
6. Load test on single phase transformer
7. Load test on three phase squirrel cage Induction motor

TOTAL : 60 PERIODS

TEXT BOOKS:

1. A. E. Fitzgerald, Kingsely Jr Charles, D. Umans Stephen, "Electric Machinery", Tata McGraw Hill, Sixth Edition, 2003.
2. B. L. Theraja, "A Textbook of Electrical Technology", (vol. I), Chand and Company Ltd., New Delhi, 2005.
3. V. K. Mehta, "Basic Electrical Engineering", S. Chand and Company Ltd., New Delhi, 2008.

REFERENCES:

1. William H. Hayt & Jack E. Kemmerly, "Engineering Circuit Analysis", McGraw-Hill Book Company Inc., 2006.
2. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", Pearson Education., 5th Edition, 2002.
3. B.R. Gupta ,'Fundamental of Electric Machines' New age International Publishers, 3rd Edition ,Reprint 2015.

4. S.K. Bhattacharya, "Electrical Machines", Mc Graw -Hill Education, New Delhi, 3rd Edition,2009.

WEB RESOURCES:

1. https://www.springerprofessional.de/en/electrical-machines-and-drives/15402586?tocPage=1
2. https://www.academia.edu/37967928/a-textbook_of_electrical_technology_volume_II_ac_and_dc_machines_BL.Theraja.pdf._BUKU_BL.THERAJA_VOL_II

ONLINE RESOURCES:

1. https://swayam.gov.in/nd1_noc19_ee69/preview
2. https://nptel.ac.in/courses/108102146/
3. https://www.coursera.org/lecture/motors-circuits-design/1-course-introduction-EP7KP

OUTCOMES:

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

1. Understand electric circuits and apply circuit theorems. (K2)
2. Apply the knowledge of electric circuits for engineering application. (K3)
3. Understand the working principles of various electrical machines. (K2)
4. Choose the electrical machines for different applications. (K3)
5. Analyze the performance of electrical machines and electrical circuits in practical. (K4)
6. Build the knowledge to select the starters and braking for electrcial machines. (K2)

CO- PO,PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	-	-	-	-	-	-	-	3	3
CO2	3	3	2	2	1	1	1	-	-	-	-	1	3	3
CO3	3	2	1	2	1	1	-	-	-	-	1	-	2	3
CO4	3	2	2	1	-	1	1	-	-	-	1	1	2	3
CO5	3	3	2	1	1	-	-	-	-	-	-	-	3	3
CO6	3	2	1	1	1	-	-	-	-	-	1	-	3	3

SEMESTER - II

20BSPH202 SDG NO. 4	PHYSICS OF MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the formation of alloy and phase diagrams
- To interpret the properties of ferrous alloys and its uses
- To familiarize the mechanical properties of materials
- To expose the magnetic, dielectric and superconducting materials properties and application
- To explicate the properties and applications of advanced materials

UNIT I ALLOY FORMATION AND PHASE DIAGRAMS 9

Types of alloys - Solid solutions - Hume Rothery's rules - the phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the Tie-line rule - Lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions - free energy composition curves for binary systems - micro structural change during cooling

UNIT II FERROUS ALLOYS 9

The iron-carbon equilibrium diagram - phases, invariant reactions - microstructure of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's laws - phase transformations - T-T-T-diagram for eutectoid steel – pearlite, bainte and martensite transformations - tempering of martensite.

UNIT III MECHANICAL PROPERTIES 9

Tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - solid solution strengthening - precipitation hardening - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods of increasing fatigue life - hardness - Brinell hardness - Vickers microhardness.

UNIT IV MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS 9

Ferromagnetism - domain theory - types of energy - hysteresis - hard and soft magnetic materials - ferrites - dielectric materials - types of polarization -

Langevin-Debye equation - frequency effects on polarization - dielectric breakdown - Insulating materials -Ferroelectric materials - superconducting materials - properties - applications.

UNIT V ADVANCED MATERIALS **9**

Metallic glasses: types, glass forming ability of alloys, melt spinning process, applications - shape memory alloys: phases, shape memory effect, pseudoelastic effect, NiTi alloy, applications – Advanced ceramics –applications – composites: classification, role of matrix and reinforcement – nanomaterials: preparation (bottom up and top down approaches), properties and applications – carbon nanotubes: types.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. W.F.Smith , J. Hashemi , & R.J.Prakash, "Materials Science and Engineering", Tata McGraw Hill Education Pvt. Ltd., 2014.
2. R.Balasubramaniam, "Callister's Materials Science and Engineering", Wiley India Pvt. Ltd., 2014.
3. V.Raghavan, "Physical Metallurgy: Principles and Practice", PHI Learning, 2015.
4. William D. Callister Jr., David G.Rethwisch, "Callister's Materials Science and Engineering", 10th edition, Global edition, John Wiley & Sons, 2019.
5. Donald R Askeland, Wedelin J Wright, "Essentials of Materials Science and Engineering", Cengage Learning India Private Ltd., 2018.

REFERENCES

1. George Dieter, "Mechanical Metallurgy",. McGraw Hill ,2013.
2. James F. Shackelford, " Introduction to Materials Science for Engineers", 8th edition, 8th edition, Pearson, 2015.
3. O.P.Kanna, " Materials science and Metallurgy", Dhanpat Raj Publications, 2nd edition, 2014.
4. Susan Troiler –Mckinstry and Robert E. Newnham, "Materials Engineering: Bonding, Structure, Structure – property relationship" Cambridge University press, 2018.
5. A.Daniel, Brandt, J.C.Warner, " Metallurgy Fundamentals: Ferro and Non Ferrous" 6th edition, Good Heart Wilcox, 2019.

OUTCOMES:

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

1. Understand the concept of formation of alloys and invariant phase reactions related to unary and binary system (K3)
2. Demonstrate the practical exposure on microstructure of ferrous and non-ferrous alloys and their applications (K3)
3. Explain the classification, phase transformation and the effect alloying elements in ferrous alloys (K2)
4. Analyze the various testing procedures for understanding the properties of materials and the strengthening methods (K4)
5. Gain knowledge on magnetic, dielectric, super conducting, composite, ceramic materials, metallic glasses, shape memory alloys, nanomaterials and their properties (K2)
6. Apply the suitable magnetic, superconducting, ceramic, nano, composite materials and shape memory alloys for specific engineering applications (K3)

CO- PO, PSO MAPPING :

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

SEMESTER - II

20ESGE201 SDG NO. 4,9,12	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	3	1.5

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

ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipments – 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 HWR and FWR.

CIVIL ENGINEERING PRACTICE

Buildings:

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

Plumbing Works:

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.

3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5. Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

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

MECHANICAL ENGINEERING PRACTICE

Welding:

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

Machine assembly practice:

1. Study of centrifugal pump.
2. Study of air conditioner.

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 : 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

1. 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 Digital Live-wire detector	 2 Nos 2 Nos

2. Electronics

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

3. 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 Demolition Hammer Circular Saw Planer Hand Drilling Machine Jigsaw	 2 Nos 2 Nos 2 Nos 2 Nos 2 Nos 2 Nos

4. Mechanical

1	Arc welding transformer with cables and holders	5 Nos
2	Welding booth with exhaust facility	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 students should be able to

1. Elaborate on the components, gates, soldering practices. Calculate electrical parameters such as voltage, current, resistance and power. (K1)
2. Design and implement Rectifier and Timer circuits (K2)
3. Measure the electrical energy by single phase and three phase energy meters. (K2)
4. Prepare the carpentry and plumbing joints. (K2)
5. Perform different types of welding joints and sheet metal works (K2)
6. Perform different machining operations in lathe and drilling. (K2)

CO - PO, PSO MAPPING:

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

SEMESTER - II

20TPHS201 SDG NO. 4&5	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the nuances in resume building
- To explore various virtual meeting tools
- To gain knowledge about online certification courses
- To develop knowledge in Google Suite products
- To enhance presentation skills

UNIT I RESUME BUILDING **6**

Your Strength, Projects, Internship, Paper Presentation, uploading your coding in github, Introduction to HackerRank, HackerEarth virtual online assessment (Auto Proctored) (Practicals - Construct a resume, Register for a online Mock Assessment / Contest)

UNIT II VIRTUAL MEETINGS **6**

Basic Etiquette of virtual meeting – Introduction to Skype - Zoom - Webex - Google Meet - Gotowebinar - Jio meet – Screen Share - Jamboard - Feedback polling - Chatbox

(Practicals - Accept and Register for a mock class to attend - How to host a meeting).

UNIT III ONLINE LEARNING **6**

Online Certification - Coursera – Udemy – Edx – Cisco – Online Practice Platforms - SkillRack – Myslate - FACEprep - BYTS - aptimithra - Contest Registrations - TCS Campus Commune - HackwithInfy, InfyTQ - Virtusa NurualHack - Mindtree Osmosis – Online assessment - AMCAT-PGPA.

(Practicals - Campus Commune Registration , Coursera registration - Mock Registration (KAAR Technologies as sample).

UNIT IV GOOGLE SUITE **8**

Define google suite - Benefits of google suite - Google Search - Sheet - Docs - Forms - Calender - Drive - Slide - Translate - Duo - Earch - Maps - Hangouts- Sites - Books - Blogger

(Practicals – Create google sheets and share - Create google Forms and share, Create Google Slide and share , Google drive creation and share (Knowledge of Rights), Create poll and share.

UNIT V PRESENTATION SKILLS **4**

Email Writing – Group Discussion - Power Point Presentation

(Practicals- Create a self SWOT Analysis report. A PowerPoint Slide Preparation)

TOTAL : 30 PERIODS

WEB REFERENCES :

Unit I: Resume Building:

1. https://zety.com/blog/resume-tips
2. https://resumegenius.com/blog/resume-help/how-to-write-a-resume
3. https://www.hackerearth.com/recruit/
4. https://www.hackerrank.com/about-us

Unit – II:Virtual Meetings

1. https://www.claphamschool.org/our-community/blog/online-learning-etiquette-guide-14-principles-to-guide-students
2. https://online.hbs.edu/blog/post/virtual-interview-tips?c1=GAW_SE_NW&source=IN_GEN_DSA&cr2=search__-__nw__-__in__-__dsa__-__general&kw=dsa__-__general& cr5=459341920955&cr7=c&gclid=Cj0KCQjw8fr7BRDSARIsAK0Qqr4dRRbboL3kltrwDsr7hm8oIHtN5dfjD3NIFZULuzNwEXxhjpNFQ2caApn5EALw_wcB
3. https://hygger.io/blog/top-10-best-group-meeting-apps-business/
4. https://www.zdnet.com/article/best-video-conferencing-software-and-services-for-business/

Unit – III:Online Learning

1. https://www.coursera.org/browse
2. https://support.udemy.com/hc/en-us/articles/229603868-Certificate-of-Completion
3. https://www.edx.org/course/how-to-learn-online
4. https://www.cisco.com/c/en/us/training-events/training-certifications/certifications.html
5. https://campuscommune.tcs.com/en-in/intro
6. https://www.freshersnow.com/tcs-campus-commune-registration/
7. https://www.infosys.com/careers/hackwithinfy.html
8. https://www.mindtree.com/blog/osmosis-2013-my-experiences
9. https://www.myamcat.com/knowing-amcat
10. https://www.admitkard.com/blog/2020/02/06/amcat/

Unit IV: Google Suite

1. https://www.inmotionhosting.com/blog/what-is-g-suite-and-why-should-i-consider-using-it/
2. https://en.wikipedia.org/wiki/G_Suite
3. https://blog.hubspot.com/marketing/google-suite
4. https://kinsta.com/blog/g-suite/

Unit V: Presentation Skills

1. https://www.mindtools.com/CommSkll/EmailCommunication.htm
2. https://www.grammarly.com/blog/email-writing-tips/
3. https://business.tutsplus.com/articles/how-to-write-a-formal-email--cms-29793
4. https://www.softwaretestinghelp.com/how-to-crack-the-gd/
5. https://www.mbauniverse.com/group-discussion/tips
6. https://slidemodel.com/23-powerpoint-presentation-tips-creating-engaging-interactive-presentations/
7. https://business.tutsplus.com/articles/37-effective-powerpoint-presentation-tips--cms-25421
8 https://blog.prezi.com/9-tips-on-how-to-make-a-presentation-a-success/
9. http://www.garrreynolds.com/preso-tips/design/

OUTCOMES:

On completion of this course, the student should be able to

1. Construct a suitable resume and registration procedure for online mock assessments. (K1)
2. Handle various virtual meeting tools. (K3)
3. Acquire exposure about online certification courses. (K4)
4. Get involved and work in a collaborative manner. (K2)
5. Gain knowledge in various presentation methodologies. (K1)
6. Apply knowledge to practice Google suite features and SWOT analysis. (K3)

CO – PO MAPPING

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

SEMESTER - II

20HSMG201 SDG NO. 4 & 5	INTERPERSONAL VALUES	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Values through Practical activities

UNIT I INTERPERSONAL VALUES **6**

Interpersonal Relationships and Values – Importance and Barriers – Building and maintain relationships – Mutual understanding – Respect to others.

UNIT II EFFECTIVE COMMUNICATION **6**

Communication skills –Importance and Barriers - Impressive formation and management – Public speaking

UNIT III GROUP DYNAMICS **6**

Group formation –Teamwork – Identify others attitude and behaviour – Formation of relationship – Personal and professional.

UNIT IV MUTUAL RELATIONSHIP **6**

Building mutual understanding and cooperation – Enhancing decision making skills – Problem solving skills – Comparative Appraisal – Interpersonal needs.

UNIT V POSITIVE ATTITUDE **6**

Fostering trust and cooperation – Developing and maintain positive attitude – Improving socialization – Development of security and comfort.

TOTAL: 30 PERIODS

Note: Each topic in all the above units will be supplemented by practice exercises and classroom activities and projects.

REFERENCE BOOKS:

1. Barun K. Mitra, "Personality Development and Soft Skills", Oxford University Press, 2016.
2. B.N.Ghosh, "Managing Soft Skills for Personality Development", McGraw Hill India, 2012.

OUTCOMES:

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

1. Develop a healthy relationship & harmony with others. (K1)
2. Practice respecting every human being. (K3)
3. Practice to eradicate negative temperaments. (K3)
4. Acquire Respect, Honesty, Empathy, Forgiveness and Equality. (K4)
5. Manage the cognitive abilities of an Individual. (K5)
6. Understanding the importance of public speaking and teamwork. (K2)

CO – PO MAPPING :

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

SEMESTER - III

20ESCE201 SDG NO. 4, 9, 12	ENGINEERING MECHANICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To predict the effect of force and motion in the course of carrying out the design functions of engineering

UNIT I STATICS OF PARTICLES 10

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.

UNIT II EQUILIBRIUM OF RIGID BODIES 10

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.

UNIT 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.

UNIT IV PROPERTIES OF SURFACES AND SOLIDS 9

Centroids and Centre of Mass and Volume – Simple and Composite Areas and Solids - Theorems of Pappus - Area 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.

UNIT V DYNAMICS OF PARTICLES AND RIGID BODIES 9

Displacement, Velocity and Acceleration – Relative Motion - Curvilinear Motion - Newton's Laws of Motion – 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 / Wheel and Sphere.

TOTAL: 45 PERIODS

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 andDynamics", 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:

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

1. Recall the basic vector operations. (K1)

2. Apply the basic concepts of laws of mechanics to solve engineering problems. (K3)
3. Predict the effect of forces on particles under static and dynamic conditions. (K3)
4. Analyse the effect of forces on rigid bodies under static and dynamic conditions. (K3)
5. Apply the concepts of centroid and moment of inertia for various shapes and sections. (K3)
6. Examine the effect of frictional forces on bodies. (K3)

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	1	1	-	-	-	-	1	2	2
CO2	3	2	1	-	-	1	1	-	-	-	-	1	2	2
CO3	3	2	1	-	-	1	1	-	-	-	-	1	2	2
CO4	3	2	1	-	-	1	1	-	-	-	-	1	2	2
CO5	3	2	1	-	-	1	1	-	-	-	-	1	2	2
CO6	3	2	1	-	-	1	1	-	-	-	-	1	2	2

SEMESTER - III

20MEPC301 SDG NO. : 4,9,12,13	MANUFACTURING PROCESSESS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and welding
- To understand the working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching
- To transform Raw Material into a Finished Product using various Manufacturing Processes
- To identify appropriate Manufacturing process for producing a component in a least expensive possible way

UNIT I METAL CASTING AND WELDING 9

Sand Casting Mould – Type Of Patterns - Pattern Materials – Pattern Allowances – Moulding Sand Properties and Testing – Cores – Types and Applications – Moulding Machines– Types and Applications – Special Casting Techniques; Melting Furnaces : Blast and Cupola Furnaces; Defects in Casting

Welding: Operating Principle, Basic Equipment, Merits and Applications of: Fusion Welding Processes: Gas Welding - Types – Flame Characteristics; Manual Metal Arc Welding – Gas Tungsten Arc Welding- Gas Metal Arc Welding – Submerged Arc Welding – Electro Slag Welding, Friction Stir Welding, Plasma, Laser Welding; Operating Principle and Applications of: Resistance Welding - Brazing and Soldering; Weld Defects: Types, Causes And Cure.

UNIT II METAL FORMING PROCESSES 9

Hot Working and Cold Working of Metals – Forging Processes – Open, Impression and Closed Die Forging – Forging Operations. Rolling of Metals– Types of Rolling – Flat Strip Rolling – Shape Rolling Operations – Defects in Rolled Parts. Principle of Rod and Wire Drawing – Tube Drawing – Principles of Extrusion – Types – Hot and Cold Extrusion. Sheet Metal Characteristics – Shearing, Bending and Drawing Operations – Stretch Forming Operations – Formability of Sheet Metal – Test Methods

UNIT III THEORY OF METAL CUTTING AND TURNING MACHINES 9

Mechanism of Metal Cutting, Cutting Forces, Merchant's Circle, Cutting Tool Nomenclature, Types of Chips, Tool Materials and Cutting Fluids, Taylor's Equation, Machining Variables, Machinability, Problems on Metal Cutting- Centre Lathe, Constructional Features, Specification, Operations – Taper Turning Methods, Thread Cutting Methods, Special Attachments, Machining Time and Power Estimation. Capstan and Turret Lathes - Tool Layout – Automatic Lathes: Semi Automatic – Single Spindle : Swiss Type, Automatic Screw Type – Multi Spindle.

UNIT IV SHAPER, PLANER, SLOTTER, DRILLING, MILLING AND GEAR CUTTING MACHINES 9

Shaper, Planer, Slotter - Types of Operations and Mechanisms. Drilling, Tapping, Reaming and Boring, Milling Operations - Types of Milling Cutter and Nomenclature. Gear Cutting – Forming and Generation Principle and Construction of Gear Milling, Hobbing and Gear Shaping Processes – Finishing of Gears.

UNIT V ABRASIVE PROCESSES AND BROACHING 9

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 and Applications - Lapping and Honing Processes.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Hajra Chouldhary S.K and Hajra Choudhury. AK., "Elements of workshop Technology", volume I and II, Media promoters and Publishers Private Limited, Mumbai, 2008
2. Kalpakjian. S, “Manufacturing Engineering and Technology”, Pearson Education India Edition, 2013.

REFERENCES:

1. Paul Degarmo E, Black J.T and Ronald A. Kosher, “Materials and Processes, in Manufacturing" Eight Edition, Prentice – Hall of India, 1997.
2. Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 4th Edition, TMH-2013
3. Roy. A. Lindberg, "Processes and Materials of Manufacture", PHI / Pearson education, 2006
4. Sharma, P.C., "A Text book of production Technology", S.Chand and Co. Ltd., 2014.
5. Rao. P.N “Manufacturing Technology - Metal Cutting and Machine Tools", 3rd Edition, Tata McGraw-Hill, New Delhi, 2013.
6. Winston.A.Knight, Geoffrey Boothroyd, “Fundamentals of Metal Machining and Machine Tools” CRC Press, 3rd Edition
7. A.Bhattacharya, “Metal Cutting : Theory And Practice” New Central Book Agency, 1984

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/
6. http://web.mit.edu/2.810/www/files/lectures/lec5-machining-2018.pdf

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/
8. https://nptel.ac.in/courses/112/104/112104290/
9. https://nptel.ac.in/courses/112/103/112103248/
10. https://nptel.ac.in/courses/112/103/112103250/
11. https://nptel.ac.in/courses/112/107/112107089/
12. https://nptel.ac.in/courses/113/106/113106087/
13. https://www.mooc-list.com/course/fundamentals-manufacturing-processes-edx

OUTCOMES:

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

1. Students able to know the capability of selecting suitable manufacturing processes to manufacture the products optimally. (K2)
2. Obtain fundamental knowledge and able to know the method of operations in manufacturing processes. (K2)
3. Understand the knowledge about the various tools, equipment, and machinery required for basic manufacturing processes. (K2)
4. Understand the requirements to achieve Best quality manufacturing methods for various industrial engineering needs. (K2)
5. Students can able to apply the different metal removing, finishing and super finishing and for component production.(K2)
6. Understand the application, advantages and limitations of various manufacturing processes Introduce to recent emerging areas in primary manufacturing process.(K2)

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	0	0	0	0	0	0	0	0	0	0	1	1
CO2	1	1	0	0	0	0	0	0	0	0	0	0	2	2
CO3	1	1	0	0	0	0	0	0	0	0	0	0	2	2
CO4	1	0	0	0	0	0	0	0	0	0	0	0	1	1
CO5	2	1	0	0	0	0	0	0	0	0	0	0	1	1
CO6	1	0	0	0	0	0	0	0	0	0	0	0	1	1

SEMESTER - III

20MEPC302 SDG NO. 4,7, 12,15	BASIC THERMAL SCIENCES	L	T	P	C
		3	1	0	4

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart are permitted)

OBJECTIVES:

- Enable students to analyze and evaluate various thermodynamic cycles used for energy production - work and heat within the natural limits of conversion
- To enable student to understand the concepts of system, entropy and availability.
- To impart the concepts of ideal, real gases and the various gas relations associated with it.
- To make student understand about the concepts of Gas mixtures and psychrometry.

UNIT I BASIC CONCEPTS AND FIRST LAW 9

Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach - Path and point functions - Intensive and extensive properties. System and their types. Thermodynamic Equilibrium State, path and process - Quasi-static, reversible and irreversible processes - Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work, p-V diagram - Zeroth law of thermodynamics – concept of temperature and thermal equilibrium – relationship between temperature scales –new temperature scales - First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes.

UNIT II SECOND LAW AND AVAILABILITY ANALYSIS 9

Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat pump - Statements of second law and its corollaries - Carnot cycle ,Reversed Carnot cycle, Performance. Clausius inequality - Concept of entropy, T-s diagram, T-ds Equations, entropy change for - pure substance, ideal gases - different processes, principle of increase in entropy - Space applications of II Law - High and low grade energy - Available and non-available energy of a source and finite body - Energy and irreversibility - Expressions for the energy of a closed system and open systems - Energy balance and entropy generation - Irreversibility.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE **9**

Formation of steam and its thermodynamic properties: p-v, p-T, T-v, T-s, h-s diagrams, p-v-T surface - Use of Steam Table and Mollier Chart - Determination of dryness fraction - Application of I and II law for pure substances - Ideal and actual Rankine cycles, Cycle Improvement Methods -Reheat and Regenerative cycles, Economiser, pre heater, Binary and Combined cycles.

UNIT IV IDEAL, REAL GASES AND THERMODYNAMIC RELATIONS **9**

Properties of Ideal gas - Ideal and real gas comparison- Equations of state for ideal and real gases Reduced properties - Compressibility factor - Principle of Corresponding states – Generalised Compressibility Chart and its use- Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes. Simple Calculations.

UNIT V GAS MIXTURES AND PSYCHROMETRY **9**

Mole and Mass fraction, Dalton's and Amagat's Law - Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function - Psychrometric properties, Psychrometric charts - Property calculations of air vapour mixtures by using chart and expressions - Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing - Simple Applications

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R.K.Rajput, “A Text Book Of Engineering Thermodynamics”, Fifth Edition,2017.
2. Yunus A. Cengel& Michael A. Boles, “Thermodynamics”, 8th edition 2015.

REFERENCES :

1. Arora C.P, “Thermodynamics”, Tata McGraw-Hill, New Delhi, 2003.
2. Borgnakke & Sonnatag, “Fundamental of Thermodynamics”, 8th Edition , 2016.
3. Chattopadhyay, P, "Engineering Thermodynamics", Oxford University Press, 2016.
4. Michael J. Moran, Howard N. Shapiro, “Fundamentals of Engineering Thermodynamics”, 8th Edition.
5. Nag.P.K., “Engineering Thermodynamics”, 5th Edition, Tata McGraw-Hill, New Delhi, 2013

WEB RESOURCES:

1. https://nptel.ac.in/courses/112/104/112104113/
2. https://nptel.ac.in/courses/112/108/112108148/
3. https://www.mcgoodwin.net/pages/thermodynamics.pdf

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/101/104/101104067/
5. https://nptel.ac.in/courses/112/105/112105220/
6. https://nptel.ac.in/courses/112/105/112105266/
7. https://nptel.ac.in/courses/112/103/112103275/

OUTCOMES:

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

1. Describe the various thermodynamics systems and its associated laws (K1)
2. State and apply the laws of thermodynamics for various thermal systems (K2)
3. Illustrate the concept of available and unavailable energies for different thermodynamic systems (K3)
4. Identify the suitable thermodynamic cycle for power developing and cooling systems (K3)
5. Derive the thermodynamic relations for real and ideal gases and gas mixtures (K3)
6. Make use of Thermodynamic charts and tables to obtain the properties for various processes (K3)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	3	-	-	-	-	-	2	-	-	-	1	3	3
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	1	3	3
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO6	3	3	-	-	-	-	-	2	-	-	-	-	3	3

SEMESTER - III

20MEPC303 SDG NO. 4,8,9,12	ENGINEERING METALLURGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic structure and the phase diagrams
- To impart knowledge on the various heat treatment processes and strengthening mechanisms.
- To study and test various metallic and non-metallic materials
- To identify and select suitable materials for various engineering applications

UNIT I ALLOYS AND PHASE DIAGRAMS **9**

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – carbon equilibrium diagram. Classification of steel and cast Iron - microstructure, properties and application.

UNIT II HEAT TREATMENT AND STRENGTHENING MECHANISMS **9**

Definition- Full annealing, stress relief, recrystallisation and spheroidising – normalizing, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram CCR – Hardenability, Jominy end quench test - Austempering, martempering – case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening.

Strengthening Mechanisms: Cold working, Grain size control, precipitation strengthening, dispersion strengthening, particulate and fiber strengthening, texture strengthening.

UNIT III FERROUS AND NON FERROUS METALS **9**

Effect of alloying additions on steel- α and β stabilisers– stainless and tool steels – HSLA, Maraging steels – Cast Iron - Grey, white, malleable, spheroidal – alloy cast irons, Copper and copper alloys Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

UNIT IV NON METALLIC MATERIALS **9**

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic

polymers (PP, PS, PVC, PMMA, PET,PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON –Composites- Classifications- Metal Matrix and FRP - Applications of Composites

UNIT V MECHANICAL METALLURGY AND TESTING OF MATERIALS 9

Plastic Deformation: Dislocations and Deformations by Slip, Twinning, Stacking faults. Dislocation Theory. Fracture: Types, Griffth‟s theory of brittle fracture. Testing of Materials - Tension, Torsion, Shear, Delamination, Hardness, Impact, fatigue and Creep Testing of materials according to ASTM Standards.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Avner, S.H., “Introduction to Physical Metallurgy”, McGraw Hill Book Company,1997.
2. Williams D Callister, “Material Science and Engineering”, Wiley India Pvt Ltd, Revised Indian Edition 2014.

REFERENCES :

1. Kenneth G.Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 2010.
2. R.K.Rajput, “ Engineering Materials and Metallurgy”, S.Chand & Co
3. Raghavan.V, “Materials Science and Engineering”, Prentice Hall of India Pvt. Ltd., 2015.
4. U.C.Jindal : Material Science and Metallurgy, "Engineering Materials and Metallurgy", First Edition, Dorling Kindersley, 2012
5. Upadhyay. G.S. and Anish Upadhyay, “Materials Science and Engineering”, Viva Books Pvt. Ltd., New Delhi, 2006

WEB RESOURCES:

1. https://nptel.ac.in/courses/112/108/112108150/
2. https://nptel.ac.in/courses/113/106/113106032/
3. http://web.utk.edu/~prack/MSE%20300/surface%20treatments.pdf
4. http://nitc.ac.in/index.php/?url=users/view/270/12/3

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/122/102/122102008/
2. https://nptel.ac.in/courses/113/102/113102080/
3. https://nptel.ac.in/courses/113/104/113104074/

4. https://nptel.ac.in/courses/112/104/112104219/
5. https://nptel.ac.in/courses/113/105/113105028/
6. https://nptel.ac.in/courses/113/106/113106075/
7. https://nptel.ac.in/courses/112/104/112104220/

OUTCOMES:

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

1. Impart knowledge in basics of materials and its characteristics. [K2]
2. Interpret the phase diagram by identifying appropriate transformation process. [K2]
3. Restate in preparing specimens for material testing as per standards. [K2]
4. Identify the effect of secondary processes in material properties. [K3]
5. Apply the secondary processes and its effects on microstructure of different materials. [K3]
6. Analyze the characteristics of materials for industrial applications. [K4]

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	2	3	3
CO2	3	2	3	1	-	2	2	-	-	-	-	2	3	3
CO3	2	-	2	-	-	2	2	1	-	-	-	3	3	3
CO4	2	-	2	-	-	2	3	1	-	-	-	3	3	3
CO5	3	2	1	2	-	2	-	2	-	-	-	2	3	3
CO6	3	3	2	2	-	2	-	1	-	-	-	3	3	3

SEMESTER - III

20BSMA303 SDG NO. 4	PARTIAL DIFFERENTIAL EQUATIONS AND PROBABILITY THEORY	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To introduce the basic concepts of PDE for solving standard partial differential equations
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations
- To introduce Fourier Transform techniques for applications in engineering problems
- To provide necessary basic concepts in probability theory and random variables
- To introduce one dimensional and two-dimensional random variables and Learn some standard distributions applicable to engineering which can describe real life phenomenon

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

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

UNIT III FOURIER TRANSFORMS 12

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

UNIT IV PROBABILITY AND RANDOM VARIABLES 12

Probability – Axioms of probability – Conditional probability – Baye's theorem – Discrete and continuous random variables – Moments – Moment generating

functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT V TWO – DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, Third print, 2016.
2. Ibe. O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007.

REFERENCES:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, INC.
2. Trivedi. K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2nd Edition, 2002.
3. Ray Wylie. C and Barrett. L.C., "Advanced Engineering Mathematics", Tata McGraw Hill Education Pvt. Ltd, Sixth Edition, New Delhi, 2012
4. Ramana. B.V., "Higher Engineering Mathematics", Tata Mc Graw Hill Publishing Company Limited, New Delhi, 2008.
5. Yates. R.D. and Goodman. D. J., "Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2012.
6. Veerarajan. T., "Probability, Statistics and Random Processes", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Third print, 2016.

WEB RESOURCES:

1. https://ocw.mit.edu/courses/mathematics/18-600-probability-and-random-variables-fall-2019/lecture-notes/index.htm
2. https://nptel.ac.in/courses/122103012/

ONLINE RESOURCES:

1. https://youtu.be/vEt3eqihm80
2. https://www.youtube.com/watch?v=bjybXMwWjjc

OUTCOMES:

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

1. Solve first order linear and nonlinear partial differential equations, linear partial differential equations of second and higher order with constant coefficients and find the variable separable solution of partial differential equations. (K3)
2. Find the Fourier series solution of one-dimensional wave equation, one dimensional and two-dimensional heat equations. (K3)
3. Formulate and classify a partial differential equation. (K2)
4. Compute the Fourier Transform, Inverse Fourier Transform, Sine and Cosine Transform of simple functions. (K3)
5. Calculate the probability, conditional probability and statistical averages of events, one dimensional, two-dimensional random variables defined on discrete and continuous sample space, and random variables associated with discrete and continuous distributions. (K3)
6. Apply Central limit theorem to find the approximate probabilities of the sum and average of larger number of independent and identically distributed random variables and use the concept of transformation of random variables to find the marginal and joint Probability density functions. (K3)

CO- PO, PSO MAPPING :

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

SEMESTER - III

20CEPC306 SDG NO. 4,6,9,14	FLUID MECHANICS AND MACHINERY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the properties of fluids, measurement of pressure, types of flow and basic equations of motion.
- To apply conservation laws, boundary layer theory and various losses.
- To understand the basic concepts of Dimensional Analysis and similitude.
- To study various types of pumps, turbines.

UNIT I FLUID PROPERTIES AND PRESSURE MEASUREMENTS 9

Units and Dimensions – Fluid Properties – Density, Specific Gravity, Viscosity, Surface Tension, Capillarity, Compressibility and Bulk Modulus – Pascal's Law – Pressure Measurements – Manometers - Simple- Differential and Inverted U Tube Manometers

UNIT II FLUID KINEMATICS AND DYNAMICS 9

Fluid Kinematics - Lagrangian and Eulerian Descriptions - Types of Fluid Flow – Control Volume – Continuity Equation– Velocity and Acceleration - Energy Equation – Euler and Bernoulli's Equations and its Applications- Orifice Meter, Venturimeter and Pitot Tube – Momentum Equation – Moment of Momentum Equation.

UNIT III FLOW THROUGH PIPES AND BOUNDARY LAYER CONCEPT 9

Laminar Flow Through Circular Pipes-major and Minor Losses - Hagen Poisullie Equation - Turbulent Flow- Darcy Weisbach Equation – Chezy's Formula.

Boundary Layer Theory - Definition - Types - Displacement, Energy and Momentum Thickness.

UNIT IV DIMENSIONAL ANALYSIS AND MOMENTUM PRINCIPLE 9

Dimensional Analysis - Need and Methods of Dimensional Analysis - Dimensional Homogeneity- Rayleigh Method and Buckingham π Theorems - Applications - Similitude - Types - Prototype and Model – Model Testing and Analysis.

UNIT V HYDRAULIC PUMPS AND TURBINES 9

Impact of Jet – Force Exerted by a Jet on Normal, Inclined and Curved Surfaces- Angular Momentum Principle - Construction of Velocity Diagrams.

Classification of Turbines - Construction, Working and Design of Pelton Wheel, Kaplan and Francis Turbines - Head, Losses, Work Done and Efficiency - Specific Speed - Operating Characteristics. Introduction to Draft Tube.

Classification of Pumps - Centrifugal Pump - Working Principle - Discharge, Work Done and Efficiencies - Operating Characteristics. Reciprocating Pump – Working Principle- Performance Calculation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dr.R.K.Bansal, (2000), "Fluid Mechanics and Hydraulic Machines", Laxmi Publication (P) Ltd., New Delhi.
2. P.N.Modi and S.M.Seth (1999), "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, Naisarak, Delhi.

REFERENCES

1. Vijay Gupta and S.K.Gupta, (1999), "Fluid Mechanics and Applications", New-Age International Ltd.
2. D.S. Kumar,(2004), "Fluid Mechanics and Fluid Power Engineering", Katson Publishing House, Delhi.
3. V.L. Streeter, (2001), "Fluid Mechanics", McGraw Hill Book Co.
4. R.K. Rajput, "Fluid Mechanics and Hydraulic Machines", S.Chand& Company Ltd, 2010.

WEB RESOURCES:

1. https://nptel.ac.in/courses/112/104/112104118/
2. https://nptel.ac.in/courses/112/104/112104117/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112/105/112105171/
2. https://nptel.ac.in/courses/105/101/105101082/
3. https://nptel.ac.in/courses/112/105/112105183/
4. https://nptel.ac.in/courses/112/105/112105206/
5. https://nptel.ac.in/courses/112/105/112105269/

OUTCOMES:

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

1. Interpret the values and relationships of fluid properties, principles of continuity, momentum and energy as applied to fluid motions. (K2)
2. Compare and contrast the different types of flows in a fluid motion. (K2)
3. Understand the applications of hydro machines in industries. (K2)
4. Illustrate and Interpret a suitable hydro machines in relation to given situation in hydro power plants. (K2)

5. Develop a range of analytical fluid flow and evaluation techniques using fluid mechanics principles. (K3)
6. 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	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	-	-	-	1	-	3	3	3
CO2	3	3	2	2	1	1	-	-	-	2	-	3	3	3
CO3	3	3	3	2	1	1	-	-	-	1	-	3	3	3
CO4	3	3	3	2	1	1	-	-	-	1	-	3	3	3
CO5	3	3	3	2	1	1	-	-	-	1	-	3	3	3
CO6	3	3	3	2	1	1	-	-	-	1	-	3	3	3

SEMESTER - III

20MEPL301 SDG NO. 4,9,12,13	MANUFACTURING PROCESS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To operate arc welding and gas welding equipments
- To prepare moulds in foundry
- To Study and practice the various operations that can be performed in lathe, shaper, drilling, milling and special purpose machines etc.
- To equip the student with practical knowledge required in the core industries

LIST OF EXPERIMENTS

1. Fabrication of simple structural shapes using Gas Metal Arc Welding
2. Joining of plates and pipes using Gas Metal Arc Welding/ Arc Welding /Submerged arc welding
3. Preparation of green sand moulds
4. Manufacturing of simple sheet metal components using shearing and bending operations.
5. Manufacturing of sheet metal components using metal spinning on a lathe

6. Taper Turning
7. External Thread cutting
8. Internal Thread Cutting
9. Eccentric Turning
10. Knurling
11. Square Head Shaping
12. Hexagonal Head Shaping
13. Contour milling using vertical milling machine
14. Spur gear cutting in milling machine
15. Helical Gear Cutting in milling machine
16. Gear generation in hobbing machine
17. Gear generation in gear shaping machine
18. Plain Surface grinding
19. Cylindrical grinding
20. Tool angle grinding with tool and Cutter Grinder
21. Measurement of cutting forces in Milling / Turning Process

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1	Arc welding transformer with cables and holders	2 Nos
2	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit	1 No.
3	Moulding table, Moulding equipments	2 Nos
4	Sheet metal forming tools and equipments	2 Nos
5	Centre Lathes	7 Nos.
6	Horizontal Milling Machine	1 No.
7	Vertical Milling Machine	1 No.
8	Shaper	1 No.
9	Surface Grinding Machine	1 No.
10	Cylinderical Grinding Machine	1 No.
11	Radial Drilling Machine	1 No.
12	Lathe Tool Dynamometer	1 No.
13	Milling Tool Dynamometer	1 No.
14	Gear Hobbing Machine	1 No.
15.	Gear Shaper	1 No.
16	Tool Cutter and Grinder	1 No.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Join two metals using arc welding. (K2)
2. Use sheet metal fabrication tools and make simple tray and funnel.(K2)
3. Use different moulding tools, patterns and prepare sand moulds.(K2)
4. Make the workpiece as per given shape and size using Lathe, Milling, Drilling and Special Purpose Machines.(K2)
5. Use different machine tools to manufacture gears and finishing operations(K2)
6. Develop simplified Manufacturing Processes with the aim of reduction of cost and scrap(K2)

CO – PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	-	-	-	-	2	-	-	2	2	2
CO2	2	2	2	-	-	-	-	-	2	-	-	2	2	2
CO3	2	2	2	-	-	-	-	-	2	-	-	2	2	2
CO4	2	2	2	-	-	-	-	-	2	-	-	2	2	2
CO5	2	2	2	-	-	-	-	-	2	-	-	2	2	2
CO6	2	2	2	-	-	-	-	-	2	-	-	2	2	2

SEMESTER - III

20MEPL302 SDG NO. 4, 8, 9,12	COMPUTER AIDED DRAFTING LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To comprehend the absolute, relative and polar coordinate systems
- To learn the procedure to Create, edit, annotate and plot drawings using basic AutoCAD commands
- To Visualize and graphically reproduce complex layouts in drafting and design areas
- To calculate part features using math skills

LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELLING

1. Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views.
6. Drawing of a plan of residential building (Two bed rooms house.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

LIST OF EQUIPMENTS:

1. Pentium IV computer or better hardware, with suitable graphics facility.
2. Licensed software for Drafting and Modelling. – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings.

OUTCOMES:

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

1. Comprehend the absolute, relative and polar coordinate systems. (K1)
2. Create, edit, annotate and plot drawings using basic AutoCAD commands. (K1)
3. Visualize and graphically reproduce complex layouts in drafting and design areas.(K2)
4. Create 3D Models and Plotting of Simple objects.(K2)
5. Create graphical models by creating basic solid primitives.(K3)
6. Generate bill of materials in assembly. (K3)

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	1	-	2	-	-	-	1	2	1	2	2	2
CO2	2	-	3	-	3	-	-	-	1	2	1	2	2	2
CO3	2	-	3	-	3	-	-	-	1	2	1	2	2	2
CO4	3	1	3	2	3	-	-	-	1	2	1	2	2	2
CO5	2	1	3	-	2	-	-	-	1	2	1	2	2	2
CO6	2	1	2	-	2	-	-	-	1	2	1	2	2	2

SEMESTER - III

20METE301 SDG NO. 4,11,15	LIVE-IN-LAB - I	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students face reviews and viva voce examination.

GUIDELINES TO BE FOLLOWED:

The student individually works on a specific topic may be selected from published data or from the creative ideas approved by project supervisor who is familiar in the area of interest (Design/ Manufacturing/ Thermal/Mechatronics) and head of the department. The selected topic may be analytical or experimental. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners. The student would apply the knowledge gained from theoretical and practical courses, so as to give confidence to the students to be creative, well planned, organized, coordinated in their Live-in Lab Project-II.

The progress of the project is reviewed and evaluated with a minimum of three reviews with the guidance of Project Coordinator. The review committee may be constituted by the Head of the Department. The student must submit a

project report at the end of the semester for evaluation.

EVALUATION: Project work evaluation is based on Regulations of Credit system of Autonomous Regulatory Body.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. List the problems and conduct literature survey to identify the gap and come up with an application oriented research problem in the specific domain.(K1)
2. Understand the project characteristics and explore necessary tools and components needed at various stages of the project(K2)
3. Design and validate the proposed system using simulation.(K3)
4. Develop the Prototype of the proposed system by adapting Industrial safety standards and best financial management practices(K5)
5. Analyze the obtained results and prepare a technical report.(K4)
6. Evaluate the project and go for journals and patents publication.(K5)

CO- PO & PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO4	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO6	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - III

20METP301 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE & COGNITIVE SKILLS – PHASE 1

COURSE OBJECTIVE:

- To educate and enrich the students on quantitative ability, reasoning ability, and verbal ability.

UNIT I QUANTITATIVE ABILITY – I **6**

Problems on Trains - Time and Distance - Height and Distance - Time and Work.

UNIT II QUANTITATIVE ABILITY – II **6**

Problems on Ages - Alligation or Mixture - Chain Rule - Simple Interest - Simple Equation - Theory Of Equation.

UNIT III REASONING ABILITY – I **6**

Analytical Reasoning - Pipes and Cistern - Logical Problems - Logical Games - Logical Deduction - Data Sufficiency - Arithmetic Reasoning.

UNIT IV VERBAL ABILITY – I **6**

Idioms & Phrases - Synonyms - Antonyms - Classification.

UNIT V CREATIVITY ABILITY – I **6**

Venn Diagrams, Cube and Cuboids, Dice, Cubes and Dice, Figure Matrix

TOTAL : 30 PERIODS

REFERENCES:

1) R. S. Agarwal, "Quantitative Aptitude for Competitive Exams"
2) Sarvesh Verma, "Quantum CAT"
3) R. S. Agarwal, "A Modern Approach to Logical Reasoning"
4) Arun sharma, "Verbal Ability and Reading Comprehension"

PROBLEM SOLVING USING C PROGRAMMING AND GEOMETRIC DIMENSIONING AND TOLERANCES – PHASE 2

COURSE OBJECTIVE:

- To provide exposure to problem-solving through programming.
- To train the student to the basic concepts of the C-programming language.
- To provide exposure to problem-solving through programming.
- The course aims to provide exposure to problem-solving through programming. It aims to train the student to the basic concepts of the C-programming language. This course involves a lab component which is designed to give the student hands-on experience with the concepts.
- Understand the basics to define the geometry for part and assemblies. Understand the geometrical requirements of the drawings.

UNIT I INTRODUCTION TO PRINCIPLES OF PROGRAMMING 6

Introduction to Programming - Programing Domain : Artificial Intelligence-Systems Programming - Assembly Level Languages - Problem solving using Algorithms and Flowcharts.

UNIT II INTRODUCTION TO C PROGRAMMING 6

Features of C and its Basic Structure - Simple C programs - Constants - Integer Constants - Real Constants - Character Constants - String Constants Floating-point Numbers - The type cast Operator - Interactive Programming.

Operators Expressions and Control statement - The goto statement - The if statement - The if-else statement - Nesting of if statements - The conditional expression - The break statement and continue statement.

UNIT III ARRAYS, STRINGS AND POINTERS 6

Arrays - Multidimensional Arrays - Strings, Basics of Pointers - Pointer Arithmetic - Similarities between Pointers and One-dimensional Arrays Structures - Unions And Functions - Basics of Structures - Arrays of Structures - Pointers to Structures - Function Basics - Function Prototypes and Passing Parameters - Structures and Functions Recursion.

UNIT IV BASICS OF GEOMETRY TERMINOLOGY 6

Basics of Geometric Dimensioning and Tolerances – Terminology & basic tools - Symbols of Geometric Dimensioning and Tolerances.

UNIT V MREPRESENTATION OF GD & T **6**

Adding GD&T to drawing/Design – Datum - Tolerances – Form, Orientation, profile.

TOTAL : 30 PERIODS

REFERENCES:

1. Balagurusamy, "Programming in ANSI C", Tata McGraw-Hill Education, 2008.
2. Stephen G. Kochan, "Programming in C" (3rd Edition), Sams, 2004 .
3. Stephen G. Kochan, "Programming in C", III Edition, Pearson Education.
4. Geometric Dimensioning and Tolerancing by P.S.Gill, S.K. Kataria & sons, edition 2013.
5. Fundamentals of Geometric Dimensioning and Tolerancing by Alex krulikowski, 2012, 3rd edition, Delmar cengage learning publications.

ONLINE RESOURCES

1. https://www.coursera.org/learn/introduction-cad-cam-practical-cnc-machining
2. https://nptel.ac.in/courses/112/105/112105211/

WEB RESOURCES

1. https://www.steckermachine.com/blog/g-code-and-m-code-programming
2. http://www.helmancnc.com/cnc-programming-for-beginners-a-simple-cnc-programming-example/

COURSE OUTCOMES :

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

1. Analyze their quantitative ability. (K4)
2. Understand the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)
3. Create their verbal ability through vocabulary building and grammar. (K6)
4. Evaluate the situations to analyse the computational methods in order to identify and abstract the programming task involved. (K5)
5. Understanding the basics of geometric dimensioning and tolerance.(K2)
6. Identify the symbols of GD&T. (K1)

CO- PO & PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO2	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO3	-	-	-	-	3	2	-	-	1	3	-	2	-	-
CO4	-	-	-	-	3	2	-	3	3	3	-	2	2	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2	2	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - IV

20MEPC401 SDG NO. 4,8,9,12,16	MEASUREMENTS AND CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic of measurements.
- To learn Calibrating and analyzing the characteristics of measuring instruments.
- To learn various measuring techniques of field variables like pressure, temperature in industrial applications.
- To Determine error and analyzing uncertainty in the measurements.
- This course develops the students approach to identify different Control system components like Hydraulic, Pneumatic, Electrical and Electronic.

UNIT I INTRODUCTION TO MEASUREMENTS 9

General Concepts - Units and Standards - Measuring instruments - Sensitivity, readability, range of accuracy, precision - Static and dynamic response - Repeatability hysteresis - Systematic and random errors - Correction Calibration.

Stability – definitions – characteristic equation – location of roots in the S plane for stability – Routh Hurwitz criterion – Nyquist stability criterion – gain margin and phase margin –root locus – rules for the construction of root loci – compensation technique using Bode plot and root locus.

UNIT II INSTRUMENTS FOR MEASUREMENTS-I 9

Motion measurement: Displacement measuring device – wire wound potentiometer, LVDT, Photocell, Resistance strain gauge.

Measurement of speed: Tachometers – Types, stroboscope. seismic – Displacement, velocity and Acceleration pickups (Accelerometer)

Force, Torque and power measurement: Basic force measurements – characteristics of Elastic force transducers. Torque and power measurement on rotating shaft – Electric, hydraulic dynamometers, use of strain gauge to measure torque and force.

UNIT III INSTRUMENTS FOR MEASUREMENTS-II 9

Pressure measurement: Elastic transducer type elements, High pressure measurement, low pressure (Vacuum) measurement

Temperature measurement: Thermal expansion methods, Thermoelectric methods, Radiation methods, Digital Thermometers.

Miscellaneous measurements: Humidity sensing, Fiber optic sensor for pressure, temperature measurement. Silicon quartz sensors.

UNIT IV INTRODUCTION TO CONTROL SYSTEMS 9

Introduction – Open loop and closed loop systems – Basic elements – analysis of physical systems – mechanical, thermal, electrical, hydraulic and pneumatic systems – Mathematical representation – Transfer function – Block diagrams – Signal flow graphs – reduction techniques. Components – potentiometers – Synchros – AC and DC servo motor, stepper motor – Application of stepper motor, AC & DC – tachogenerators. Basic elements - Feedback principle, implication of measurements - Error detectors - Final actuating Elements -

Two Position, multiposition, floating proportional controls - Relays - Servo amplifiers - Servo motors - Mechanical, Electrical, magnetic, electronic, hydraulic, pneumatic systems.

Applications: Governing of speed - Kinetic and Process Control - Pressure, temperature, fluid level, flow - Thrust and flightcontrol - Photoelectric controls.

UNIT V TIME RESPONSE AND FREQUENCY RESPONSE 9

Time response – test signals – step response of first order and second order systems – time domain specifications – response P, PI, PID controllers, position control system Type and order of a system – steady state error – static error and generalized error coefficients practical problems.

Frequency response – Frequency domain specifications estimation of the specifications for a second order system – Bode plot – polar plots – constant M and N circles – Nichol's Chart – closed loop response from the open loop response – BIBO stability requirements.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Xavier S.P. Eugene, & Babu.J.Joseph Cyril, "Principles of Control Systems", S Chand & Company, 2nd edition
2. M.Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 4thedition, 2012
3. A.K.Shawney, "A Course in Electronic Measurements and Instrumentation", Dhanpat Rai & Co. (P) Limited, 2015.
4. R.K.Rajput, "Mechanical Measurements and Instrumentation", S.K. Kataria& Sons; Reprint 2013 edition

REFERENCES

1. Ernest O. Doebelin, "Measurement systems, Application and Design", 4th Edition, McGraw Hill International edition.

2. R.S. Sirohi& M.C. Radha Krishna, "Mechanical Measurements", New Age International (P) Limited, Publishers. 3rdEdition.

WEB RESOURCES:

1. https://nptel.ac.in/courses/108/103/108103007/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/108/105/108105064/
2. https://nptel.ac.in/courses/107/106/107106081/
3. https://nptel.ac.in/courses/108/103/108103007/
4. https://nptel.ac.in/courses/108/102/108102043/
5. https://nptel.ac.in/courses/112/107/112107242/

OUTCOMES:

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

1. Describe the concepts of measurements and control systems to apply in various metrologicalinstruments.(K2)
2. Illustrate measurement of field variables like motion, speed, force, torque and power.(K2)
3. Outline various measuring techniques of field variables like pressure, temperature inindustrial applications.(K2)
4. Explain different time domain ,frequency domain and specification parameters to conclude dynamic performance of a system. (K2)
5. Identify time domain ,frequency domain system and their components, selection to meet desired response.(K3)
6. Select electrical models/ mechanical models to design a physical system for a specific operation.(K3)

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	1	1	1	-	2	-	2	2	3
CO2	2	2	1	1	-	1	1	1	-	2	-	2	2	3
CO3	2	2	1	1	-	1	1	1	-	2	-	2	2	3
CO4	2	2	1	1	-	1	1	1	-	2	-	2	1	2
CO5	2	2	1	1	-	1	1	1	-	1	-	2	2	3
CO6	2	2	1	1	-	1	1	1	-	2	-	2	2	3

SEMESTER - IV

20MEPC402 SDG NO. 4,8,9, 12,16	METROLOGY, MEASUREMENTS AND COMPUTER AIDED INSPECTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge on various Metrological equipments available to measure the dimension of the components.
- To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.
- To measure recessed areas those are difficult to measure using optical systems.
- To improve the quality of the product, increase the productivity in the inspection process and reduce the lead times in manufacturing

UNIT I BASICS OF MEASUREMENT AND LINEAR MEASUREMENT 9

Definition of metrology-needs, elements and methods of measurement. Accuracy and Precision, Basic definitions in Measurements. Generalized measurement system - static characteristics of instruments - factors considered in selection of instruments - Errors - classification - sources of error. Calibration – uncertainty. General cares and rules in measurement, Standards and its types.

Linear Measuring Instruments: Evolution – Vernier caliper, Micrometer, feeler gauges, dial indicator, surface plates, Slip Gauge- classification and calibration. Comparators- mechanical, electrical, optical and pneumatic.

UNIT II ANGULAR, SURFACE MEASUREMENTS AND GAUGES 9

Angular Measuring Instruments: Types – Bevel protractor, Spirit level, Clinometers, Angle gauges, Sine bar – Angle alignment telescope – Autocollimator – applications, Angle dekkor. Principles and methods of straightness measurement – Flatness measurement – Surface finish measurement. Limit gauges – gauge design – terminology – procedure – concepts of interchangeability and selective assembly.

UNIT III FORM AND MECHANICAL PARAMETER MEASUREMENTS 9

Thread measurement, Gear measurement, Roundness measurement –Position sensors: Potentiometer, LVDT, Proximity sensors - types. Temperature sensors: Bimetallic strip, Thermocouples, Liquid in glass thermometer, Resistance temperature detector, Thermocouples and Thermopiles, Thermistor, Optical pyrometer. Force, Torque, Power measurement -Mechanical, Pneumatic, Hydraulic and Electrical type.

UNIT IV CO-ORDINATE MEASURING MACHINE AND LASER METROLOGY **9**

CMM: Need, Types and applications - Manual CMMs, CNC CMMs, Multi-sensor CMMs, Portable CMMs, CMM software, Modes of operation-Types of probes

LASER METROLOGY: Interferometry, applications of Interferometry, methods of Interferometry, Michelson‟s Interferometer, ACLI- N.P.L flatness Interferometer, Zeiss interferometer, Twyman-Green interferometer, sources of errors, corrections to be made, laser spectroscopy, laser holography, machine tool alignment

UNIT V MACHINE VISION SYSTEM **9**

Machine Vision: Image sensing and acquisition, types of cameras and their principles, machine vision lightings, designing a machine vision system- lens design, choice of camera and illumination, laser vision system, software for image processing.

Industrial Applications: Machine vision in industry automation, dimensional measurement, identification of flaws and defects, pattern recognition applications, sorting and counting, study of surface finish, tool wear measurement, robot guidance, safety monitoring.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2005.
2. Jain R.K. “Engineering Metrology”, Khanna Publishers, 2009.

REFERENCES

1. Alan S. Morris, “The essence of Measurement”, Prentice Hall of India 1996.
2. Beckwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education , 2014.
3. Charles Reginald Shotbolt, “Metrology for Engineers”, 5th edition, Cengage Learning EMEA,1990.
4. Davies E R, “Computer and Machine Vision: Theory, Algorithms, Practicalities”, Academic Press, 2012.
5. Bhabatosh Chanda and Dutta Majumder D, “Digital Image Processing and Analysis”, PHI Learning Pvt. Ltd., 2011.
6. Raghavendra and Krishnamurthy “Engineering Metrology & Measurements”, Oxford Univ. Press, 2013.

WEB RESOURCES:

1. https://nptel.ac.in/courses/112/106/112106139/
2. 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/

OUTCOMES:

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

1. Describe the concepts of measurements to apply in various metrological instruments used in engineering applications.(K2)
2. Outline the principles of different measurement tools to interpret the results.(K2)
3. Illustrate the concepts of advanced measuring techniques in metrology.(K2)
4. Exhibit the different profile parameter measurements used for industrial components.(K2)
5. Make use of basic metrological knowledge for solving engineering problems.(K3)
6. Apply relevant measuring principles to measure mechanical parameters in industrial applications.(K3)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	1	-	-	-	-	2	2
CO2	2	2	-	-	-	-	-	1	-	-	-	-	2	2
CO3	2	2	-	-	-	-	-	1	-	-	-	-	2	2
CO4	2	2	-	-	-	-	-	1	-	-	-	-	2	2
CO5	3	3	-	-	-	-	-	2	-	-	-	-	3	3
CO6	3	3	-	-	-	-	-	2	-	-	-	-	3	3

SEMESTER - IV

20MEPC403 SDG NO. 4,8,9,12	COMPUTER AIDED DESIGN AND MANUFACTURING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the usage of computers in designing mechanical components
- To introduce the student to the basic tools of computer-aided design (CAD) and computer-aided manufacturing (CAM)
- To expose the student to contemporary computer design tools
- To prepare the student to be an effective user of a CAD/CAM system
- To understand the concepts of CNC and Part Programming

UNIT I INTRODUCTION **9**

Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- computer graphics – co-ordinate systems- 2D and 3D transformations homogeneous co-ordinates - Line drawing -Clipping- viewing transformation-Introduction to CAD and CAM – Manufacturing planning, Manufacturing control.

UNIT II GEOMETRIC MODELING **9**

Representation of curves- Hermite curve- Bezier curve- B-Spline curves-rational curves. Techniques for surface modeling – surface patch- Coons and Bicubic patches- Bezier and B-Spline surfaces. Solid modeling techniques- CSG and B-rep

UNIT III VISUAL REALISM AND ASSEMBLY OF PARTS **9**

Hidden – Line – Surface - Solid removal algorithms – shading – colouring – computer animation - Assembly modeling.

UNIT IV CAD STANDARDS **9**

Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc. - communication standards.

UNIT V FUNDAMENTAL OF CNC AND PART PROGRAMMING **9**

Introduction to NC systems and CNC - Machine axis and Co-ordinate system-CNC machine tools. Principle of operation - Construction features including structure- Drives and CNC controllers-2D and 3D machining on CNC-Introduction of Part Programming, types - Manual part programming on Lathe

and Milling machines using G codes and M codes- Cutting Cycles, Loops, Sub program and Macros.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ibrahim Zeid, "Mastering CAD CAM", Tata McGraw-Hill PublishingCo.2007
2. Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2008.

REFERENCES

1. Chris McMahon and Jimmie Browne, "CAD/CAM Principles", "Practice and Manufacturing management " Second Edition, Pearson Education, 1999.
2. Donald Hearn and M. Pauline Baker, "Computer Graphics"'. Prentice Hall, Inc,1992.
3. Foley, Wan Dam, Feiner and Hughes, "Computer graphics principles & practice", Pearson Education -2003.
4. William M Neumann and Robert F.Sproul, "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.
5. Radhakrishnan P, Subramanyan S and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd, New Delhi,2000.

WEB RESOURCES:

1. https://nptel.ac.in/courses/112/102/112102102/
2. https://nptel.ac.in/courses/112/102/112102103/
3. http://nitc.ac.in/index.php/?url=users/view/270/12/3

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112/104/112104031/
2. https://nptel.ac.in/courses/112/102/112102101/
3. https://nptel.ac.in/courses/112/105/112105211/
4. https://nptel.ac.in/courses/112/104/112104252/
5. http://guides.lib.ua.edu

OUTCOMES:

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

1. Understand the basic concepts of transformations, clipping algorithm, Manufacturing models and Metrics in Design and Manufacturing (K2)
2. Apply the fundamentals of parametric curves, surfaces and Solids in Desgin and Manufacturing (K3)

3. Apply the Visual Realsim Concepts to reduce computation in Desgin and Manufacturing (K3)
4. Discover the different types of Standard systems used in Design and Manufacturing (K3)
5. Apply CNC programming concepts to develop part programme for Lathe & Milling Machines (K3)
6. Summarize the different types of modelling & manufacturing techniques used in product development (K2)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	3	3
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	2	1	-	-	-	-	-	-	-	-	-	2	2
CO4	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO5	3	2	1	-	-	-	-	-	-	-	-	-	3	3
CO6	3	3	1	-	-	-	-	-	-	-	-	-	3	3

SEMESTER - IV

20MEPC404 SDG NO. 4,7,9,13	APPLIED THERMAL SCIENCES	L	T	P	C
		3	0	0	3

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart are permitted)

OBJECTIVES:

- To apply the concepts, laws and methodologies of thermodynamics in the analysis of gas power cycles
- To apply the thermodynamic concepts to steam nozzles and turbines
- To apply the concepts of thermodynamics to air compressor
- To apply the thermodynamic concepts into various thermal application like IC engines, steam turbines, compressor and refrigeration & air conditioning systems

UNIT I GAS POWER CYCLES **9**

Gas cycles : Air standard cycles- Otto cycle, Diesel cycle, Dual cycle and Brayton cycle – efficiency, mean effective pressure.

UNIT II STEAM NOZZLES AND STEAM TURBINES 9

Steam Nozzles: Types, exit velocity, critical pressure ratio, effect of friction, throat and exit area calculations.

Steam Turbines: Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency - optimal operating conditions. Multi-staging, compounding and governing.

UNIT III AIR COMPRESSOR 9

Reciprocating Air compressor: Classification and comparison, working principle, single stage compressor - work done, volumetric efficiency, multi stage compressor - minimum power requirement, performance calculation.

Rotary Air Compressor: Working principle of Rotary compressors, comparison

UNIT IV INTERNAL COMBUSTION ENGINES AND COMBUSTION 9

IC Engines: Classification - Petrol and Diesel engines, 2 stroke and 4 stroke, valve timing and port timing diagrams, Accessories- Fuel supply and ignition system, Cooling system, lubrication system, performance calculation of IC engines.

Combustion: Desirable properties and qualities of fuels. Air-fuel ratio calculation – lean and rich mixtures. Combustion in SI and CI Engines – Knocking – phenomena and control.

UNIT V REFRIGERATION, PSYCHROMETRY AND AIR–CONDITIONING 9

Refrigeration: Vapour compression refrigeration cycle, Effect of superheat and sub-cooling, Performance calculations, working principle of air cycle, vapour absorption system, and thermoelectric refrigeration.

Psychrometry: Psychrometric properties and processes. Air-conditioning systems: concept of RSHF, GSHF and ESHF, Cooling load calculations. Components of air conditioning systems and working principle of summer and winter air conditioning.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Kothandaraman. C.P., Domkundwar. S, Domkundwar. A.V., "A course in thermal Engineering", Fifth Edition, DhanpatRai& sons , 2016.
2. Rajput. R. K., "Thermal Engineering", S. Chand Publishers, 2017.

REFERENCES

1. Arora C.P, "Refrigeration and Air Conditioning," Tata McGraw-Hill Publishers 2008.

2. Ganesan V., “Internal Combustion Engines”, Third Edition, Tata Mcgraw-Hill 2012.
3. Ramalingam K.K., "Thermal Engineering", SCITECH Publications (India) Pvt. Ltd., 2009.
4. Rudramoorthy R., “Thermal Engineering”, Tata McGraw-Hill, New Delhi, 2003.
5. Sarkar B.K, “Thermal Engineering”, Tata McGraw-Hill Publishers, 2007.
6. Nag P.K, “Basic and Applied Thermodynamics”, Tata McGraw-Hill, New Delhi, 1st edition, 2002.

WEB RESOURCES:

1. https://nptel.ac.in/courses/112/106/112106133/
2. https://nptel.ac.in/courses/112/105/112105129/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112/107/112107216/
2. https://nptel.ac.in/courses/112/107/112107291/
3. https://nptel.ac.in/courses/112/103/112103277/
4. https://nptel.ac.in/courses/112/103/112103275/
5. https://nptel.ac.in/courses/112/107/112107208/
6. https://nptel.ac.in/courses/112/105/112105128/

OUTCOMES:

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

1. Select suitable thermal systems for various thermal applications (K1)
2. Recognize and discuss the principles of turbo machines for enabling a sustainable society. (K2)
3. Identify and examine the problems associated to different thermal systems (K3)
4. Calculate the performance of power developing and refrigerating systems (K3)
5. Compute the performance of turbo machines and various thermal components. (K3)
6. Apply thermodynamic concepts, laws and methodologis to different power and cooling systems (K3)

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	2	3	3
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	-	3	2
CO6	3	3	-	-		-	-	-	-	-	-	1	3	3

SEMESTER - IV

20BSMA403 SDG NO. 4	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To define Null and Alternate hypothesis, identify small, large samples and gain knowledge in testing of hypothesis
- To differentiate between one way and two-way classification of ANOVA and gain knowledge in Design of experiments
- To impart knowledge on numerical solution of algebraic, transcendental and system of linear equations and learn to compute Eigen values and Eigen vectors
- To understand various numerical techniques of finding the interpolating polynomials in equal and unequal intervals and learn the concept of numerical differentiation and integration
- To gain knowledge in solving ordinary and partial differential equations using numerical techniques

UNIT I TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F-distributions for mean, variance and proportion - Contingency table (test for independence) - Goodness of fit.

UNIT II DESIGN OF EXPERIMENTS 12

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method -Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 12

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

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

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Grewal, B.S. and Grewal, J.S., “Numerical Methods in Engineering and Science ", 10th Edition, Khanna Publishers, New Delhi, 2015.
2. Johnson, R.A., Miller, I. and Freund J., “Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCES

1. Burden, R.L and Faires, J.D, "Numerical Analysis”, 9th Edition, Cengage Learning, 2016.
2. Devore, J.L., "Probability and Statistics for Engineering and the Sciences”, Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald, C.F. and Wheatley, P.O. "Applied Numerical Analysis”, Pearson Education, Asia, New Delhi, 2006.
4. Spiegel, M.R., Schiller, J. and Srinivasan, R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 2004.
5. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., “Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.

WEB RESOURCES:

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

ONLINE RESOURCES:

1. https://freevideolectures.com/course/3057/numerical-methods-and-computation
2. https://nptel.ac.in/courses/111107105/
3. https://www.maths.unsw.edu.au/courses/math2089-numerical-methods-and-statistics

OUTCOMES:

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

1. Apply test of hypothesis for large and small samples in various real-life problems. (K3)
2. Apply chi-square test for goodness of fit and test for independence and interpret the results. (K3)
3. Construct an optimal design for practical problems and analyze the data to obtain objective conclusions. (K4)
4. Obtain the numerical solution of algebraic, transcendental equations and Eigen value problems. (K3)
5. Apply numerical techniques to interpolate data and find differentiation and integration. (K3)
6. Solve ordinary and partial differential equations using numerical techniques. (K3)

CO - PO, PSO MAPPING :

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

SEMESTER - IV

20CEPC405 SDG NO. 4, 9	STRENGTH OF MATERIALS FOR MECHANICAL ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts of stress and strain
- To determine the principal stresses and deformation in cylindrical and spherical shells
- To determine stresses and deformation in circular shafts and helical spring due to torsion
- To study the concept of shearing force and bending moment due to external loads in beams and their effect on stress distribution
- To compute slopes and deflections in determinate beams by various methods

UNIT I STRESS, STRAIN & DEFORMATIONS OF SOLIDS 9

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

UNIT II ANALYSIS OF STATE OF STRESS AND CYLINDRICAL AND SPHERICAL SHELLS (THIN AND THICK) 9

Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress. Stresses and deformation in thin and thick cylinders due to internal pressure. Stresses and deformation in thin and thick spherical shells subjected to internal pressure. Lame's theorem.

UNIT III TORSION AND SPRINGS 9

Torsion Equation - Deformation in solid and hollows shafts – Stepped shafts–shafts fixed at the both ends- Stresses & deflection in open and closed coil helical springs with axial load – Stresses and deflection in carriage springs.

UNIT IV STRESSES IN BEAMS 9

Beams – types, Transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending–bending stress distribution- Shear stress distribution.

UNIT V DEFLECTION OF BEAMS & COLUMNS **9**

Computation of slopes and deflections in beams - Double Integration method – Macaulay's method – Area moment method - Euler Equation and Rankine Formula for buckling of columns.

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, 2018.

REFERENCES

1. Rajput, R.K., "Strength of Materials", S. Chand Publications, 2018.
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. https://nptel.ac.in/courses/112/106/112106141/
2. https://nptel.ac.in/courses/112/107/112107146/
3. https://nptel.ac.in/courses/105/102/105102090/
4. http://ocw.mit.edu/courses/mechanical-engineering
5. http://nitc.ac.in/index.php/?url=users/view/270/12/3

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/112/107/112107147/
2. https://nptel.ac.in/courses/105/105/105105108/
3. https://nptel.ac.in/courses/105/106/105106116/
4. https://nptel.ac.in/courses/105/104/105104160/
5. https://nptel.ac.in/courses/105/106/105106172/

OUTCOMES:

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

1. Interpret the concepts and principles of stress and strain and perform calculations, related to the strength of structured and mechanical components (K3).

2. Analyse members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behavior of materials.(K3)
3. Predict the internal stresses developed in structural and mechanical components.(K3)
4. Demonstrate an understanding of the relationships between loads, member forces and deformations and material stresses and strains (K3)
5. Demonstrate an understanding of the assumptions and limitations of the structural mechanics theory.(K3)
6. Apply structural mechanics of deformable bodies to solve engineering problems (K3)

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	1	1	-	-	-	-	1	2	2
CO2	3	2	1	-	-	1	1	-	-	-	-	1	2	2
CO3	3	2	1	-	-	1	1	-	-	-	-	1	2	2
CO4	3	2	1	-	-	1	1	-	-	-	-	1	2	2
CO5	3	2	1	-	-	1	1	-	-	-	-	1	2	2
CO6	3	2	1	-	-	1	1	-	-	-	-	1	2	2

SEMESTER - IV

20MEPL401 SDG NO. 4,7,12	METROLOGY AND MEASUREMENTS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To measure various parameters accurately using different measuring instruments for Quality Inspection in Industries
- To identify and classify different measuring tools and explain accuracy and precision
- To conduct, analyse, interpret, and present measurement data from measurements experiments
- To identify sources of variability, error, and uncertainties

LIST OF EXPERIMENTS

1. Calibration and use of measuring instruments – vernier caliper, micrometer, vernier height gauge – using gauge blocks
2. Calibration and use of measuring instruments – depth micrometer, bore gauge, telescopic gauge
3. Measurement of linear dimensions using Comparators
4. Measurement of angles using bevel protractor and sine bar
5. Measurement of screw thread parameters – Screw thread Micrometers and Three wire method (floating carriage micrometer)
6. Measurement of gear parameters – gear tooth vernier caliper
7. Measurement of features in a prismatic component using Coordinate Measuring Machine
8. Programming of CNC Coordinate Measuring Machines for repeated measurements of identical components
9. Non-contact (optical) measurement using toolmaker's microscope / profile projector.
10. Measurement of surface finish in components manufactured by various processes (turning, milling, grinding, etc.,) using stylus based instruments.
11. Machine tool metrology – Level tests using precision level, Testing of straightness of a machine tool guide way using autocollimator.
12. Measurement of force, torque and temperature

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

1	Micrometer and dial gauges	5
2	Vernier Caliper	5
3	Vernier Height Gauge	2
4	Vernier depth Gauge	2
5	Slip Gauge Set	2
6	Gear Tooth Vernier	2
7	Sine Bar	2
8	Floating Carriage Micrometer	1
9	Profile Projector / Tool Makers Microscope	1
10	Parallel / counter flow heat exchanger apparatus	1
11	Mechanical / Electrical / Pneumatic Comparator	1
12	Autocollimator	1
13	Temperature Measuring Setup	1
14	Force Measuring Setup	1
15	Torque Measuring Setup	1

16	Coordinate measuring machine	1
17	Surface finish measuring equipment	1
18	Bore gauge	1
19	Telescope gauge	1

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Discuss the various parameters like length, height, angle, displacement, flatness, etc.(K2)
2. Intrepret the various linear and angular measurements using measurants like comparator, sine bar, floating carriage micrometer etc.(K2)
3. Inspect various profiles of small mechanical components using light illumination devices.(K2)
4. Develop the knowledge on measuring various physical and dynamic properties like Tolerance, force and temperature using LVDT, Load cell and Thermocouples.(K3)
5. Formulate some unknown quantity or parameter of engineering interest(K3)
6. Relate the surface quality of a given specimen which is important in all kind of manufacturing.(K3)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2	2	2
CO3	3	2	-	-	-	-	-	-	-	-	-	2	2	2
CO4	3	2	-	-	-	-	-	-	-	-	-	2	2	2
CO5	3	2	-	-	-	-	-	-	-	-	-	2	2	2
CO6	3	2	-	-	-	-	-	-	-	-	-	2	2	2

SEMESTER - IV

20CEPL403 SDG NO. 4,9	STRENGTH OF MATERIALS AND FLUID MECHANICS & MACHINERY LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To supplement the theoretical knowledge gained in Mechanics of Solids and Fluid Mechanics with practical testing for determining the strength of materials under externally applied loads
- To enable the students to have a clear understanding of the Design for strength and stiffness and losses in pipe flow
- To understand the flow measurements.
- To analyses the Performance of various Pumps and Turbines

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. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

S.No	NAME OF THE EQUIPMENT	QTY
1	Universal Tensile Testing machine with double shear attachment – 40 Ton Capacity	1
2	Torsion Testing Machine (60 NM Capacity)	1
3	Impact Testing Machine (300 J Capacity)	1
4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1

FLUID MECHANICS AND MACHINERY LABORATORY

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.

2. Determination of the Coefficient of discharge of given Venturi meter.
3. Determination of friction factor for a given set of pipes.
4. Conducting experiments and drawing the characteristic curves of centrifugal pump/submergible pump.
5. Conducting experiments and drawing the characteristic curves of reciprocating pump.
6. Conducting experiments and drawing the characteristic curves of Gear pump.
7. Conducting experiments and drawing the characteristic curves of Pelton wheel, Francis and Kaplan Turbine.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

1	Bernoulli's Apparatus.	1 No.
2	Orifice meter setup	1 No.
3	Venturi meter setup	1 No.
4	Rotameter setup	1 No.
5	Pipe Flow analysis setup	1 No.
6	Centrifugal pump/submergible pump setup	1 No.
7	Reciprocating pump setup	1 No.
8	Gear pump setup	1 No.
9	Pelton wheel Turbine setup	1 No.
10	Francis turbine setup	1 No.
11	Kaplan turbine setup	1 No.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students should 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. (K2)
2. Estimate and compare the elastic constants such as Young's modulus and Rigidity modulus of the given specimen through Deflection testing and spring testing with standard values. (K2)
3. Compare the structures and hardness of Unhardened and Hardened specimen through microscopic examinations. (K2)
4. Measure the flow rate of fluid using different flow measuring devices and calculate the friction loss and other minor losses in a pipe flow. (K2)
5. Predict the basic performance characteristics of hydraulic Pumps. (K2)
6. Predict the basic performance characteristics of hydraulic Turbines. (K2)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	-	-	1	1	-	-	-	-	1	1	2
CO2	2	2	1	-	-	1	1	-	-	-	-	1	1	2
CO3	2	2	1	-	-	1	1	-	-	-	-	1	1	2
CO4	2	2	1	-	-	1	1	-	-	-	-	1	1	2
CO5	2	2	1	-	-	1	1	-	-	-	-	1	1	2
CO6	2	2	1	-	-	1	1	-	-	-	-	1	1	2

SEMESTER - IV

20METE401 SDG NO.4,6,7,8,9, 11,12,13, 17	LIVE-IN-LAB - II	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same
- To train the students face reviews and viva voce examination

COURSE METHODOLOGY

- The student should continue the Live-in Lab Project-I on the selected topic under the same supervisor selected in Live-in Lab Project-I. The student has to complete design part and design evaluation of the selected project in Live-in Lab Project-I. At the end of the semester, the progress of the project is reviewed and evaluated with a minimum of three reviews with the guidance of Project Coordinator. The students will be evaluated through project report and the viva-voce examination by the panel of members. The review committee may be constituted by the Head of the Department. The student must submit a detailed project report at the end of the semester for evaluation.

EVALUATION: Project work evaluation is based on Regulations of Credit system of Autonomous Regulatory Body.

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

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Conduct literature survey to identify the gap and an application oriented research problem in the specific domain(K4)
2. Design and validate the proposed system using simulation(K6)
3. Prototype the proposed system(K5)
4. Analyze the obtained results and prepare a technical report(K4)
5. Publish the work in journals and apply for the patents.(K3)
6. Prepare for industrial environment and real time work(K3)

CO- PO & PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO4	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO6	2	2	2	2	3	2	2	2	2	2	3	3	3	3

SEMESTER - IV

20METP401 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

PROBLEM SOLVING SKILLS – PHASE 1

COURSE OBJECTIVE:

- Improve their quantitative ability.
- Improve their reasoning ability.
- Enhance their verbal ability through vocabulary building and grammar
- Equip with creative thinking and problem solving skills

UNIT I QUANTITATIVE ABILITY – III **6**

Compound Interest - Profit and Loss - Partnership - Percentage - Set Theory

UNIT II QUANTITATIVE ABILITY – IV **6**

True Discount - Ratio and Proportion - Simplification - Problems on H.C.F and L.C.M

UNIT III REASONING ABILITY – II **6**

Course of Action - Cause and Effect - Statement and Conclusion - Statement and Argument - Data Sufficiency (DS) - Statement and Assumption - Making Assumptions.

UNIT IV VERBAL ABILITY – II **6**

Change of Voice - Change of Speech - Letter and Symbol Series - Essential Part - Verbal Reasoning - Analyzing Arguments.

UNIT V CREATIVITY ABILITY – II **6**

Seating Arrangement - Direction Sense Test - Character Puzzles - Missing Letters Puzzles - Mirror &Water Images.

TOTAL : 30 PERIODS

REFERENCES:

1) R. S. Agarwal, "Quantitative Aptitude for Competitive Exams"
2) Sarvesh Verma, "Quantum CAT"
3) R. S. Agarwal, "A Modern Approach to Logical Reasoning"
4) Arun sharma, "Verbal Ability and Reading Comprehension"

ADVANCED C PROGRAMMING AND CNC PROGRAMMING - PHASE 2

COURSE OBJECTIVE:

- To improve C programming skills with understanding of code organization and functional hierarchical decomposition with using complex data types.
- The course is oriented to those who want to advance structured and procedural programming understating and to improve C programming skills. The major objective is to provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To educate and enrich the students on the programming aspect of CNC machines.

UNIT I INTRODUCTION TO RECURSION AND GROWTH FUNCTIONS **6**

Introduction to Recursion - Recurrence Relation - Deriving time complexity and space complexity using recurrence relation Polynomial Equations -

Compare growth functions - Nth Fibonacci Number - Exponent Function - Taylor Series - Tower of Hanoi.

UNIT II STORAGE CLASSES, THE PREPROCESSOR AND DYNAMIC MEMORY ALLOCATION 6

Storage Classes and Visibility - Automatic or local variables - Global variables - Macro Definition and Substitution - Conditional Compilation - Dynamic Memory Allocation - Allocating Memory with malloc and callo Allocating Memory with calloc - Freeing Memory - The Concept of linked list - Inserting a node by using Recursive Programs - Deleting the Specified Node in a Singly Linked List.

UNIT III FILE MANAGEMENT AND BIT MANIPULATION 6

Defining and Opening a file - Closing Files - Input/output Operations on Files - Predefined Streams - Error Handling during I/O Operations - Random Access to Files - Command Line Arguments - The hexadecimal number system - C bitwise operators - How to generate all the possible subsets of a set - Tricks with Bits - Applications of bit operations.

UNIT IV INTRODUCTION 6

Introduction to NC and CNC machine – types – constructional details.

UNIT V BASICS OF PROGRAMMING 6

Basics of part programming – G codes and M codes – Programming and Machining of a component.

TOTAL : 30 PERIODS

REFERENCES:

1. R. G. Dromey, "How to Solve It By Computer", Pearson, 1982
2. A.R. Bradley, "Programming for Engineers", Springer, 2011
3. Kernighan and Ritchie, "The C Programming Language", (2nd ed.) Prentice Hall, 1988
4. CNC Programming by Dr. S. K. Sinha
5. CNC Programming Handbook (3rd edition) by Peter Smid
6. CNC Trade Secrets by James Harvery

COURSE OUTCOMES :

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

1. Analyze their quantitative ability. (K4)
2. Understand the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)
3. Create their verbal ability through vocabulary building and grammar. (K6)
4. Evaluate code organization and functional hierarchical decomposition with complex data types. (K5)
5. Understand to improve C programming skills to apply advance structured and procedural programming. (K2)
6. Write a part program for a given product drawing and demonstrate the program by using a CNC Machine. (K2)

CO- PO & PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO2	-	-	-	-	3	2	-	3	2	3	-	2	-	-
CO3	-	-	-	-	3	2	-	-	1	3	-	2	-	-
CO4	-	-	-	-	3	2	-	3	3	3	-	2	2	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2	2	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2	2	2

Imagine the Future and

Make it happen!

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

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

There is CLEAN WATER AND SANITATION for everyone. AFFORDABLE AND CLEAN ENERGY

which will help to create DECENT WORK AND ECONOMIC GROWTH. Our prosperity shall be fuelled

by investments in INDUSTRY, INNOVATION AND INFRASTRUCTURE that will help us to

REDUCE INEQUALITIES by all means. We will live in SUSTAINABLE CITIES AND COMMUNITIES.

RESPONSIBLE CONSUMPTION AND PRODUCTION will help in healing our planet.

CLIMATE ACTION will reduce global warming and we will have abundant,

flourishing LIFE BELOW WATER, rich and diverse LIFE ON LAND.

We will enjoy PEACE AND JUSTICE through STRONG INSTITUTIONS

and will build long term PARTNERSHIPS FOR THE GOALS.

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

Together we can...

Sai Prakash Leo Muthu

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