



Sri

SAI RAM
ENGINEERING COLLEGE

An Autonomous Institution

West Tambaram, Chennai - 44
www.sairam.edu.in

Approved by AICTE, New Delhi
Affiliated to Anna University



DEPARTMENT OF
**MECHANICAL & AUTOMATION
ENGINEERING**

**REGULATIONS
2020**

Academic Year 2021-22 onwards

**AUTONOMOUS
CURRICULUM AND**

**SYLLABUS
I - IV
SEMESTERS**

SRI SAI RAM ENGINEERING COLLEGE



VISION

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



MISSION

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



QUALITY POLICY

We at Sri Sai Ram Engineering College 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 Service to satisfy the Students, Parents, Industry and Society.

DEPARTMENT OF MECHANICAL & AUTOMATION ENGINEERING



VISION

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



MISSION

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

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

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

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

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

AUTONOMOUS 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

AUTONOMOUS CURRICULUM AND SYLLABI

Regulations 2020

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	20MUPC301	Basic Manufacturing Processes	3	0	0	3	3
3	20MEPC302	Engineering Thermodynamics	3	1	0	4	4
4	20MUPW301	Sensors in Automation	3	0	2	5	4
5	20BSMA303	Partial Differential Equations and Probability Theory	3	1	0	4	4
6	20EIPC304	Basic Electronics and Control System	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	20MUTE301	Live-in Lab I	0	0	2	2	1
10	20MUTP301	Skill Enhancement	0	0	2	2	1
		TOTAL	18	2	12	32	26

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20MUPC401	Fluid Power Automation	3	0	0	3	3
2	20MUPC402	Theory of Machines	3	0	0	3	3
3	20MUPC403	CNC Machines and Metrology	3	0	0	3	3
4	20MUPC404	Computer Aided Design	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	20MUPL401	Strength of Materials & Metrology Laboratory	0	0	3	3	1.5
8	20MUPL402	Fluid Power Systems Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - II							
9	20MUTE401	Live-in Lab II	0	0	2	2	1
10	20MUTP401	Skill Enhancement	0	0	2	2	1
		TOTAL	18	1	10	29	24

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO 1:** Graduates will have sound technical acumen and leadership to become competent engineers leading to a successful career.
- PEO 2:** Graduates will pursue lifelong learning in generating innovative engineering solutions using fundamentals in basic science and complex problem-solving skills.
- PEO 3:** Graduates will strengthen entrepreneurial quality and self-employment in the program adopted..
- PEO 4:** Graduates will inculcate ethical responsibilities and render service towards peers, society and the nation without compromise.
- PEO 5:** Graduates will demonstrate commitment towards sustainable development for the betterment of the society ensuring ethical and moral values.

PROGRAM SPECIFIC OUTCOMES (PSOs)

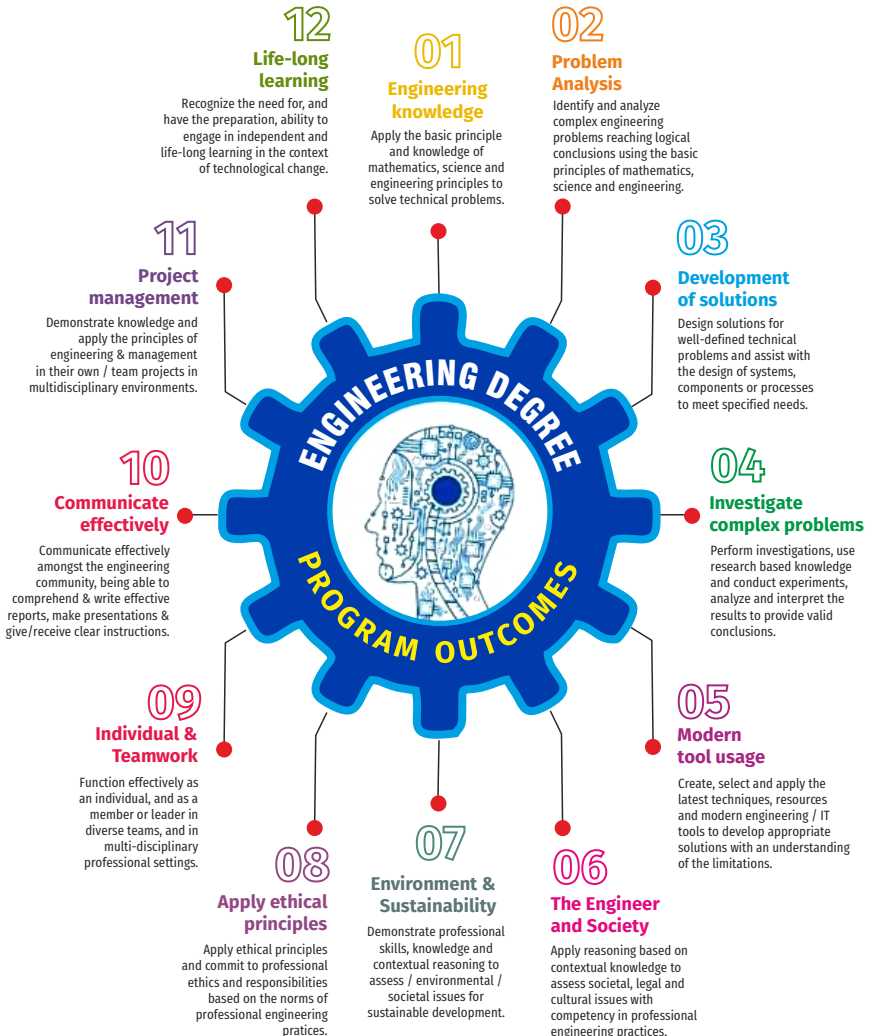
- PSO 1:** Capable of exhibiting the knowledge and skills in understanding the basic concepts of the Mechanical and Automation Engineering and improving the performance of manufacturing and production systems by implementing the latest technological advancements and excel as entrepreneurs.
- PSO 2:** Posses sound fundamentals of basic sciences so as to apply them for engineering problem analysis and research in multiple related spheres, showing passion for higher education and research in the chosen field.

COMPONENTS OF THE CURRICULUM (COC)

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total Number of credits
Basic Sciences(BS)	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



SEMESTER - I

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

OBJECTIVES:

The intent of the course is

- To understand and 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) – Diagonalization of a Quadratic form using orthogonal transformation - Nature of Quadratic forms.

UNIT II DIFFERENTIAL CALCULUS

12

Limits, continuity, Differentiation rules - Maxima and Minima of functions of one variable, partial derivatives (first and second order – basic problems), 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 integrals - 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 area of revolution and volume of revolution. Evaluation of improper integrals.

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. Diagonalize the matrix using orthogonal transformation and apply Cayley Hamilton Theorem to find the inverse and integral powers of a square matrix. (K3)
2. Evaluate the limit, examine the continuity and use derivatives to find extreme values of a function. (K3)
3. Evaluate definite and improper integrals using techniques of integration. (K3)
4. Apply double and triple integrals to find the area of a region and the volume of a surface. (K3)
5. Compute infinite series expansion of a function. (K3)

CO - PO MAPPING :

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

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

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://engineeringvidelectures.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. Express and explain short texts on different topics with key information applying suitable vocabulary (K2)
2. Interpret and dramatize fluently in informal and formal contexts (K2)
3. Choose and apply the right syntax in comprehending diversified general and technical articles (K3)
4. Analyze and write technical concepts in simple and lucid style (K3)
5. Construct informal letters and e-mails thoughtfully (K2)
6. Demonstrate technical concepts and summaries in correct grammar and vocabulary (K2)

CO - PO MAPPING :

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

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 - CO₂ 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. To understand the crystal systems and elastic properties of Materials (K2)
2. To distinguish different crystal structures and heat conduction in conductor and insulators (K4)
3. To explain powder diffraction method-deformation of materials in response to action load, quantum mechanics to understand wave particle dualism (K2)
4. To apply quantum theory to set up one dimensional Schrodinger's wave equation and applications to a matter wave system and principle of laser action (K3)
5. To analyze bending of beams, types of optical fiber and modes of heat transfer (K4)
6. To discuss light propagation in optical fibers and transfer of heat energy in different measures and its applications (K2)

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" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015.
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.
4. Ravikrishnan A, 'Engineering Chemistry', Sri Krishna Hitech Publishing Company Pvt. Ltd, New Edition 2021.

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 and recognize the basic design of adsorption systems and its industrial applications. (K2)
2. Recognize the basic concepts of electrochemistry and apply the principles of electrochemistry to corrosion process and the applications of protective coatings to overcome the corrosion. (K2)
3. Disseminating the importance of chemistry of fuels and combustion to enhance the fuel efficiency. (K2)
4. Acquire the basics of non-conventional sources of energy and illustrate the principles and the reaction mechanism of batteries and fuel cells. (K2)
5. Explain 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	2	2	-	-	1	2	-	-	-	-	1
CO2	3	2	3	2	2	1	2	-	-	-	-	3
CO3	3	2	3	2	-	1	2	-	-	-	-	1
CO4	3	2	3	2	-	1	2	-	-	-	1	3
CO5	3	2	3	1	2	1	1	-	-	-	1	3

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	PS01	PS02
C01	3	3	3	3	2	1	1	-	2	2	-	3	2	3
C02	3	3	3	3	2	-	1	1	2	2	3	3	2	3
C03	3	3	3	3	2	1	1	1	2	-	3	-	3	2
C04	3	3	3	3	2	1	-	1	2	2	3	3	1	2
C05	3	3	3	3	2	1	1	1	2	2	3	3	2	1
C06	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. Jeyapooan, "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
C01	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C02	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C03	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C04	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C05	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C06	3	2	2	-	-	-	-	-	2	2	-	2	2	2

SEMESTER - 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. Interpret quantitative chemical analysis to generate experimental skills in building technical competence. (K3)
5. Analyze the quality of water for domestic and industrial purpose. (K3)

6. Standardize the solutions using volumetric titrations, conductivity, pH, redox potential and optical density measurements. (K3)

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 to check whether a given number is odd or even?
7. Write a program to find the factorial of a given number.
8. Write a program to find out the average of 4 integers.
9. Write a program to 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:

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 Building , 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 compiler 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 levels 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. Erwin Kreyszig, Advance Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill Publishing Company, New Delhi, 2008.

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 and vector point functions. Use vector point function to establish a relation between line, surface and volume integrals. (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 apply the properties of analytic functions to check for harmonic and orthogonal functions and find the images of circle and straight lines under the standard transformations. (K3)
4. Use Cauchy's integral theorem, formula and Cauchy's Residue theorem to evaluate complex and real integrals, find the Taylor's and Laurent's series expansion. (K3)
5. Apply Laplace and inverse Laplace Transforms to solve the Linear ordinary differential equations with constant coefficients. (K3)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	3	2	1	-	-	-	-	-	-	-	1
C02	3	3	2	1	-	-	-	-	-	-	-	1
C03	3	3	2	1	-	-	-	-	-	-	-	1
C04	3	3	2	1	-	-	-	-	-	-	-	1
C05	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=EAlaIQobChMI49DF9bnd6AIVSY6PCh1d_gV9EAAAYASAAEgIBPvD_BwE.

OUTCOMES:

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

1. Define technical terms with the correct use of grammar (K1)
2. Identify new words, phrases, idioms and summarize articles/ write ups effectively (K2)
3. Pronounce words correctly, speak fluently and share opinions and suggestions effectively in conversations, debates and discussions (K3)
4. Construct reports convincingly and write official letters emphatically (K3)
5. Communicate confidently while speaking and writing by employing language strategies (K2)
6. Adapt group behavior, execute their role as a contributing team member and prepare winning job applications (K3)

CO - PO MAPPING:

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

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	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**9**

Definition, scope and importance of environment – need for public awareness – Ecosystem: concept of an ecosystem – structure and functions of an ecosystem – Biotic and abiotic components – Biogeochemical cycle (C, N & P) – energy flow in the ecosystem – food chains, food webs and ecological pyramids – ecological succession - keystone species. Introduction to biodiversity definition: genetic, species and ecosystem diversity – values of biodiversity – IUCN Red list species classification - endemic, endangered, rare, vulnerable, extinct and exotic species – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – man-wildlife conflicts. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of Terrestrial (Forest, Grassland, Desert) and Aquatic ecosystem (Pond, Lake, River, Estuary and Marine)

UNIT II ENVIRONMENTAL POLLUTION**9**

Definition – causes, effects and control measures of: Air pollution, Water pollution, Soil pollution Marine pollution, Noise pollution, Thermal pollution and Nuclear pollution – solid waste management: causes, effects and control measures of municipal solid wastes (MSW) – role of an individual in prevention of pollution – Case studies related to environmental pollution. Disaster management: floods, earthquake, cyclone and landslides – nuclear holocaust – Case studies.

UNIT III NATURAL RESOURCES**9**

Forest resources: Use and over – exploitation, deforestation – Land resources: land degradation, man induced landslides, soil erosion and desertification – Water resources: Use and over- utilization of surface and groundwater – dams-benefits and problems, conflicts over water – Mineral resources: Environmental effects of extracting and using mineral resources – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – fertilizer – pesticide problems, water logging and salinity. Energy resources: Renewable energy (Solar energy, Wind energy, Tidal energy, Geothermal energy, OTE, Biomass energy) and non renewable energy (Coal, Petroleum, Nuclear energy) sources. – role of an individual in conservation of natural resources. Case studies – timber extraction, mining, dams and their effects on forests and tribal people.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT**10**

Atmospheric Chemistry - Composition and structure of atmosphere. Climate change - greenhouse effect- role of greenhouse gases on global warming. Chemical and photochemical reactions in the atmosphere - Formation of

smog, PAN, acid rain (causes, effect and control measures). Oxygen and ozone chemistry - Ozone layer depletion (causes, effect and control measures). environmental ethics: Issues and possible solutions – Green chemistry - 12 principles of green chemistry.

Urbanisation - Urban problems related to energy - Water conservation: rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns - case studies. Environment Legislations and 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. 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 - Environmental Impact Assessment (EIA).

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

8

Population growth, variation among nations – population explosion – family welfare programme – women and child welfare environment and human health – HIV / AIDS – Role of Information Technology in environment and Human health – Case studies – human rights – value education – Sustainable Development – Need for sustainable development – concept - 17 SDG goals – 8 Millennium Development Goals(MDG).

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.
3. Ravikrishnan A, 'Environmental Science and Engineering', Sri Krishna Hitech Publishing Company Pvt. Ltd, Revised Edition 2020.

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. Explain the different components of environment, structure and function of an ecosystem, importance of biodiversity and its conservation. (K1)
2. Aware about problems of environmental pollution, its impact on human and ecosystem, control measures and basic concepts in Disaster Management. (K2)
3. Disseminate the need for the natural resources and its application to meet the modern requirements and the necessity of its conservation. (K2)
4. Illustrate the various aspects of atmospheric chemistry with a focus on climate change and recognize the principles of green chemistry. Describe suitable scientific, technological solutions and Protection Acts to eradicate social and environmental issues. (K2)
5. Recognize the need for population control measures and the environmental based value education concepts to achieve the Sustainable Development Goals. (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 of 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 electrical 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, bainite 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.

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

- Understand the concept of formation of alloys and invariant phase reactions related to unary and binary system (K2)
- Demonstrate the practical exposure on microstructure, phase transformation, effect of alloying elements in ferrous alloys and their applications (K2)
- Explain the phase transformation TTT diagram, various testing procedures for understanding the properties of materials and strengthening methods (K2)
- Understand the basic knowledge of ferromagnetic and ferrimagnetic materials (K2)
- Gain knowledge on dielectric, super conducting, composite, ceramic materials, metallic glasses, shape memory alloys, nanomaterials and their properties (K2).
- Apply the suitable superconducting, ceramic, nano, composite materials and shape memory alloys for specific engineering applications (K2)

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	ENGINEERING PRACTICES	L	T	P	C
SDG NO. 4,9,12	LABORATORY	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	2 Nos
	Digital Live-wire detector	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	2 Nos
	Demolition Hammer	2 Nos
	Circular Saw	2 Nos
	Planer	2 Nos
	Hand Drilling Machine	2 Nos
	Jigsaw	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/knowning-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/CommSkil/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.garreynolds.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 & 5	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”, 12th Edition, Tata McGraw-Hill Publishing company, New Delhi, 2004.
2. Dubey, N.H, “Engineering Mechanics – Statics and Dynamics”, McGraw Hill Education (India) Pvt Ltd.

REFERENCES:

1. Bhavikatti, S.S and Rajashekarappa, K.G., “Engineering Mechanics”, New Age International (P) Limited Publishers, 1998.
2. Hibbeler, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 14th 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. Kottiswaran. N, 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. Apply the Fundamental concepts of Mechanics and operation of forces to solve equilibrium of particles in 2D and 3D (K3)
2. Apply Varignon’s theorem to equilibrium of rigid bodies in 2D & 3D (K3)
3. Apply coulombs law of friction to calculate contact friction, wedge friction, ladder friction and rolling resistance. (K3)

4. Calculate the centroid, centre of mass, volume and area of simple, composite solids using Theorem of Pappus. (K2)
5. Calculate the moment of inertia, product of inertia, radius of gyration of plane & composite areas and mass moment of inertia of prismatic, cylindrical and spherical solids (K2)
6. Determine relative and curvilinear motion using equations of motion and impulse, momentum, impact of elastic bodies, general plane motion of rigid bodies. (K3)

CO – PO MAPPING :

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

SEMESTER - III

20MUPC301 SDG NO. 4,9,12,13	BASIC MANUFACTURING PROCESSES	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 metal cutting.
- To understand the working of standard machine tools such as lathe, milling, drilling and allied machines, grinding and allied machines.
- 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; Defects in Casting. Welding: Fusion Welding - Operating Principle, Basic Equipment, Merits and Applications: 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; Resistance Welding - Brazing and Soldering; Weld Defects.

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.

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.

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: Semiautomatic – Single spindle: Swiss Type, Automatic Screw Type – Multi Spindle.

UNIT IV DRILLING, MILLING AND GEAR CUTTING MACHINES**9**

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**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.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Kalpakjian, S, "Manufacturing Engineering and Technology", Pearson Education India, 8thEdition, 2019.
2. HajraChoudhary S.K and HajraChoudhary. A.K., "Elements of workshop Technology", volume I and II, Media promoters and Publishers Private Limited, Mumbai, 2008.

REFERENCES:

1. Paul Degarmo E, Black J.T and Ronald A. Kosher, "Materials and Processes, in Manufacturing" 9thEdition, Prentice – Hall of India, 2003.
2. Rao, P.N. "Manufacturing Technology Foundry, Forming and Welding", 45thEdition, TMH-2018
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., 2019.
5. Rao. P.N "Manufacturing Technology - Metal Cutting and Machine Tools", 4thEdition, Tata McGraw-Hill, New Delhi, 2018.

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. <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/112/103/112103248/>
8. <https://nptel.ac.in/courses/112/103/112103250/>
9. <https://nptel.ac.in/courses/112/107/112107089/>
10. <https://www.mooc-list.com/course/fundamentals-manufacturing-processes-edx>

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

1. Explain different Metal casting & Joining processes, associated defects, merits and demerits. (K2)
2. Summarize various hot working and cold working methods of metals and explain various sheet metal making processes. (K2)
3. Interpret metal cutting theory based on cutting force and power consumption. (K2)
4. Describe the constructional and operational features of centre lathe and other special purpose lathes. (K2)
5. Discuss the working construction of various milling, drilling and gear cutting machines. (K2)
6. Explain the types of various abrasive process. (K2)

CO – PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	3	2	1	1	1	1	1	-	-	-	1	2	2	2
CO2	3	2	2	2	1	1	1	-	-	-	1	2	2	2
CO3	3	2	2	2	1	1	1	-	-	-	1	2	2	2
CO4	3	2	2	2	1	1	1	-	-	-	1	2	2	2
CO5	3	2	2	2	1	1	1	-	-	-	1	2	2	2
CO6	3	2	2	2	1	1	1	-	-	-	2	2	2	2

SEMESTER - III

20MEPC302 SDG NO. 4,7,12,15	ENGINEERING THERMODYNAMICS	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 & Sonntag, "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
C01	3	3	-	-	-	-	-	-	-	-	-	-	3	3
C02	3	3	-	-	-	-	-	2	-	-	-	1	3	3
C03	3	3	-	-	-	-	-	-	-	-	-	-	3	2
C04	3	3	-	-	-	-	-	-	-	-	-	1	3	3
C05	3	3	-	-	-	-	-	-	-	-	-	-	3	2
C06	3	3	-	-	-	-	-	2	-	-	-	-	3	3

SEMESTER - III

20MUPW301 SDG NO. 4,9	SENSORS IN AUTOMATION	L	T	P	C
		3	0	2	4

OBJECTIVES:

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

UNIT I INTRODUCTION

9

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

UNIT II MOTION, PROXIMITY AND RANGING SENSORS

9

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT III FORCE, MAGNETIC AND HEADING SENSORS

7

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

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS

11

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT V DAQ SYSTEMS AND APPLICATIONS

9

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

TOTAL : 45 PERIODS

LABORATORY EXPERIMENTS:**PERIODS: 15HRS**

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

TEXTBOOKS

1. Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 7th Edition, 2009.
2. Sawney A K and PuneetSawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, DhanpatRai& Co, New Delhi, 2013

REFERENCE BOOKS

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

WEB RESOURCES:

1. https://swayam.gov.in/nd1_noc19_ee41/preview
2. <https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf>

ONLINE RESOURCES:

1. <https://instrumentationtools.com/tag/sensors-and-transducers-nptelpdf/>
2. <https://electronics-tutorials.ws/io/io>

OUTCOMES:

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

1. Familiar with various calibration techniques and signal types for sensors (K1)
2. Explain the various sensors used in Automotive and Mechatronics applications (K2)
3. Describe the working principle and characteristics of force, magnetic and heading sensors (K1).
4. Understand the basic principles of various pressure and temperature, smart sensors (K1)
5. Understand the basic principles of various optical and smart sensors (K1)
6. Ability to implement the DAQ systems with different sensors for real time applications (K2)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	1	-	1	-	-	-	1	-	-	-	-	-	1	1
C02	1	1	2	1	-	1	1	1	-	-	-	-	1	2
C03	1	-	-	1	1	-	-	-	-	-	-	-	1	1
C04	1	-	-	-	2	1	1	1	-	-	-	1	1	1
C05	1	-	-	-	2	1	1	1	-	-	-	1	1	2
C06	1	1	2	1	2	1	1	1	1	-	1	2	1	2

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 understand the basic concepts of probability, one dimensional and two-dimensional random variables. Introduce 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. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
2. Veerarajan. T., "Transforms and Partial Differential Equations", Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, Third print, 2016.

REFERENCES:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
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 Mc Graw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012
4. Ramana B.V., "Higher Engineering Mathematics", Tata Mc Graw Hill Publishing Company Limited, NewDelhi, 2008.
5. Yates R.D. and Goodman D. J., "Probability and Stochastic Processes", Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2012.
6. Ibe O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007.
7. Veerarajan T., "Probability, Statistics and Random Processes", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Third print, 2016.
8. Narayanan S., Manicavachagom Pillay T.K. and Ramanaiah G., "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt. Ltd.1998.

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, higher order linear and nonlinear partial differential equations 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. Compute the Fourier and Inverse Fourier Transform, Sine and Cosine Transform of simple functions. (K3)
4. Calculate the probability, conditional probability and statistical averages of one dimensional discrete and continuous random variables and corresponding probability distributions. (K3)

5. Find the relation between two-dimensional random variables and their transformations. (K3)

CO- PO MAPPING:

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

SEMESTER - III

20EIPC304 SDG NO. 4,8,9,12,16	BASIC ELECTRONICS & CONTROL SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT I ELECTRONIC DEVICES

9

Types of Materials - Silicon & Germanium- N type and P type materials - Structure, Operation and Characteristics of Diodes - PN, Zener. Transistors - Bipolar Junction Transistor (NPN and PNP in CE, CB, CC configuration) - Field Effect Transistors - JFET, MOSFET, Thyristors - SCR and UJT

UNIT II ELECTRONIC CIRCUITS

9

Amplifier – Transistor as Amplifier, Ideal Opamp –Block diagram, Inverting and Non-inverting amplifier, Instrumentation Amplifier, Differentiator, Integrator, Oscillator- Wein Bridge, Hartley and Crystal Oscillators

UNIT III ELECTRONIC SIGNAL CONDITIONING

9

Standard analog signals, Signal Level and bias changes, filtering and impedance matching, sampled data system and linearization, sample and hold

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

UNIT IV SYSTEMS AND REPRESENTATION

9

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

UNIT V TIME RESPONSE ANALYSIS OF SYSTEMS

9

Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants

TOTAL : 45 PERIODS

TEXTBOOKS:

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

REFERENCE BOOKS:

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

WEB RESOURCES:

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

ONLINE RESOURCES:

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

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

1. To describe the characteristics of various semiconductor devices such as diodes, Transistors and Thyristor (K2)
2. To illustrate the working of various configurations operational amplifiers and oscillator circuits (K2)
3. To explain the concepts related to analog and digital conditioning.(K2)
4. Derive the mathematical model of electrical, mechanical systems and determine/reduce the transfer function for the system using block diagram reduction and signal flow graph methods (K3).
5. Derive the time domain behavior of I &II order systems (K2)

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

SEMESTER - III

20MEPL301 SDG NO. 4,9,12,13	MANUFACTURING PROCESSES 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 and Knurling
7. Thread cutting – External and Internal
8. Eccentric Turning
9. Head Shaping – Square and Hexagonal
10. Contour milling using vertical milling machine
11. Spur gear cutting in milling machine
12. Helical Gear Cutting in milling machine
13. Gear generation in hobbing machine
14. Gear generation in gear shaping machine
15. Grinding – Plain Surface and Cylindrical
16. Tool angle grinding with tool and Cutter Grinder
17. 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. Cylindrical 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.

OUTCOMES:

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

1. Join two metals using arc welding. (K1)
2. Use sheet metal fabrication tools and make simple tray and funnel. (K1)

3. Use different moulding tools, patterns and prepare sand moulds. (K1)
4. Make the work piece 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)

CO-PO, PSO MAPPING :

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

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

SEMESTER - III

20MUTE301 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/ Automation/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

OUTCOMES:

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

1. Comprehend an industrial or real life problem and identify right/ real issue with solution. (K1)
2. Complete the necessary studies and review the literature, design a setup of equipment, complete the analysis. (K2)
3. Write a project report based on the findings. (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	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

SEMESTER - III

20MUTP301 SDG NO. 4,11,15	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE & COGNITIVE SKILLS - PHASE I**OBJECTIVES:**

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

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

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 &
Geometric Tolerances– Phase 2**

OBJECTIVES:

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, define the geometry for parts, assemblies and geometrical requirements of the drawings. This course involves a lab component which is designed to give the student hands-on experience with the concepts.

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 ArraysStructures, 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 GEOMETRIC TERMINOLOGY 6

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

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

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

REFERENCES:

1. E. 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", 3rd 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/112105211>

WEB RESOURCES:

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

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
C01	-	-	-	-	3	2	-	3	2	3	-	2	-	-
C02	-	-	-	-	3	2	-	3	2	3	-	2	-	-
C03	-	-	-	-	3	2	-	-	1	3	-	2	-	-
C04	-	-	-	-	3	2	-	3	3	3	-	2	2	2
C05	-	-	-	-	3	2	-	-	2	3	-	2	2	2
C06	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - IV

20MUPC401 SDG NO. 4,9	FLUID POWER AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT I INTRODUCTION TO FLUID POWER PRINCIPLES 8

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

UNIT II FLUID POWER GENERATING/UTILIZING COMPONENTS 9

Hydraulic pumps and motor gears, vane, piston -selection and specification- Drive characteristics – Linear actuator – Types, mounting details, cushioning – power packs – construction. Reservoir capacity, heat dissipation, accumulators and their types. Pneumatics: Properties of air - Perfect Gas Laws - Types of Actuators and Compressor - Filters, Regulator, Lubricator and Muffler.

UNIT III FLUID POWER CONTROL ELEMENTS 9

Direction Flow and pressure control valves – Types, Construction and Operation – Servo and Proportional valves – Applications – Accessories: Reservoirs, Pressure Switches – Applications; Air control Valves, Quick Exhaust Valves.

UNIT IV CIRCUIT DESIGN 9

Basic Hydraulic Circuits: Meter in, Meter out and Bleed off circuits; Intensifier circuits, Regenerative Circuit, Counter balance valve circuit and sequencing circuits. Pneumatic Circuit Designing: Design of Pneumatic sequencing circuits using Cascade method and Shift register method (up to 3 cylinders), Design of Pneumatic circuits for Pick and Place applications.

**UNIT V ELECTRO PNEUMATICS & ELECTRONIC CONTROL OF
HYDRAULIC AND PNEUMATIC CIRCUITS**

10

Design of Electro-Pneumatic Circuits using single solenoid and double solenoid valves; with and without grouping; Design of Pneumatic circuits using PLC Control (ladder programming only) up to 2 cylinders, with applications of Timers and Counters and concept of Flag and latching. Digital Hydraulics: Introduction, different ways to realize motion control with on/off valves, Benefits and challenges of digital Hydraulics.

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

WEB RESOURCES:

1. <http://link.springer.com/content/pdf/bfm%3A978-1-349-16126-3%2F1.pdf>
2. [https://yuken-usa.com/pdf/special/Basic_Hydraulic_And_Components_\(Pub_ES-100-2\)_pdf](https://yuken-usa.com/pdf/special/Basic_Hydraulic_And_Components_(Pub_ES-100-2)_pdf)

ONLINE RESOURCES:

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

OUTCOMES:

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

1. Understand basic automation techniques for small manufacturing set-ups. (K1)
2. Illustrate the working principles of fluid power accessories like pumps, motors. (K3)
3. Analyze pneumatic and hydraulic circuits of medium complexity. (K3)
4. Illustrate the working of control and regulation elements used in pneumatic and hydraulic circuits. (K3)
5. Demonstrate the use of electrical and electronics control in pneumatic and hydraulic circuits. (K3)
6. Analyze the benefits and challenges of Digital Hydraulics. (K3)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	1	1	-	-	-	-	-	-	-	-	-	1	2	2
C02	1	1	-	-	-	-	-	-	-	-	-	1	2	2
C03	2	1	-	-	-	-	-	-	-	-	-	1	2	2
C04	2	-	-	-	-	-	-	-	-	-	-	1	2	2
C05	2	-	-	-	1	-	-	-	-	-	-	1	2	2
C06	2	-	-	-	1	-	-	-	-	-	-	1	2	2

SEMESTER - IV

20MUPC402 SDG NO. 4,9	THEORY OF MACHINES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the principles in the formation of mechanisms and their kinematics
- To understand the effect of control mechanism in different machine elements
- To understand the importance of balancing and vibration

UNIT I INTRODUCTION**9**

Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint & motion – Degrees of freedom – Slider crank – single and double – Crank rocker mechanisms – Inversions, applications. Introduction to Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II GEARING AND CAMS**9**

Gear terminology, law of gearing- nomenclature of spur & helical gears -- interference – requirement of minimum number of teeth in gears. Simple, Compound and reverted gear trains -determination of speed and torque in epicyclic gear trains. Types of cams, Types of followers. Displacement, Velocity and, acceleration time curve for cam profiles. Follower motions including SHM, Uniform acceleration and retardation and Cycloidal motion.

UNIT III MECHANISM FOR CONTROL**9**

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

UNIT IV BALANCING**9**

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

UNIT V VIBRATION**9**

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

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Sadhu Singh, “Theory of Machines: Kinematics and Dynamics”, Pearson Education, 3rd Edition, 2011.
2. Rattan S.S, “Theory of Machines”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 4th Edition, 2014.

REFERENCES:

1. Khurmi, R. S., Gupta, J. K., "Theory of Machines", S.Chand Publisher, 14th Edition, 2020.
2. John Joseph Uicker, Pennock, G. R., Joseph Edward Shigley, 'Theory of Machines and Mechanisms', Oxford University Press, 2003.
3. Amitabha Ghosh and Mallick, 'Theory of Machines and Mechanisms', East West Press, 3rd Edition 2020.
4. Thomas Bevan, "Theory of Machines", CBS Publication, 3rd Edition, 2005.
5. Singh, V.P., "Mechanical Vibrations", Dhanpat Rai Publications (P) Ltd, 3rd Edition, 2011.

WEB RESOURCES:

1. <http://www.mechanisms.co>.
2. <http://dynref.engr.illinois.edu>
3. <https://nptel.ac.in/courses/112/101/112101096/>

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/112/101/112101096/>
2. <http://nitc.ac.in/index.php?url=users/view/270/12/3>
3. <https://nptel.ac.in/courses/112/104/112104114/>
4. <https://nptel.ac.in/courses/112/104/112104121/>

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

1. Enumerate the basic concepts of various mechanisms. (K1)
2. Understand the concepts of gears and gear trains. (K1)
3. Draw the cam profiles for the given specification. (K2)
4. Study and analyse the characteristics of governors and the gyroscopic effect on automobiles, ships and airplanes. (K3)
5. Understand the balancing of Rotating and Reciprocating Masses. (K1)
6. Compute the parameters of free and forced vibrations. (K3)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	2	1	1	-	-	-	-	-	-	-	1	2	2
C02	3	2	2	1	-	-	-	-	-	-	-	1	3	3
C03	2	2	1	1	-	-	-	-	-	-	-	1	2	2
C04	2	2	1	1	-	-	-	-	-	-	-	1	2	2
C05	1	1	1	-	-	-	-	-	-	-	-	1	2	2
C06	3	3	3	-	-	-	-	-	-	-	-	1	3	2

SEMESTER - IV

20MUPC403 SDG NO. 4,8,9, 12,16	CNC MACHINES AND METROLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand evolution and principle of CNC machine tools
- Write simple programs for CNC turning and machining centres
- Generate CNC programs for popular CNC controllers
- Describe about linear and angular measurements in metrology
- Study about the advancement in metrology

UNIT I INTRODUCTION TO CNC MACHINE TOOLS**9**

Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators– Computer Aided Inspection, CNC Machine building, structural details, configuration and design, guide ways – Friction, Anti friction and other types of guide ways.

UNIT II DRIVES AND WORK HOLDING DEVICES**9**

Spindle drives – DC shunt motor, 3 phase AC induction motor, feed drives –stepper motor, servo principle, DC and AC servomotors, Axis measuring system – synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosyn, laser interferometer, work holding devices for rotating and fixed work parts, economics of CNC, maintenance of CNC machines.

UNIT III CNC PROGRAMMING**9**

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

UNIT IV LINEAR AND ANGULAR MEASUREMENTS**9**

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

UNIT V ADVANCES IN METROLOGY**9**

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

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Warren S. Seamers, "Computer Numeric Control", Fourth Edition, Thomson Delmar, 2002.
2. Jain R.K. "Engineering Metrology", Khanna Publishers, 22nd Edition, 2022.

REFERENCES:

1. HMT, "Mechatronics", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. Gupta I.C., "Engineering Metrology", Dhanpatrai Publications, 2018.
3. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education, 6th Edition, 2013.
4. Berry Leathan – Jones, "Introduction to Computer Numerical Control", Pitman, London, 1987.
5. Radhakrishnan P, "Computer Numerical Control Machines and Computer Aided Manufacturer", New Central Book Agency, 2018.

WEB RESOURCES:

1. <https://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 basics of CNC machines(K1)
2. Discuss various drives and Work holding devices used in CNC Machine tools. (K2)
3. Write simple programs for CNC machine tools(K2)
4. Describe the concepts of linear measurements applicable to various metrological instruments.(K2)
5. Discuss the concepts of angular measurements applicable to various metrological instruments. (K2)
6. Understand about the advancement in metrology.(K1)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	1	1	-	-	-	-	-	-	-	2	3	2	2
C02	2	1	2	-	-	-	-	-	-	-	1	2	2	2
C03	2	1	1	-	-	-	-	-	-	-	2	2	1	2
C04	2	2	1	-	-	-	-	-	-	-	2	2	2	2
C05	2	2	1	-	-	-	-	-	-	-	2	2	2	2
C06	2	2	1	-	-	-	-	-	-	-	2	2	2	2

SEMESTER - IV

20MUPC404 SDG NO. 4,8,9,12	COMPUTER AIDED DESIGN	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).
- To expose the student to contemporary computer design tools.
- To prepare the student to be an effective user of a CAD system.

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS 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.

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 9

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

UNIT IV ASSEMBLY OF PARTS 9

Assembly modelling – interferences of positions and orientation – tolerance analysis-mass property calculations – mechanism simulation and interference checking.

UNIT V 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.

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 McMahan and Jimmie Browne, "CAD/CAM Principles", "Practice and Manufacturing management" Second Edition, Pearson Education, 1999.
2. Donald Hearn and M. Pauline Baker, "Computer Graphics". Pearson Education India, 2nd Edition, 2002.
3. Foley, Van Dam, Feiner and Hughes, "Computer graphics principles & practice", Pearson Education India, 2013.
4. William M Neumann and Robert F.Sproul, "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.

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. Acquire the knowledge on fundamentals of Computer Graphics concepts in engineering. (K1)
2. Understand the knowledge of surface modeling techniques in engineering applications. (K1)
3. Understand the knowledge of solid modeling techniques in engineering applications. (K1)
4. Render and animate the components by applying Line, Surface and Solid removal Algorithms. (K3)
5. Demonstrate the knowledge of assembly techniques. (K3)

6. Interchange CAD documents effectively between cad software's using various standards. (K2)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	-	2	1	1	-	-	-	1	1	1	1	2	3
C02	2	2	2	-	2	1	-	-	-	1	1	2	2	2
C03	2	2	2	-	2	1	-	-	-	1	1	1	2	2
C04	1	1	1	-	2	-	-	-	-	3	-	2	2	3
C05	3	2	2	1	1	-	-	-	1	1	-	2	2	2
C06	1	-	1	-	3	1	-	-	1	3	1	2	2	2

SEMESTER - IV

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

OBJECTIVES:

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

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 - Eigenvalues 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 derivatives using interpolation polynomials - Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY AND PARTIAL 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. Solution of two dimensional Laplace's and Poisson's equations on rectangular domain - One dimensional heat flow equation by Crank Nicholson method - One dimensional wave equation by explicit method.

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://freevidelectures.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 student should be able to

1. Apply statistical techniques for testing of hypothesis of small and large samples. (K3)
2. Perform Analysis of Variance (ANOVA) in the Design of Experiments. (K3)
3. Provide numerical solution for Algebraic equations, Transcendental equations and Eigen value problems. (K3)
4. Apply Numerical techniques to interpolate data and find Numerical Differentiation and Integration. (K3)
5. Solve Ordinary and Partial Differential equations using numerical techniques. (K3)

CO- PO MAPPING:

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

SEMESTER - IV

20CEPC405 SDG NO. 4, 9	STRENGTH OF MATERIALS	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. Lamé's theorem.

UNIT III **TORSION AND SPRINGS** 9

Torsion Equation - Deformation in solid and hollow 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", 8th Edition in S.I. Units, McGraw Hill Education (India) Pvt. Ltd., 2020.
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, 3rd Edition, 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. Perform calculations related to deformation of deformable bodies using the concepts of stress and strain. (K2)
2. Determine the principal stress on a plane and deformation of thin and thick vessels subjected to internal pressure. (K3)

3. Calculate the dimensions and deformation of cylindrical member's subjected to torsional load. (K3)
4. Compute the stresses and dimensions of the structural member subjected to transverse load. (K3)
5. Determine the deflection in structural member subjected to transverse load. (K3)
6. Predict the behaviour of columns subjected to axial loading. (K3)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	2	2	-	-	1	-	-	-	-	-	1	2	2
C02	3	2	2	-	-	1	-	-	-	-	-	1	2	2
C03	3	2	2	-	-	1	-	-	-	-	-	1	2	2
C04	3	2	1	-	-	1	-	-	-	-	-	1	2	2
C05	3	2	1	-	-	1	-	-	-	-	-	1	2	2
C06	3	2	1	-	-	1	-	-	-	-	-	1	2	2

SEMESTER - IV

20MUPL401 SDG NO. 4,9,12,13	STRENGTH OF MATERIALS & METROLOGY LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To supplement the theoretical knowledge gained in Mechanics of Solids 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.
- 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**STRENGTH OF MATERIALS LABORATORY**

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 - Brinell 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.

METROLOGY LABORATORY

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

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Universal Tensile Testing machine with double shear attachment – 40 Ton Capacity
2. Torsion Testing Machine (60 NM Capacity)
3. Impact Testing Machine (300 J Capacity)
4. Brinell Hardness Testing Machine
5. Rockwell Hardness Testing Machine
6. Spring Testing Machine for tensile and compressive loads (2500 N)
7. Micrometer and dial gauges
8. Vernier Height Gauge and Vernier depth Gauge
9. Vernier Caliper and Gear Tooth Vernier
10. Sine Bar
11. Floating Carriage Micrometer

12. Mechanical / Electrical / Pneumatic Comparator
13. Bore gauge
14. Surface finish measuring equipment
15. Telescope gauge
16. Coordinate measuring machine

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. (K3)
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.(K3)
3. Understand the various linear and angular measurements using measurants like comparator, sine bar, floating carriage micrometer etc. and inspect various profiles of mechanical components.(K1)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Co1	3	2	-	-	-	1	-	-	-	-	-	1	2	2
CO2	3	2	-	-	-	1	-	-	-	-	-	1	2	2
CO3	3	2	-	-	-	1	-	-	-	-	-	1	2	2

SEMESTER - IV

20MUPL402	FLUID POWER SYSTEMS LABORATORY	L	T	P	C
SDG NO. 4,9,12,13		0	0	3	1.5

OBJECTIVES:

- To enable the students to have a clear understanding of the losses in pipe flow
- To understand the flow measurements.
- To analyses the Performance of various Pumps and Turbines
- To know Microprocessor programming
- To design, model and analyse basic Electrical, Hydraulic & Pneumatic Systems

LIST OF EXPERIMENTS

1. Determination of friction factor for a given set of pipes.
2. Conducting experiments and drawing the characteristic curves of centrifugal pump/submergible pump
3. Conducting experiments and drawing the characteristic curves of reciprocating pump.
4. Conducting experiments and drawing the characteristic curves of Gear pump.
5. Stepper motor interface.
6. Traffic light interface.
7. Speed control of DC motor.
8. Study of various types of transducers.
9. Study of hydraulic, pneumatic and electro-pneumatic circuits.
10. Modelling and analysis of basic hydraulic, pneumatic and electrical circuits using Software.
11. Study of PLC, Design and Development of Color Sorting Conveyor system, Pick and place conveyor system using sensors and PLC.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Pipe Flow analysis setup
2. Centrifugal pump/submergible pump setup
3. Reciprocating pump setup
4. Gear pump setup.
5. Basic Pneumatic Trainer Kit with manual and electrical controls/ PLC Control each.

6. Basic Hydraulic Trainer Kit
7. Hydraulics and Pneumatics Systems Simulation Software

OUTCOMES:

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

1. 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)
2. Conduct experiments on pumps, turbines and to analyze their performance characteristics. (K2)
3. Demonstrate the functioning of control systems with the help of PLC and microcontrollers. (K3)

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Co1	3	2	-	-	-	1	-	-	-	-	-	1	2	2
CO2	3	2	-	-	-	1	-	-	-	-	-	1	2	2
CO3	3	2	-	-	-	1	-	-	-	-	-	1	2	2

SEMESTER - IV

20MUTE401 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

OUTCOMES:

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

1. Comprehend an industrial or real life problem and identify right/ real issue with solution. (K1)
2. Design a setup of equipment based on review of literature, complete the analysis (K3)
3. Write a project report based on the findings. (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	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

SEMESTER - IV

20MUTP401 SDG NO. 4	SKILL ENHANCEMENT				L	T	P	C
					0	0	2	1

PROBLEM SOLVING SKILLS - PHASE I

OBJECTIVES:

- 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 & CNC Programming– Phase 2**OBJECTIVES:**

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

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 calloc 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-constructural details.

UNIT V BASICS OF PROGRAMMING 6

Basics of part programming-G Codes and M Codes-Programming and Machining of a component.

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 Edition) 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.

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 advanced structured and procedural programming. (K2)
6. Write a part program for a given product drawing and demonstrate the program by using a CNC Machine. (K1)

CO-PO & PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	-	-	-	-	3	2	-	3	2	3	-	2	-	-
C02	-	-	-	-	3	2	-	3	2	3	-	2	-	-
C03	-	-	-	-	3	2	-	-	1	3	-	2	-	-
C04	-	-	-	-	3	2	-	3	3	3	-	2	2	2
C05	-	-	-	-	3	2	-	-	2	3	-	2	2	2
C06	-	-	-	-	3	2	-	-	2	3	-	2	2	2

Imagine the Future and Make it happen!



1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH AND WELL-BEING



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS



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 Drakash Leo Mathur

Chairman & CEO - Sairam Institutions

We build a Better nation
through Quality education.



Sri

SAI RAM ENGINEERING COLLEGE

An Autonomous Institution

Affiliated to Anna University & Approved by AICTE, New Delhi

Accredited by **NBA** and **NAAC "A+"**
ISO 9001:2015 Certified and **MHRD NIRF** ranked institutions

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