COURSE STRUCTURE

For

B.Tech.

Mechanical Engineering

(*for 2023 Admitted batch only)*

PRAGATI ENGINEERING COLLEGE

(An Autonomous Institution)

ADB Road, Surampalem, Kakinada District, A.P.-533 437

(Approved by AICTE, New Delhi & Permanently Affiliated to JNTUK, Kakinada)

(Recognized by UGC under sections 2 (f) and 12 (b) of UGC act, 1956)

Pragati Engineering College (Autonomous)

R23

Department of Mechanical Engineering

COURSE STRUCTURE

INDUCTION PROGRAMME

S.No.	Course Name	Category	L	T	P	Credits
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0	0	6	0
2	Career Counselling	MC	2	0	2	0
3	Orientation to all branches -- career options, tools, etc.	MC	3	0	0	0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2	0	3	0
5	Proficiency Modules & Productivity Tools	ES	2	1	2	0
6	Assessment on basic aptitude and mathematical skills	MC	2	0	3	0
7	Remedial Training in Foundation Courses	MC	2	1	2	0
8	Human Values & Professional Ethics	MC	3	0	0	0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2	1	2	0
10	Concepts of Programming	ES	2	0	2	0

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Department of Mechanical Engineering

I YEAR – I SEMESTER

Sl. No	Category	Course Code	Course Title	L	T	P	Credits
1	BS&H	23BE101T	Communicative English	2	0	0	2
2	BS&H	23BM101T	Linear Algebra and Calculus	3	0	0	3
3	BS&H	23BC101T	Engineering Chemistry	3	0	0	3
4	Engineering Science	23CM101T	Basic Civil and Mechanical Engineering	3	0	0	3
5	Engineering Science	23CS101T	Introduction to Programming	3	0	0	3
6	Engineering Science	23ME102P	Engineering Workshop	0	0	3	1.5
7	BS&H	23BE101P	Communicative English Laboratory	0	0	2	1
8	Engineering Science	23CS101P	Computer Programming Laboratory	0	0	3	1.5
9	BS&H	23BC101P	Engineering Chemistry Laboratory	0	0	2	1
10	BS&H	23MH101P	Health and wellness, Yoga and sports	0	0	1	0.5
Total Credits							**19.5**

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Department of Mechanical Engineering

I YEAR – II SEMESTER

Sl. No	Category	Course Code	Course Title	L	T	P	Credits
1	BS&H	23BP201T	Engineering Physics	3	0	0	3
2	BS&H	23BM201T	Differential Equations and Vector Calculus	3	0	0	3
3	Engineering Science	23EE201T	Basic Electrical and Electronics Engineering	3	0	0	3
4	Engineering Science	23ME201T	Engineering Graphics	1	0	4	3
5	Professional Core	23ME202T	Engineering Mechanics	3	0	0	3
6	BS&H	23BP201P	Engineering Physics Laboratory	0	0	2	1
7	Engineering Science	23EE201P	Electrical and Electronics Engineering Workshop	0	0	3	1.5
8	Professional Core	23ME202P	Engineering Mechanics Laboratory	0	0	3	1.5
9	Engineering Science	23IT201P	IT Workshop	0	0	2	1
10	BS&H	23MH202P	NSS/NCC/Scouts and Guides/Community Service	0	0	1	0.5
Total Credits							**20.5**

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
Department of Mechanical Engineering

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COURSE STRUCTURE

II YEAR – I SEMESTER

Sl. No	Category	Course Code	Course Title	L	T	P	Credits
1	BS	23BM303T	Numerical Methods and Transform Techniques	3	0	0	3
2	HSMC	23HM301T	Universal Human Values - Understanding Harmony& Ethical Human Conduct	2	1	0	3
3	Engineering Science	23ME301T	Thermodynamics	2	0	0	2
4	Professional Core	23ME302T	Mechanics of Solids	3	0	0	3
5	Professional Core	23ME303T	Material Science and Metallurgy	3	0	0	3
6	Professional Core	23ME301P	Mechanics of Solids and Materials Science Laboratory	0	0	3	1.5
7	Professional Core	23ME301P	Computer-aided Machine Drawing	0	0	3	1.5
8	Engineering Science	23AM302P	Python programming Laboratory	0	0	2	1
9	Skill Enhancement Course	23EC301S	Embedded Systems and IoT	0	1	2	2
10	Audit Course	23BC301T	Environmental Science	2	0	0	-
Total Credits							**20**

II YEAR – II SEMESTER

Sl. No	Category	Course Code	Course Title	L	T	P	Credits
1	Management Course- I	23ME401T	Industrial Management	2	0	0	2
2	Basic Science	23BM401T	Complex Variables, Probability and Statistics	3	0	0	3
3	Professional Core	23ME402T	Manufacturing Processes	3	0	0	3
4	Professional Core	23ME403T	Fluid Mechanics & Hydraulic Machines	3	0	0	3
5	Professional Core	23ME404T	Theory of Machines	3	0	0	3
6	Professional Core	23ME403P	Fluid Mechanics & Hydraulic Machines Laboratory	0	0	3	1.5
7	Professional Core	23ME402P	Manufacturing Processes Laboratory	0	0	3	1.5
8	Skill Enhancement course	23BE401S	Soft Skills	0	1	2	2
9	Engineering Science	23HM401P	Design Thinking & Innovation	1	0	2	2
Total Credits							**21**
Mandatory Community Service Project Internship of 08 weeks duration during summer Vacation							

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

B.Tech. III Year I Semester

S.No.	Course Code	Category	Title	L	T	P	C
1.	23ME501T	Professional Core	Machine Tools and Metrology	3	0	0	3
2.	23ME502T	Professional Core	Thermal Engineering	3	0	0	3
3.	23ME503T	Professional Core	Design of Machine Elements	3	0	0	3
4.	1. 23ME504T 2. 23ME505T 3. 23ME506T 4. 23ME507T **MOOCs** 23ME508T	Professional Elective-I	1. Design for Manufacturing 2. Conventional and Futuristic Vehicle Technology 3. Renewable Energy Technologies 4. Non-Destructive Evaluation 5. Any of the below 12-week SWAYAM NPTEL (MOOC) Course i. Mechanical Behavior of Materials. ii. Introduction to Composites. iii. Fundamentals of Additive Manufacturing Technologies. iv. Metal Additive Manufacturing.	3	0	0	3
5.	1. 23CE507T 2. 23EE508T 3. 23EC504T 4. 23CS506T	Open Elective-I	1. Construction Project Management. 2. Renewable Energy Sources. 3. Electronic Devices and Circuits. 4. Introduction to Cloud Computing.	3	0	0	3
6.	23ME502L	Professional Core	Thermal Engineering Laboratory	0	0	3	1.5
7.	23ME5013L	Professional Core	Theory of Machines Laboratory	0	0	3	1.5
8.	23ME501L/ 23CS501S	Skill Enhancement course	Machine Tools and Metrology Laboratory/ Salesforce Administrator Explorer	0	0	4	2
9.	23EC5018L	Engineering Science	Tinkering Laboratory	0	0	2	1
10.	23ME501P	Community Service Project Internship		-	-	-	2
Total				**15**	**0**	**12**	**23**

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

B.Tech. III Year II Semester

S.No.	Course Code	Category	Title	L	T	P	C
1.	23ME601T	Professional Core	Heat Transfer	3	0	0	3
2.	23AM604T	Professional Core	Artificial Intelligence and Machine Learning	3	0	0	3
3.	23ME602T	Professional Core	Finite Element Methods	3	0	0	3
4.	1. 23ME603T 2. 23ME604T 3. 23ME605T 4.23ME606T **MOOCs** 23ME607T	Professional Elective-II	1. Mechanical Vibrations 2. Advanced Manufacturing Processes 3. Micro Electro Mechanical Systems 4. Sensors and Instrumentation 5. Any of the below 12-Week SWAYAM NPTEL (MOOC) Course i. Advanced Machining Processes ii. Automation in Manufacturing iii. Engine System and Performance iv. Fundamentals of Nuclear Power Generation.	3	0	0	3
5.	1. 23ME608T 2. 23ME609T 3. 23ME6010T 4. 23ME6011T **MOOCs** 23ME6012T	Professional Elective-III	1. Energy Storage Technologies 2. Industrial Hydraulics and Pneumatics 3. Industrial Robotics 4. Refrigeration and Air-Conditioning 5. Any of the below 12-week SWAYAM NPTEL (MOOC) Course i. Design of Mechanical Transmission Systems ii. Computer Integrated Manufacturing iii. Welding Metallurgy iv. Product Design and Manufacturing	3	0	0	3
6.	1. 23CE6012T 2. 23EE6012T 3. 23EC6013T 4. 23CS604T 5. 23HM601T	Open Elective - II	1. Disaster Management 2. Fundamentals of Electric Vehicles 3. Principles of Communications 4. Object Oriented Programming through JAVA 5. Entrepreneurship and Venture Creation	3	0	0	3
7.	23ME601L	Professional Core	Heat Transfer Laboratory	0	0	3	1.5
8.	23AM604L	Professional Core	Artificial Intelligence and Machine Learning Laboratory	0	0	3	1.5
9.	23ME6013L/ 23CS602S	Skill Enhancement course	Robotics and Drone Technologies Laboratory/ Salesforce Developer Catalyst	0	0	4	2
10.	23CM601T	Audit Course	Technical Paper Writing and IPR	2	0	0	-
Total				**20**	**0**	**10**	**23**
Mandatory Industry Internship of 08 weeks duration during summer vacation							

Pragati Engineering College (Autonomous)

R23

I Year I Semester
COMMUNICATIVE ENGLISH
(Common to CE, EEE, ME, ECE, CSE (CS) and IT)

Course Category	Humanities	**Course Code**	23BE101T
Course Type	Theory	**L-T-P-C**	2-0-0-2
Prerequisites	LSRW Skills	**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	The main objective of introducing this course, Communicative English, is to facilitate effective listening, Reading, Speaking and Writing skills among the students.
2	It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary.
3	This course helps the students to make them effective in speaking and writing skills and to make them industry ready.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the context, topic, and pieces of specific information from social or Transactional dialogues.	K2
CO2	Apply grammatical structures to formulate sentences and correct word forms.	K3
CO3	Analyze discourse markers to speak clearly on a specific topic in informal discussions.	K4
CO4	Evaluate reading / listening texts and to write summaries based on glob	K5
CO5	Create a coherent paragraph, essay, and resume.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

Pragati Engineering College (Autonomous)

COURSE CONTENT

UNIT I

Lesson: HUMAN VALUES: Gift of Magi (Short Story)

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

Grammar: Parts of Speech, Basic Sentence Structures-forming questions.

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

UNIT II

Lesson: NATURE: The Brook by Alfred Tennyson (Poem)

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to linkthe ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics)

Grammar: Cohesive devices - linkers, use of articles and zero article; Prepositions.

Vocabulary: Homonyms, Homophones, Homographs.

UNIT III

Lesson: BIOGRAPHY: Elon Musk

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed.

Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, paraphrasing.

Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations.

Vocabulary: Compound words, Collocations.

UNIT IV

Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters, Resumes

Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons.

UNIT V

Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.

Speaking: Formal oral presentations on topics from academic contexts.

Reading: Reading comprehension.

Writing: Writing structured essays on specific topics.

Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Vocabulary: Technical Jargons.

TEXT BOOKS

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, OrientBlack Swan, 2023. (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5).

REFERENCE BOOKS

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge,2014
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge UniversityPress, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

WEB RESOURCES

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

Pragati Engineering College (Autonomous)

R23

I Year I Semester
LINEAR ALGEBRA AND CALCULUS
(Common to All Branches)

Course Category	Basic Sciences	**Course Code**	23BM101T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Matrix Algebra, Limits, Continuity, Differentiability and integrability	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES
To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Develop and use of matrix algebra techniques that are needed by engineers for practical applications.	K3
CO2	Find the Eigen values and Eigen vectors and able to reduce the given quadratic form into canonical form by orthogonal transformation.	K3
CO3	Utilize mean value theorems to real life problems.	K3
CO4	Familiarize with functions of several variables which is useful in optimization & learn important tools of calculus in higher dimensions	K3
CO5	Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-

Pragati Engineering College (Autonomous)

COURSE CONTENT

UNIT I

Matrices:

Rank of a matrix by echelon form, normal form. Cauchy–Binet formulae (without proof). Inverse of Non- singular matrices by Gauss-Jordan method, **System of linear equations**: Solving system of Homogeneous linear equations and solving Non-Homogeneous linear equations by Gauss elimination method, Gauss Jacobi and Gauss Seidel Iteration Methods**.**

UNIT II

Eigenvalues, Eigenvectors and Orthogonal Transformation:

Eigenvalues, Eigenvectors and their properties, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Diagonalization of a matrix, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

UNIT III

Calculus:

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems. Taylor's and Maclaurin series.

UNIT IV

Partial differentiation and Applications (Multi variable calculus):

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

UNIT V

Multiple Integrals (Multi variable Calculus):

Double integrals, change of order of integration, triple integrals, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

TEXT BOOKS

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

REFERENCE BOOKS

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, , Pearson publishers, 9th edition.
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications,2014, Third Edition (Reprint 2021)
6. Advanced Engineering Mathematics by H. K Dass, S. Chand Publications, 2022, 22nd Edition (Reprint 2022).

WEB RESOURCES

1. https://en.wikipedia.org/wiki/System_of_linear_equations
2. https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors
3. https://www.math.hmc.edu/calculus/tutorials/eigenstuff/
4. https://en.wikipedia.org/wiki/Quadratic_form
5. https://en.wikipedia.org/wiki/Calculus
6. https://en.wikipedia.org/wiki/Partial_derivative
7. https://www.whitman.edu/mathematics/calculus_online/section14.03.html
8. https://en.wikipedia.org/wiki/Multiple_integral
9. http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx

Pragati Engineering College (Autonomous)

R23

I Year I Semester
ENGINEERING CHEMISTRY
(Common to CE and MECH)

Course Category	Basic Science	**Course Code**	23BC101T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To familiarize engineering chemistry and its applications
2	To impart the concept of soft and hard waters, softening methods of hard water
3	To train the students on the principles and applications of electrochemistry, polymers, surface chemistry, and cement

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Compare the quality of drinking water with BIS and WHO Standards	K2
CO2	Illustrate the principles and applications of Batteries, Fuel cells and fuels.	K2
CO3	Explain calorific values, octane number, refining of petroleum and crack in go foils.	K2
CO4	Explain the setting and hardening of cement.	K2
CO5	Summarize the concepts of colloids, Micelle and nano materials.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT -I

Water Technology

Soft and hard water, Estimation of hardness of water by EDTA Method, Estimation of dissolved Oxygen - Boiler troubles–Priming, foaming**,** scale and sludge, Caustic embrittlement, Industrial water treatment–Specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization(WHO) standards, Removal of hardness of water by Ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electro dialysis.

UNIT - II

Electrochemistry and Applications

Electrodes–electrochemical cell, Nernst equation, cell potential calculations.

Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (Ni -Cd), and lithium ion batteries -working principle of the batteries Including cell reactions; Fuel Cells-Basic Concepts, the Principle and working of hydrogen-oxygen Fuel cell.

Corrosion: Introduction to corrosion, metal oxide formation by dry electrochemical corrosion, Pilling-Bedworth ratios and uses electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, Factors affecting the corrosion (Nature of the metal and nature of the environment), Corrosion controlling methods: *cathodic and anodic protection, electroplating and electro less plating (Nickel and Copper).*

UNIT - III

Polymers and Fuel Chemistry

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth polymerization.

Thermo plastics and Thermo-setting plastics- Preparation, properties and applications of polystyrene, PVC, Nylon 6, 6 and Bakelite.

Elastomers–Preparation, properties and applications of BunaS, BunaN, Thiokolrubbers.

Fuels – Types of fuels, calorific value of fuel- HCV&LCV- Dulong's formula *-numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octane and Cetanenumber- Alternative fuel-Ethanol and bio fuel-bio diesel.*

UNIT– IV

Modern Engineering Materials

Composites- Definition, Constituents, Classification- Particle, Fibre and Structural rein forced composites, properties and Engineering applications

Refractories-Classification, Properties, Factors affecting the refractory materials and Applications.

Lubricants-Classification, Functions of lubricants, Mechanism, Properties of lubricating oils–Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and Applications.

Building materials- Portland Cement-constituents and manufacturing – Setting and Hardening of cement.

UNIT -V

Surface Chemistry and Nano materials

Introduction to surface chemistry, colloids, Micelle formation, synthesis of colloids (Braggs Method), chemical and biological methods of preparation of Nano metals and Metal oxides, stabilization of colloids and nano materials by stabilizing agents, adsorption isotherm (Freundlich and Longmuir), BET equation (noderivation) applications of colloids and nano materials– catalysis, medicine, sensors, etc.

Textbooks:

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai,2013.
2. PeterAtkins, Juliode Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. H.F.W.Taylor, Cement Chemistry, 2/e, Thomas Telford Publications,1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman, 1992.
3. Text book of Polymer Science, Fred W.BillmayerJr,3rdEdition

WEB RESOURCES

UNIT –I

Water Technology : *https://nptel.ac.in/courses/105106119*

UNIT - II

Electrochemistry and Applications:*https://archive.nptel.ac.in/courses/103/105/103105110/*

UNIT - III

Polymers andFuel Chemistry

https://archive.nptel.ac.in/content/storage2/courses/113104058/lecture1/1_7.htm

UNIT – IV

Modern Engineering Materials:

https://archive.nptel.ac.in/courses/105/102/105102012/

https://www.thelubricantstore.com/lubricant-properties

UNIT -V

Surface Chemistry and Nano materials

https://digimat.in/nptel/courses/video/103103154/L24.html

Pragati Engineering College (Autonomous)

R23

I Year I Semester
BASIC CIVIL AND MECHANICAL ENGINEERING
(Common to CE, EEE, ME, ECE, CSE (CS) and IT)

Course Category	Engineering Science	**Course Code**	23CM101T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

PART-A: BASIC CIVIL ENGINEERING

COURSE OBJECTIVES	
1	Get familiarized with the scope and importance of Civil Engineering sub-divisions
2	Introduce the preliminary concepts of surveying.
3	Acquire preliminary knowledge on Transportation and its importance in nation's economy.
4	Get familiarized with the importance of quality, conveyance and storage of water.
5	Introduction to basic civil engineering materials and construction techniques.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	enlist various basic characteristics and sub-divisions of Civil Engineering, pre-fabricated materials and technology to appreciate their role in ensuring better society.	K2
CO2	illustrate the concepts of surveying and basics of Foundation Engineering.	K3
CO3	know the significance of various domains in transportation engineering and be acquitted with types of pavements. Get an overview about Environmental Engineering and Water Resource Engineering.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering -Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement- Aggregate - Bricks-Stones-Sand-Cement Concrete-Steel-Timber. Introduction to Prefabricated construction Techniques.

UNIT II

Surveying: Objectives of Surveying- Horizontal Measurements- Angular Measurements Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

Foundations: Types of foundations — Bearing capacity and settlement — Requirement of good foundations.

UNIT III

Transportation Engineering: Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

TEXT BOOKS

1. Basic Civil Engineering, M.S.Palanisamy, Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

REFERENCE BOOKS

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

WEB RESOURCES

1. https://nptel.ac.in/courses/105101087
2. https://nptel.ac.in/courses/105104101
3. https://nptel.ac.in/courses/105104103

Pragati Engineering College (Autonomous)

PART – B: BASIC MECHANICAL ENGINEERING

COURSE OBJECTIVES	
1	Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
2	Explain different engineering materials and different manufacturing processes.
3	Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the different manufacturing processes.	K2
CO2	Explain the basics of thermal engineering and its applications.	K3
CO3	Describe the working of different mechanical power transmission systems, power plants and basics of robotics and its applications.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT - I

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society-Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT - II

Manufacturing Processes: Principles of Casting**,** Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT - III

Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants.

Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

Textbooks:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

Reference Books:

1. AppuuKuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I.
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications.
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.

Web References:

1. https://ocw.mit.edu/courses/2-000-how-and-why-machines-work-spring-2002/
2. https://ocw.mit.edu/courses/2-008-design-and-manufacturing-ii-spring-2004/
3. https://ocw.mit.edu/courses/2-12-introduction-to-robotics-fall-2005/

Pragati Engineering College (Autonomous)

R23

I Year I Semester

INTRODUCTION TO PROGRAMMING

(Common to All Branches)

Course Category	Engineering Science	**Course Code**	23CS101T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To introduce students to the fundamentals of computer programming.
2	To provide hands-on experience with coding and debugging.
3	To foster logical thinking and problem-solving skills using programming.
4	To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
5	To encourage collaborative learning and teamwork in coding projects.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand basics of computers, the concept of algorithm and algorithmic thinking.	K3
CO2	Analyze a problem and develop an algorithm to solve it.	K4
CO3	Implement various algorithms using the C programming language.	K5
CO4	Understand more advanced features of C language.	K3
CO5	Develop problem-solving skills and the ability to debug and optimize the code.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

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COURSE CONTENT

UNIT- I

Introduction to Programming and Problem Solving

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program-Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables and Constants, Basic Input and Output, Operations, Type Conversion and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT -II

Control Structures

Simple sequential programs, Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue, Programming Examples.

UNIT- III

Arrays and Strings

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Arrays Applications , Introduction to Strings, String input and output functions, String handling functions.

UNIT- IV

Pointers & User Defined Data types

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

UNIT -V

Functions & File Handling

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Storage Classes, Basics of File Handling.

Note: The syllabus is designed with C Language as the fundamental language of implementation.

TEXT BOOKS

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice- Hall, 2005, 2nd Edition
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 4th edition, 2018

REFERENCE BOOKS

1. Computing fundamentals and C Programming, Balaguruswamy, E., McGraw-Hill Education, 7th Edition, 2017
2. Programming in C, Rema Theraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rdedition, 2009

WEB RESOURCES

1. http://nptel.ac.in/courses/106104128/
2. http://students.iitk.ac.in/programmingclub/course/#notes
3. http://c-faq.com/~scs/cclass/cclass.html

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R23

I Year I Semester
ENGINEERING WORKSHOP
(Common to CE, EEE, ME, ECE, CSE(CS) and IT)

Course Category	Engineering Science	**Course Code**	23ME102P
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES
To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Identify workshop tools and their operational capabilities.	K2
CO2	Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.	K3
CO3	Apply knowledge in preparation of pipe joints and practice of Plumbing tools.	K3
CO4	Apply basic electrical engineering knowledge for House Wiring Practice	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

1.**Demonstration**: Safety practices and precautions to be observed in workshop.

2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.

a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint

3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.

a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.

a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tire

5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.

a) Parallel and series b) Two-way switch c) Godown lighting d) Tube light e) Three phase motor f) Soldering of wires

6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.

7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.

8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

Note: Minimum of 12 Experiments to be conducted from the above covering all the trades.

Textbooks:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.

2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition

2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.

3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

Pragati Engineering College (Autonomous)

R23

I Year I Semester

COMMUNICATIVE ENGLISH LABORATORY

(Common to CE, EEE, ME, ECE, CSE (CS) and IT)

Course Category	Humanities	**Course Code**	23BE101P
Course Type	Laboratory	**L-T-P-C**	0-0-2-1
Prerequisites	LSRW Skills	**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning.
2	The students will get trained in basic communication skills and also make them ready to face job interviews.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the different aspects of the English language proficiency with emphasison LSRW skills.	K2
CO2	Apply communication skills through various language learning activities.	K3
CO3	Analyze the English speech sounds, stress, rhythm, intonation and syllable divisionfor better listening and speaking comprehension.	K4
CO4	Evaluate and exhibit professionalism in participating in debates and group discussions.	K5
CO5	Able to present ideas effectively and manage interviews confidently.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT - I

Communication Skills & JAM.
Role Play or Conversational Practice.

UNIT - II

E-mail Writing.
Resume Writing, Cover letter, SOP.

UNIT - III

Vowels & Consonants.
Neutralization/Accent Rules.

UNIT - IV

Group Discussions-methods & practice.
Debates - Methods & Practice.

UNIT - V

PPT Presentations/ Poster Presentation.
Interviews Skills.

Laboratory Manual Lab Book

1. Strengthen Your Steps: A Multi-Model Course in Communication Skills published by Maruti Publications

REFERENCE BOOKS

1. Raman Meenakshi, Sangeeta-Sharma. Technical Communication. Oxford Press.2018.
2. Taylor Grant: English Conversation Practice, Tata McGraw-Hill Education India,2016
3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. A Course in Phonetics and Spoken English, (2nd Ed),Kindle, 2013

WEB RESOURCES

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. https://www.youtube.com/user/letstalkaccent/videos
2. https://www.youtube.com/c/EngLanguageClub/featured

3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

Suggested Software:

1. Walden Infotech
2. Young India Films

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R23

I Year I Semester
COMPUTER PROGRAMMING LABORATORY
(Common to All Branches)

Course Category	Engineering Science	**Course Code**	23CS101P
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES
The course aims to give students hands – on experience and train them on the concepts of the C-programming language.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Read, understand, and trace the execution of programs written in C language.	K3
CO2	Select the right control structure for solving the problem.	K3
CO3	Develop C programs which utilize memory efficiently using programming constructs like pointers.	K3
CO4	Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.	K5

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

WEEK 1

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.
ii) Exposure to Turbo C, gcc
iii) Writing simple programs using printf(), scanf()

WEEK 2

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite stepsboth using textual notation and graphic notation.

Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab 2: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

i) Sum and average of 3 numbers
ii) Conversion of Fahrenheit to Celsius and vice versa
iii) Simple interest calculation

WEEK 3

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

i) Finding the square root of a given number
ii) Finding compound interest
iii) Area of a triangle using heron's formulae
iv) Distance travelled by an object

WEEK 4

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operatorsused in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:

Lab4: Simple computational problems using the operator' precedence and associativity

i) Evaluate the following expressions.
    a. A+B*C+(D*E) + F*G
    b. A/B*C-B+A*D/3
    c. A+++B---A
    d. J= (i++) + (++i)
ii) Find the maximum of three numbers using conditional operator
iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5

Objective: Explore the full scope of different variants of "if construct" namely if-else, null- else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

Lab 5: Problems involving if-then-else structures.

i) Write a C program to find the max and min of four numbers using if-else.
ii) Write a C program to generate electricity bill.
iii) Find the roots of the quadratic equation.
iv) Write a C program to simulate a calculator using switch case.
v) Write a C program to find the given year is a leap year or not.

WEEK 6

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and

for loop in addition to structured jump constructs like break and continue including when each ofthese statements is more appropriate to use.

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops
Lab 6: Iterative problems e.g., the sum of series

i) Find the factorial of given number using any loop.
ii) Find the given number is a prime or not.
iii) Compute sine and cos series
iv) Checking a number palindrome
v) Construct a pyramid of numbers.

WEEK 7

Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.
Lab 7:1D Array manipulation, linear search

i) Find the min and max of a 1-D integer array.
ii) Perform linear search on1D array.
iii) The reverse of a 1D integer array
iv) Find 2's complement of the given binary number.
v) Eliminate duplicate elements in an array.

WEEK 8

Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integerarrays.

Suggested Experiments/Activities:
Tutorial 8: 2 D arrays, sorting and Strings.
Lab 8: Matrix problems, String operations, Bubble sort

i) Addition of two matrices
ii) Multiplication two matrices
iii) Sort array elements using bubble sort
iv) Concatenate two strings without built-in functions
v) Reverse a string using built-in and without built-in string functions

WEEK 9

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

i) Write a C program to find the sum of a 1D array using malloc()
ii) Write a C program to find the total, average of n students using structures
iii) Enter n students data using calloc() and display failed students list
iv) Read student name and marks from the command line and display the student details alongwith the total.
v) Write a C program to implement realloc()

WEEK 10

Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singlylinked lists) and nested structures

Suggested Experiments/Activities:

Tutorial 10: Bitfields, Self-Referential Structures, Linked lists

Lab10 : Bitfields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same withoutusing bit- fields

i) Create and display a singly linked list using self-referential structure.
ii) Demonstrate the differences between structures and unions using a C program.
iii) Write a C program to shift/rotate using bitfields.
iv) Write a C program to copy one structure variable to another structure of the same type.

WEEK 11

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing someexperiments by parameter passing using call by value. Basic methods of numerical integration **Suggested Experiments/Activities:**

Tutorial 11: Functions, call by value, scope and extent,

Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

i) Write a C function to calculate NCR value.
ii) Write a C function to find the length of a string.
iii) Write a C function to transpose of a matrix.
iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

i) Write a recursive function to generate Fibonacci series.
ii) Write a recursive function to find the lcm of two numbers.
iii) Write a recursive function to find the factorial of a number.
iv) Write a C Program to implement Ackermann function using recursion.
v) Write a recursive function to find the sum of series.

WEEK 13

Objective: Explore the basic difference between normal and pointer variables, Arithmeticoperations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers.

i) Write a C program to swap two numbers using call by reference.
ii) Demonstrate Dangling pointer problem using a C program.
iii) Write a C program to copy one string into another using pointer.
iv) Write a C program to find no of lowercase, uppercase, digits and other characters usingpointers.

WEEK 14

Objective: To understand data files and file handling with various file I/O functions. Explore thedifferences between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

i) Write a C program to write and read text into a file.
ii) Write a C program to write and read text into a binary file using fread() and fwrite()
iii) Copy the contents of one file to another file.
iv) Write a C program to merge two files into the third file using command-line arguments.
v) Find no. of lines, words and characters in a file
vi) Write a C program to print last n characters of a given file.

TEXT BOOKS

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum ' s Outline of Programming with C, McGraw Hill

REFERENCE BOOKS

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hallof India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

WEB RESOURCES

1. https://www.researchgate.net/publication/322908864_C_Programming_Lab_Manual
2. https://www.javatpoint.com/c-programs

R23

Pragati Engineering College (Autonomous)

I Year I Semester
ENGINEERING CHEMISTRY LABORATORY
(Common to CE and MECH)

Course Category	Basic Sciences	**Course Code**	23BC101P
Course Type	Laboratory	**L-T-P-C**	0-0-2-1
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES
Verify the fundamental concepts with experiments.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Determine the cell constant and conductance of solutions.	K2
CO2	Prepare advanced polymer materials.	K2
CO3	Estimate the given amount of dissolved compounds in a solution by using volumetric analysis and preparation of Nano particles	K3
CO4	Estimate the Iron and Calcium in cement.	K3
CO5	Calculate the hardness of water.	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

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List of Experiments:

1. Determination of Hardness of a ground water sample.
2. Estimation of $KMnO_4$ by using standared oxalic acid solution
3. Conductometric titration of strong acid vs. strong base
4. Preparation of a polymer (Bakelite)
5. Determination of percentage of Iron in Cement sample by colorimetry
6. P reparation of urea-formaldehyde resin
7. Preparation of nano materials by precipitation method.
8. Estimation of Ferrous Iron by Dichrometry.
9 Determination of percentage Moisture content in a coal sample
10. Determination of Viscosity of lubricating oil by Red wood Viscometer 1
11. Determination total alkalinity of given sample of water
12. Determination of Vitamin-C

Reference:

"Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar

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R23

I Year I Semester
HEALTH AND WELLNESS, YOGA AND SPORTS
(Common to CE, EEE, ME, ECE, CSE(CS) and IT)

Course Category	Humanities	**Course Code**	23MH101P
Course Type	Theory	**L-T-P-C**	0-0-1-0.5
Prerequisites		**Continuous Evaluation**	90
		Viva Voce	10
		Total Marks	100

COURSE OBJECTIVES
The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the importance of yoga and sports for Physical fitness and sound health.	
CO2	Demonstrate an understanding of health-related fitness components.	
CO3	Compare and contrast various activities that help enhance their health.	
CO4	Assess current personal fitness levels.	
CO5	Develop Positive Personality	

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT – I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

UNIT – II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context,

classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT – III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc. Practicing general and specific warm up, aerobics

ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

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I Year II Semester
ENGINEERING PHYSICS
(Common to CE, EEE, ME, ECE, CSE(CS) and IT)

Course Category	Basic Sciences	**Course Code**	23BP201T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Intermediate Physics	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Impart Knowledge of Physical Optics phenomena like Interference, Diffraction and Polarization required to design instruments with higher resolution.
2	Impart the knowledge of Dielectric & Magnetic materials, for engineering Applications.
3	Understand the basics of Semiconductors and their working mechanism for their utility in Engineering applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze the intensity variation of light due to polarization, interference and diffraction	K4
CO2	Familiarize with the basics of crystals and their structures.	K2
CO3	Applying the concepts of quantum mechanics for calculation of free quantum particle energies and phenomenon of electrical & thermal conductivities to sub microscopic particles	K3
CO4	Apply the basics of phenomenon related to dielectric materials and Magnetic Materials to study their dependence on temperature and frequency response.	K3
CO5	Understand the Band formation, electrical conductivities in semiconductors and study the types of semiconductors using Hall Effect.	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

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COURSE CONTENT

UNIT - I

WAVE OPTICS

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

UNIT - II

CRYSTALLOGRAPHY AND X-RAY DIFFRACTION

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X - ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods

UNIT - III

DIELECTRIC AND MAGNETIC MATERIALS

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT - IV

QUANTUM MECHANICS AND FREE ELECTRON THEORY

Quantum Mechanics: Introduction-Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Introduction-Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

UNIT - V

BAND THEORY OF SOLIDS & SEMICONDUCTOR PHYSICS

BAND THEORY OF SOLIDS

Bloch's Theorem(Qualitative)-Kronig Penny Model(Qualitative)-E vs K diagram-V vs K diagram, Effective mass of electron- Classification of Crystalline Solids-Concept of hole

SEMICONDUCTOR PHYSICS

Semiconductors: Introduction-Formation of energy bands – classification of crystalline solids - Intrinsic

semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

TEXT BOOKS

"A Text book of Engineering Physics"by M.N.Avadhanulu, P.G.Kshirsagar -S.Chand Publications,

"Engineering Physics" by Tirupati Naidu & Veeranjaneyalu, V G S Publishers

"Engineering Physics" by P.K Palanisamy,Sci Tech Publication

REFERENCE BOOKS

Kettles Introduction to Solid state Physics-Charles Kittel, Wiley India Edition

Solid State Physics ,AJ Dekker, I Edition, Macmillan Publishers India Private Limited

"Engineering Physics" by M.R.Srinivasan, New Age international publishers.

"Solid State Physics" by SO Pilai., - New age International Publishers

WEB RESOURCES

Web Resources: https://www.loc.gov/rr/scitech/selected-internet/physics.html

Unit I: https://nptel.ac.in/courses/122/107/122107035/#

Unit II: https://nptel.ac.in/courses/113/104/113104014/

Unit III: https://nptel.ac.in/courses/113/104/113104090/
https://youtu.be/DDLljK1ODeg

Unit IV : https://study.com/academy/lesson/the-de-broglie-hypothesis-definition-significance.html
https://nptel.ac.in/courses/115/101/115101107/
https://nptel.ac.in/courses/115/105/115105122/

Unit V : https://www.electronics-tutorials.ws/diode/diode_1.html
https://nptel.ac.in/courses/115/105/115105099/
https://nptel.ac.in/courses/108/108/108108122/

R23

Pragati Engineering College (Autonomous)

I Year II Semester
DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(Common to All Branches)

Course Category	Basic Sciences	**Course Code**	23BM201T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Differentiation, Integration and Partial Differentiation. Differential Equations (Variable Separable)	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To enlighten the learners in the concept of differential equations and multivariable calculus
2	To familiarize the students with the foundations of line, surface and volume integrals.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Solve the first order differential equations related to various engineering fields.	K3
CO2	Solve the higher order differential equations to various engineering fields.	K3
CO3	Identify solution methods for partial differential equations that model physical processes.	K3
CO4	Interpret the physical meaning of different operators such as gradient, curl and divergence.	K3
CO5	Estimate the work done against a field, circulation and flux using vector calculus.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-

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COURSE CONTENT

UNIT I

Differential equations of first order and first degree:

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. **Applications**: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

UNIT II

Linear differential equations of higher order (Constant Coefficients):

Definitions, homogenous and non-homogenous differential equations, complimentary function, particular integral, general solution, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT III

Partial Differential Equations:

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients

UNIT IV

Vector differentiation:

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions- Gradient and applications, Directional derivative, del applied to vector point functions- Divergence and Curl, vector identities.

UNIT V

Vector integration:

Line integral-circulation-work done by the force, Scalar potential, surface integral-flux, Green's theorem in a plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

TEXT BOOKS

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

REFERENCE BOOKS

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint)
5. Higher Engineering Mathematics, B. V. Ramana, , McGraw Hill Education, 2017

6. Advanced Engineering Mathematics by H. K Dass, S. Chand Publications, 2022, 22nd Edition (Reprint 2022).

WEB RESOURCES

1. https://mathworld.wolfram.com/First-OrderOrdinaryDifferentialEquation.html
2. https://en.wikipedia.org/wiki/Differential_equation
3. https://en.wikipedia.org/wiki/Partial_differential_equation
4. https://en.wikipedia.org/wiki/Vector_calculus
5. https://en.wikipedia.org/wiki/Vector_calculus

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R23

I Year II Semester
BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to CE, EEE, ME, ECE, CSE(CS) and IT)

Course Category	Engineering Science	**Course Code**	23EE201T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

PART-A :BASIC ELECTRICAL ENGINEERING

COURSE OBJECTIVES
To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Know the fundamental laws, operating principles of motors, generators, MC and MI instruments	K2
CO2	Apply the problem solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments; different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.	K3
CO3	Apply the mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

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COURSE CONTENT

UNIT I

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

UNIT II

Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

UNIT III

Energy Resources, Electricity Bill & Safety Measures

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Textbooks:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition

2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, DhanpatRai& Co, 2013

3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, McGraw Hill, 2019, Fourth Edition

2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020

3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017

4. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.

Web Resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076

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PART-B : BASIC ELECTRONICS ENGINEERING

COURSE OBJECTIVES	
1	To impart knowledge on semiconductor devices.
2	To introduce concepts of biasing and applications of diodes and transistors.
3	To introduce fundamentals of digital electronics.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the basic concepts of diodes and transistors	K2
CO2	Understand the working principles of semiconductor devices and applications	K2
CO3	Understand number system, Boolean algebra, basics of combinational and sequential circuits	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2	2	2										
CO3	2	2										

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COURSE CONTENT

UNIT - I

SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

UNIT - II

BASIC ELECTRONIC CIRCUITS AND INSTRUMENTTAION

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Block diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT - III

DIGITAL ELECTRONICS

Overview of Number Systems, BCD codes, Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XORand XNOR. Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Simple combinational circuits–Half and Full Adders. Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

Textbooks:

1. Robert. L. Boylestad & Louis Nashelsky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. Digital Design by Morris Mano, 3E, Prentice Hall, India, 2001

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

Web References:

1. NPTEL- https://archive.nptel.ac.in/courses/108/108/108108122/
2. Neso Academy- https://www.nesoacademy.org/ec/05-digital-electronics

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R23

I Year II Semester
ENGINEERING GRAPHICS
(Common to CE, EEE, ME, ECE, CSE(CS) and IT)

Course Category	Engineering Science	**Course Code**	23ME201T
Course Type	Theory	**L-T-P-C**	1-0-4-3
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing.
2	To impart knowledge on the projection of points, lines and plane surfaces.
3	To improve the visualization skills for better understanding of projection of solids.
4	To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
5	To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.	K2
CO2	Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.	K3
CO3	Understand and draw projection of solids in various positions in first quadrant.	K3
CO4	Explain principles behind development of surfaces.	K2
CO5	Prepare isometric and perspective sections of simple solids.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT - I

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

UNIT - II

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT - III

Projections of Solids: Types of solids: Polyhedral and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

UNIT - IV

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT - V

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (*Not for end examination*).

Textbook:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

Web References:

1. http://nptel.ac.in/courses/112103019/
2. https://www.cadtutor.net/tutorials/autocad/

Pragati Engineering College (Autonomous)

R23

I Year II Semester
ENGINEERING MECHANICS
(Common to CE and ME)

Course Category	Professional Core	**Course Code**	23ME202T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To get familiarized with different types of force systems.
2	To draw accurate free body diagrams representing forces and moments acting on a body to analyze the equilibrium of system of forces.
3	To teach the basic principles of center of gravity, centroid and moment of inertia and determine them for different simple and composite bodies.
4	To apply the Work-Energy method to particle motion.
5	To understand the kinematics and kinetics of translational and rotational motion of rigid bodies.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the fundamental concepts in mechanics and determine the frictional forces for bodies in contact.	K2
CO2	Analyze different force systems such as concurrent, coplanar and spatial systems and calculate their resultant forces and moments.	K4
CO3	Calculate the centroids, center of gravity and moment of inertia of different geometrical shapes.	K3
CO4	Apply the principles of work-energy and impulse-momentum to solve the problems of rectilinear and curvilinear motion of a particle.	K3
CO5	Solve the problems involving the translational and rotational motion of rigid bodies.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I

Introduction to Engineering Mechanics– Basic Concepts. Scope and Applications

Systems of Forces: Coplanar Concurrent Forces– Components in Space–Resultant–Moment of Force and its Application –Couples and Resultant of Force Systems.

Friction: Introduction**,** limiting friction and impending motion, Coulomb's laws of dry friction,

coefficient of friction, Cone of Static friction. Introduction to Wedges.

UNIT II

Equilibrium of Systems of Forces: Free Body Diagrams, Lami's Theorem, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses. Principle of virtual work with simple examples

UNIT III

Centroid: Centroids of simple figures (from basic principles)–Centroids of Composite Figures.

Centre of Gravity: Centre of gravity of simple body (from basic principles), Centre of gravity of composite bodies, Pappus theorems.

Area Moments of Inertia: Definition– Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, Mass Moment of Inertia of composite bodies.

UNIT IV

Rectilinear and Curvilinear motion of a particle: Kinematics and Kinetics –D'Alembert's Principle - Work Energy method and applications to particle motion-Impulse Momentum method.

UNIT V

Rigid body Motion: Kinematics and Kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse Momentum method.

Textbooks:

1.Engineering Mechanics, S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., McGraw Hill Education 2017. 5th Edition.

2. Engineering Mechanics, P.C.Dumir- S.Sengupta and Srinivas V veeravalli , University press. 2020. First Edition.

3. A Textbook of Engineering Mechanics, S.S Bhavikatti. New age international publications 2018. 4th Edition.

Reference Books:

1. Engineering Mechanics, Statics and Dynamics, Rogers and M A. Nelson., McGraw Hill Education. 2017. First Edition.

2. Engineering Mechanics, Statics and Dynamics, I.H. Shames., PHI, 2002. 4th Edition.

3. Engineering Mechanics, Volume-I: Statics, Volume-II: Dynamics, J. L. Meriam and L. G. Kraige., John Wiley, 2008. 6th Edition.

4. Introduction to Statics and Dynamics, Basudev Battachatia, Oxford University Press, 2014. Second Edition

5. Engineering Mechanics: Statics and Dynamics, Hibbeler R.C., Pearson Education, Inc., New Delhi, 2022, 14th Edition.

Web References:

1. http://nptel.ac.in/courses/122104015/
2. https://freevideolectures.com/course/2264/engineering-mechanics
3. https://ocw.mit.edu/courses/1-050-engineering-mechanics-i-fall-2007/

R23

Pragati Engineering College (Autonomous)

I Year II Semester
ENGINEERING PHYSICS LABORATORY
(Common to CE, EEE, ME, ECE, CSE(CS) and IT)

Course Category	Basic Sciences	**Course Code**	23BP201P
Course Type	Laboratory	**L-T-P-C**	0-0-2-1
Prerequisites	Intermediate Physics	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	The student will have exposure to various experimental skills which is essential for an Engineering student.
2	To gain practical knowledge by applying the experimental methods to correlate with the Theoretical Physics.
3	Apply the Analytical techniques and graphical analysis to the experimental data

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the basics of Interference, Diffraction in Physics using instruments like Spectrometer, Travelling microscope.	K2
CO2	Study the Mechanical Laws, Strength of materials, Magnetic and Dielectric constants of materials.	K3
CO3	Apply the basics of Current Electricity and Semiconductors in engineering application	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT (Any TEN of the listed experiments are to be conducted. Out of which any TWO experiments may be conducted in virtual mode).

1. Determination of radius of curvature of a given Plano-convex lens by Newton's Rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3. Verification of Brewster's law
4. Determination of wavelength of Laser light using diffraction grating.
5. Estimation of Planck's constant using photoelectric effect.
6. Sonometer: Verification of laws of stretched string.
7. Determination of young's modulus for the given material of wooden scale by non- uniform bending

(or double cantilever) method.

8. Determination of rigidity modulus of the material of the given wire using Torsional pendulum
9. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
10. Determination of magnetic susceptibility by Kundt's tube method.
11. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method.
12. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
13. Determination of dielectric constant using charging and discharging method.
14. Determination of the resistivity of semiconductors by four probe methods.
15. Determination of energy gap of a semiconductor using p-n junction diode.
16. Determination of temperature coefficients of a thermistor.
17. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.

TEXT BOOKS

College Customized Manual

REFERENCE BOOKS

A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017

WEB RESOURCES

1. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype
2. www.vlab.co.in

R23

Pragati Engineering College (Autonomous)

I Year II Semester
ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP
(Common to CE, EEE, ME, ECE, CSE(CS) and IT)

Course Category	Engineering Science	**Course Code**	23EE201P
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

PART-A: ELECTRICAL ENGINEERING WORKSHOP

COURSE OBJECTIVES
To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Know the Electrical circuit design concepts; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.	K2
CO2	Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.	K3
CO3	Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.	K3
CO4	Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.	K4
CO5	Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	2	-	1	-	-	-	1	-	-	-
CO2	2	2	2	-	1	-	-	-	1	-	-	-
CO3	2	2	1	-	1	-	-	-	1	-	-	-
CO4	2	2	-	-	1	-	-	-	1	-	-	-
CO5	-	-	-	-	1	1	1	-	1	-	-	-

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List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Measurement of Three- phase power in Three-phase induction motor using two wattmeter method.
5. Speed control of DC shunt motor.
6. Measurement of Power and Power factor using Single-phase wattmeter
7. Measurement of Earth Resistance using Megger
8. Calculation of Electrical Energy for Domestic Premises

Reference Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, DhanpatRai& Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Note: Minimum Six Experiments to be performed.

PART B: ELECTRONICS ENGINEERING WORKSHOP

COURSE OBJECTIVES
To impart knowledge on the principles of digital electronics and fundamentals ofelectron devices & its applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO6	Identify & testing of various electronic components.	K3
CO7	Understand the usage of electronic measuring instruments.	K3
CO8	Plot and discuss the characteristics of various electron devices.	K3
CO9	Explain the operation of a digital circuit.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO6	2	2		2	2							
CO7	2	2		2	2							
CO8	2	2		2	2							
CO9	2	2		2	2							

Pragati Engineering College (Autonomous)

List of experiments:

1. Introduction to Active and Passive devices must be experiment-1 (includes Resistors, Capacitors, Inductors, Diodes, Transistors, Power supplies, Ammeter(s), Voltmeter(s), necessary devices)
2. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
3. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
4. Determine ripple factor of full wave rectifier.
5. Plot Input & Output characteristics of BJT in CE and CB configurations.
6. Determining CE Amplifier input and output impedance with and without bypass capacitor.
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices. Multisim/PSPICE software for Simulation.

References:

1. Robert. L. Boylestad & Louis Nashelsky, Electronic Devices & Circuit Theory, PearsonEducation, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software.

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R23

I Year II Semester
ENGINEERING MECHANICS LABORATORY
(ME)

Course Category	Professional Core	**Course Code**	23ME202P
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	Verify the Law of Parallelogram and Triangle of Forces.
2	Determine the coefficients of friction of Static and Rolling friction and Centre of gravity of different plane Lamina.
3	Analyse the system of Pulleys and Moment of Inertia of Compound Pendulum and Flywheel.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Evaluate the coefficient of friction between two different surfaces and between the inclined plane and the roller.	K3
CO2	Verify Law of Polygon of forces and Law of Moment using force polygon and bell crank lever.	K3
CO3	Determine the Centre of gravity and Moment of Inertia of different configurations.	K3
CO4	Verify the equilibrium conditions of a rigid body under the action of different force systems.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

Students have to perform any 10 of the following Experiments:

List of Experiments:

1. Verification of Law of Parallelogram of Forces.
2. Verification of Law of Triangle of Forces.
3. Verification of the Law of polygon for coplanar-concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium using universal force table.

4. Determination of coefficient of Static and Rolling Frictions
5. Determination of Centre of Gravity of different shaped Plane Lamina.
6. Verification of the conditions of equilibrium of a rigid body under the action of coplanar non-concurrent, parallel force system with the help of a simply supported beam.
7. Study of the systems of pulleys and draw the free body diagram of the system.
8. Determine the acceleration due to gravity using a compound pendulum.
9. Determine the Moment of Inertia of the compound pendulum about an axis perpendicular to the plane of oscillation and passing through its centre of mass.
10. Determine the Moment of Inertia of a Flywheel.
11. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever.

References:

1.S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.
2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022

R23

Pragati Engineering College (Autonomous)

I Year II Semester
IT WORKSHOP
(Common to CE, EEE, ME, ECE, CSE(CS) and IT)

Course Category	Engineering Science	**Course Code**	23IT201P
Course Type	Laboratory	**L-T-P-C**	0-0-2-1
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES

1. To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables.
2. To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS.
3. To teach basic command line interface commands on Linux.
4. To teach the usage of Internet for productivity and self-paced life-long learning.
5. To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Perform Hardware troubleshooting.	K3
CO2	Understand Hardware components and inter dependencies.	K3
CO3	Safeguard computer systems from viruses/worms.	K3
CO4	Document/ Presentation preparation.	K3
CO5	Perform calculations using spreadsheets.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

PC Hardware & Software Installation

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows, Linux / BOSS on the personal computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux / BOSS Lab instructor should verify the installation and follow it up with a Viva.

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and howto use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

WORD

Task 1 – Word Orientation: The mentor needs to give an overview of Microsoft (MS) office or equivalent (FOSS) tool word: Importance of MS office or equivalent(FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using word – Accessing, overview of toolbars, saving files, Usinghelp and resources, rulers, format painter in word.

Task 2: Using Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word.

Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

EXCEL

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help

and resources.

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text.

Task 2: Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function.

POWER POINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI TOOLS – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentencesto see how the model completes them.

- Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: Whatis the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

- Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

- Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2--3.
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2-13, 3rd edition.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2-12, 2nd edition.
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft).
5. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition.
6. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition.

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Web References:

1. PC Hardware & Software Installation:
   Peripheral Devices: Computer Peripherals - Wikipedia
   Components in a CPU: CPU Components and Their Functions - Guru99
2. Internet & World Wide Web:
   TCP/IP and Networking Basics: TCP/IP Explained - Lifewire
   Internet Browsing and Configuration: How Web Browsing Works - HowStuffWorks
3. Word:
   Microsoft Word Tutorials: Microsoft Word Basics - GCFGlobal
4. Excel:
   Excel Tutorial and Functions: Excel Tutorial - Microsoft
5. AI Tools - ChatGPT:
   GPT-3.5 and ChatGPT Information: GPT-3.5 Guide - OpenAI

Pragati Engineering College (Autonomous)

R23

I Year II Semester
NSS/NCC/SCOUTS AND GUIDES/COMMUNITY SERVICE
(Common to CE, EEE, ME, ECE, CSE(CS) and IT)

Course Category	Humanities	**Course Code**	23MH202P
Course Type	Theory	**L-T-P-C**	0-0-1-0.5
Prerequisites		**Continuous Evaluation**	90
		Viva Voce	10
		Total Marks	100

COURSE OBJECTIVES
The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		
CO1	Understand the importance of discipline, character and service motto.	
CO2	Solve some societal issues by applying acquired knowledge, facts, and techniques.	
CO3	Explore human relationships by analyzing social problems.	
CO4	Determine to extend their help for the fellow beings and downtrodden people.	
CO5	Develop leadership skills and civic responsibilities.	

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT – I: Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.
Activities:

i) Conducting ice breaking sessions-expectations from the course-knowing personal talents and skills
ii) Conducting orientations programs for the students future plans-activities-releasing road map etc.
iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT – II: Nature & Care

Activities:

i) Best out of waste competition.
ii) Poster and signs making competition to spread environmental awareness.
iii) Recycling and environmental pollution article writing competition.
iv) Organising Zero-waste day.
v) Digital Environmental awareness activity via various social media platforms.
vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
vii) Write a summary on any book related to environmental issues.

UNIT – III: Community Service

Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities- experts-etc.
ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii) Conducting consumer Awareness. Explaining various legal provisions etc.
iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v) Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, A Text Book of National Service Scheme Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. Red Book - National Cadet Corps Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e 2008
4. Masters G. M. Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. Social Problems in India, Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
Department of Mechanical Engineering

R23

II YEAR I SEMESTER
Numerical Methods and Transform Techniques
(MECH)

Course Category	Basic Sciences	**Course Code**	23BM303T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Differentiation & integration, partial fractions, Binomial Theorem.	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To elucidate the different numerical methods to solve nonlinear algebraic equations
2	To disseminate the use of different numerical techniques for carrying out numerical integration.
3	To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Evaluate the approximate roots of poly nomial and transcendental equations by different algorithms. Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals.	K3
CO2	Apply numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations.	K3
CO3	Apply the Laplace transform for solving differential equations.	K3
CO4	Find or compute the Fourier series of periodic signals.	K3
CO5	Know and be able to apply integral expressions for the forwards and inverse Fourier transform to arange of non-periodic wave forms.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I
Iterative Methods:
Introduction – Solutions of algebraic and transcendental equations: Bisection method–Secant method –Method of false position– Iteration method–Newton-Raphson method (simultaneous Equations)
Interpolation: Newton's forward and backward formulae for interpolation–Interpolation with unequal intervals – Lagrange's interpolation formula.

UNIT II
Numerical integration, Solution of ordinary differential equations with initial conditions:
Trapezoidal rule– Simpson's $1/3^{rd}$ and $3/8^{th}$ rule– Solution of initial value problems by Taylor's series– Picard's method of successive approximations– Euler's method – Runge - Kutta method (second and fourth order) – Milne's Predictor and Corrector Method.

UNIT III
Laplace Transforms:
Definition of Laplace transform- Laplace transforms of standard functions- Properties of Laplace Transforms- Shifting theorems- Transforms of derivatives and integrals- Unit step function- Dirac's delta function – Inverse Laplace transforms – Convolution theorem (without proof).
Applications: Solving ordinary differential equations (initial value problems) and integro differential equations using Laplace transforms.

UNIT IV
Fourier series:
Introduction–Periodic functions–Fourier series of periodic function–Dirichlet's conditions–Even and odd functions–Change of interval–Half-range sine and cosine series.

UNIT V
Fourier Transforms:
Fourier integral theorem (without proof) – Fourier sine and cosine integrals – Infinite Fourier transforms–Sine and cosine transforms – Properties – Inverse transforms–Convolution theorem (withou tproof) – Finite Fourier transforms.

TEXT BOOKS
1. **B.S.Grewal,** Higher Engineering Mathematics,44^{th} Edition, Khanna Publishers
2. **B.V.Ramana,** Higher Engineering Mathematics, 2007 Edition,Tata Mc.Graw Hill Education.

REFERENCE BOOKS
1. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10^{th} Edition,Wiley-India.
2. **Steven C.Chapra,** Applied Numerical Methods with MAT LAB for Engineering and Science,Tata Mc.Graw Hill Education.
3. **M.K.Jain, S.R.K.Iyengar and R.K.Jain,** Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
4. **LawrenceTuryn,** Advanced Engineering Mathematics, CRC Press.

WEB RESOURCES
1. https://en.wikibooks.org/wiki/Numerical_Methods/Equation_Solving
2. https://en.wikipedia.org/wiki/Numerical_integration
3. https://mathworld.wolfram.com/LaplaceTransform.html
4. https://en.wikipedia.org/wiki/Fourier_series
5. https://mathworld.wolfram.com/FourierTransform.html

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

Department of Mechanical Engineering

R23

II YEAR I SEMESTER

UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY and ETHICAL HUMAN CONDUCT

(Common to CE, EEE, ME, ECE, CSE, IT, CSE(AI&ML), CSE(AI), CSE(DS) and CSE(CYBER SECURITY)

Course Category	HSMC	**Course Code**	23HM301T
Course Type	Theory	**L-T-P-C**	2-1-0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Blooms Taxonomy Level**
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession	K1
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.	K2
CO3	Understand the role of a human being in ensuring harmony in Family And Society.	K1
CO4	Appraise the role of a human being in ensuring harmony in Nature/Existence.	K2
CO5	Distinguish between ethical and unethical practices to actualize a harmonious environment wherever they work.	K2

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT – I Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, self-exploration as the Process for Value Education, Continuous Happiness and Prosperity-the basic human aspirations, Happiness and Prosperity- Current Scenario, Method to Fulfill the Basic Human Aspirations.
Practice Sessions: PS1 Sharing about Oneself , PS2 Exploring Human Consciousness, PS3 Exploring Natural Acceptance

UNIT – II Harmony in Human Being: Understanding Human being as the Co-existence of the self and the body, Distinguishing between the Needs of the self and the body, The body as an Instrument of the self, Understanding Harmony in the self, Harmony of the self with the body, Programme to ensure self - regulation and Health
Practice Sessions: PS4 Exploring the difference of Needs of self and body, PS5 Exploring Sources of Imagination in the self, PS6 Exploring Harmony of self with the body

UNIT – III Harmony in the Family and Society: Harmony in the family - the Basic Unit of Human Interaction, 'Trust' - the Foundational Value in Relationship, 'Respect' - as the Right Evaluation, Other Feelings, Justice in Human – to - Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.
Practice Sessions: PS7 Exploring the Feeling of Trust, PS8 Exploring the Feeling of Respect,
PS9 Exploring Systems to fulfil Human Goal

UNIT – IV Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual fulfillment among the Four Orders of Nature, Realizing Existence as Co- existence at All Levels, The Holistic Perception of Harmony in Existence
Practice Sessions: PS10 Exploring the Four Orders of Nature, PS11 Exploring Co-existence in Existence

UNIT – V Implications of the Holistic Understanding - a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value- based Life and Profession.
Practice Sessions: PS12 Exploring Ethical Human Conduct, PS13 Exploring Humanistic Models in Education, PS14 Exploring Steps of Transition towards Universal Human Order

Text books and Teachers Manual

1. A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 - R R Gaur, R Asthana, G P Bagaria
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2 - R R Gaur, R Asthana, G P Bagaria

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth- by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal

Web References:

1. https://fdp-si.aicte-india.org
2. https://www.youtube.com/playlist?list=PLWDeKF97v9SP_Kt6jqzA3pZ3yA7g_OAQz

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
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II YEAR I SEMESTER
THERMODYNAMICS
(ME)

Course Category	Professional Core	**Course Code**	23ME301T
Course Type	Theory	**L-T-P-C**	2-0-0-2
Prerequisites	Exposure to Engineering Physics	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To Understand the basic concepts of Thermodynamics, Reversibility, Irreversibility
2	To Learn first law for different thermodynamic systems and apply steady flow energy equation for various mechanical components.
3	To Understand the second law statements and concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
4	To Analyze the process of steam formation with various changes.
5	To understand fundamental concepts of Refrigeration, Psychrometry and Air conditioning.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Illustrate basic concepts of thermodynamics.	K2
CO2	Apply first law of thermodynamics for different thermodynamic systems.	K3
CO3	Analyze various concepts associated with second and third laws of thermodynamics	K4
CO4	Analyze the mixture of perfect gases using property diagram with the use of steam tables and charts.	K4
CO5	Understand various concepts of Refrigeration and Air-conditioning.	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT –I

Introduction: Basic Concepts: System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi static Process, Irreversible Process, Causes of Irreversibility.

UNIT –II

Energy in State and in Transition, Types, Work and Heat, Point and Path function. Zeroeth Law of Thermodynamics – PMM-I, Joule's Experiment – First law of Thermodynamics and applications. Limitations of the First Law – Enthalpy, Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance.

UNIT –III

Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM-II, Carnot's principle, Carnot cycle and its specialties, Thermodynamic scale of Temperature, Clausius Inequality, Entropy, Principle of Entropy Increase – Energy Equation, Availability and Irreversibility – Thermodynamic Potentials, Gibbs and Helmholtz Functions, Maxwell Relations – Elementary Treatment of the Third Law of Thermodynamics.

UNIT – IV

Pure Substances, P-V-T – surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation Property tables. Mollier charts – Various Thermodynamic processes and energy Transfer – Steam Calorimeter.

UNIT – V

Introduction to Refrigeration: working of Air, Vapor compression, VCR system Components, COP Refrigerants.

Introduction to Air Conditioning: Psychometric properties & processes – characterization of sensible and latent heat loads – load concepts of SHF.

Requirements of human comfort and concept of effective temperature – comfort chart – comfort air Conditioning, and load calculations.

Textbooks:

1. Engineering Thermodynamics, PK Nag 4th Edn, TMH.
2. Thermal Engineering – Domkundwar, Lakshmi Publishers

Reference Books:

1. Engineering Thermodynamics – Jones & Dugan PHI
2. Thermodynamics: An Engineering Approach (SIE), Y.A.Cengel & M.A.Boles , 7th Edn – McGraw Hill
3. An Introduction to Thermodynamics, Y.V.C.Rao, Universities press
4. Engineering Thermodynamics – P.Chattopadhyay – Oxford Higher Edn Publ.
5. Refrigeration and Air-conditioning, CP Arora, TMH

Online Learning Resources:

1. https://www.edx.org/learn/thermodynamics
2. https://archive.nptel.ac.in/courses/112/106/112106310
3. https://www.youtube.com/watch?v=7NI5P4KqrAs&t=1s
4. https://kp.kiit.ac.in/pdf_files/02/Study-Material_3rd-Semester_Winter_2021_Mechanical-Engg._Thermal-Engineering-1_Abhijit-Samant.pdf
5. https://www.coursera.org/learn/thermodynamics-intro

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R23

II YEAR I SEMESTER
MECHANICS OF SOLIDS
(ME)

Course Category	Professional Core	**Course Code**	23ME302T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Exposure to Engineering Mechanics	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES: The objectives of the course are to	
1	Understand the behavior of basic structural members subjected to uni axial and bi axial loads.
2	Apply the concept of stress and strain to analyse and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.
3	Students will learn all the methods to analyse beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components. Students are able to analyse beams and draw correct and complete shear and bending moment diagrams for beams.
4	Students attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior.
5	Design and analysis of Industrial components like pressure vessels.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain various types of stresses due to axial loading and the concept of strain energy.	K2
CO2	Develop shear force and bending moment diagrams for determinate beams subjected to different types of loads.	K3
CO3	Analyze the bending and shear stresses on different cross sections of the beams.	K4
CO4	Examine the slope and deflection of the beam by various methods subjected to point load, UDL, and uniformly varying loads and stresses due to torsion.	K4
CO5	Determine the stresses in thin and thick cylinders subjected to internal pressure and also can be able to find the stability of the columns.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT – I

Simple Stresses & Strains: Elasticity and plasticity – Types of stresses & strains – Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio & volumetric strain – Bars of varying section – composite bars – Temperature stresses – Complex Stresses – Stresses on an inclined plane under different uniaxial and biaxial stress conditions – Principal planes and principal stresses – Mohr's circle – Relation between elastic constants, Strain energy – Resilience – Gradual, sudden, impact and shock loadings.

UNIT – II

Shear Force and Bending Moment: Definition of beam – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

Flexural Stresses: Theory of simple bending, Derivation of bending equation, Determination of bending stresses – section modulus of rectangular, circular, I and T sections – Design of simple beam sections.

Shear Stresses: Derivation of formula – Shear stress distribution across various beams sections like rectangular, circular, triangular, I and T sections.

UNIT – IV

Deflection of Beams: Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, UDL and UVL. Mohr's theorem and Moment area method – application to simple cases.

Torsion: Introduction – Derivation – Torsion of Circular shafts – Pure Shear – Transmission of power by circular shafts, Shafts in series, Shafts in parallel.

UNIT – V

Thin and Thick Cylinders: Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in dia, and volume of thin cylinders – Thin spherical shells. Wire wound thin cylinders. Lame's equation – cylinders subjected to inside & outside pressures – compound cylinders.

Columns: Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler's Formula, Rankine's Formula

Textbooks:

1. Strength of materials /GH Ryder/ Mc Millan publishers India Ltd.
2. Strength of materials by B.C. Punmia – Lakshmi publications Pvt.Ltd, New Delhi.

Reference Books:

1. Mechanics of materials by Gere & Timoshenko.
2. Strength of Materials by Jindal, Umesh Publications.
3. Strength of Materials by S.Timoshenko – D. VAN NOSTRAND Company – PHI Publishers.
4. Strength of Materials by Andrew Pytel and Ferdinand L. Singer Longman – HarperCollins.
5. Solid Mechanics by Popov.
6. Mechanics of Materials/Gere and Timoshenko, CBS Publishers.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc19_ce18/preview
2. https://youtube/iY_ypychVNY?si=310htc4ksTQJ8Fv6
3. https://www.youtube.com/watch?v=WEy939Rkd_M&t=2s
4. https://www.classcentral.com/course/swayam-strength-of-materials-iitm-184204
5. https://www.coursera.org/learn/mechanics-1
6. https://www.edx.org/learn/engineering/massachusetts-institute-of-technology-mechanicalbehavior-of-materials-part-1-linear-elastic-behavior
7. https://archive.nptel.ac.in/courses/112/107/112107146/

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
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R23

II YEAR I SEMESTER
MATERIAL SCIENCE & METALURGY
(ME)

(Course Category	Professional Core	**Course Code**	23ME303T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Engineering Chemistry, Basic Civil and Mechanical Engineering	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To know the basic fundamentals of material science, crystalline structure and also study the basic construction of equilibrium diagram with phases in different alloy systems.
2	To study the behavior of ferrous and non-ferrous metals and alloys with their applications in different domains.
3	Able to understand the effect of heat treatment and addition of alloying elements on properties of ferrous metals.
4	Able to understand the methods of making metal powders and applications of powder metallurgy.
5	Comprehend the properties and applications of ceramic, composites and other advanced methods.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the crystalline structure of different metals and study the stability of phases in different alloy systems.	K1
CO2	Studied the behavior of ferrous and non-ferrous metals and alloys with their applications in different domains.	K3
CO3	Understand the various heat treatment and strengthening processes.	K2
CO4	Studied the making of metal powder methods and applications in powder metallurgy.	K2
CO5	Understand the properties and applications of ceramics, composites and nano materials.	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT –I

Structure of Metals and Constitution of alloys: Crystallization of metals. Packing Factor – SC, BCC, FCC & HCP – line density, plane density. Grain and grain boundaries, effect of grain boundaries – determination of grain size. Imperfections – Point and Line, Slip and Twinning.

Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds.

Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule relationship between equilibrium diagrams and properties of alloys. Study of binary phase diagrams such as Cu-Ni and Fe-Fe_3C.

UNIT –II

Ferrous metals and alloys: Structure and properties of White Cast iron, Malleable Cast iron, grey cast iron, Spheriodal graphite cast iron, Alloy cast iron. Classification of steels, structure and properties of plain carbon steels, Low alloy steels, Hadfield manganese steels, tool and die steels.

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys, Magnesium and its alloys, Super alloys.

UNIT –III

Heat treatment of Steels: Effect of alloying elements on Fe-Fe_3C system, annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface – hardening methods, age hardening treatment, Cryogenic treatment

UNIT – IV

Powder Metallurgy: Basic processes – Methods of producing metal powders – milling atomization - Granulation – Reduction – Electrolytic Deposition. Compacting methods – Sintering – Methods of manufacturing sintered parts. Secondary operations, Applications of powder metallurgical products.

UNIT – V

Ceramic and Advanced materials: Crystalline ceramics, glasses, cermets, abrasive materials, Classification of composites, manufacturing methods, particle reinforced composites, fiber reinforced composites, PMC, MMC, CMC and CCCs. Introduction to Nanomaterials and smart materials.

Textbooks:

1. Introduction to Physical Metallurgy – Sidney H. Avener – McGraw Hill.
2. Essentials of Materials Science and Engineering – Donald R. Askeland – Cengage.

Reference Books:

1. Material Science and Metallurgy – Dr. V.D. Kodgire – Everest Publishing House.
2. Materials Science and Engineering – Callister & Bala Subrahmanyam – Wiley Publications.
3. Material science and Engineering – V. Raghavan – PHI Publishers.
4. Introduction to Material Science and Engineering – Yip-Wah Chung CRC Press.
5. Material Science and Metallurgy – A V K Suryanarayana – B S Publications.
6. Material Science and Metallurgy – U. C. Jindal – Pearson Publications.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/113/106/113106032/
2. https://www.edx.org/learn/mechanics/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-3-time-dependent-behavior.
3. https://www.youtube.com/watch?v=9Sf278j1GTU
4. https://www.coursera.org/learn/fundamentals-of-materials-science
5. https://www.coursera.org/learn/material-behavior

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II YEAR I SEMESTER
MECHANICS OF SOLIDS & MATERIAL SCIENCE LABORATORY
(ME)

(Course Category	Professional Core	**Course Code**	23ME301P
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Exposure to Mechanics of Solids Material science and Metallurgy	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES
1. To study the behavior of materials under tension, compression, torsion, bending, shear and impact.
2. To study the behavior of springs under tension and compression.
3. To apply loads to various materials under different equilibrium conditions.
4. To impart the practical exposure on the microstructure of various ferrous and non- ferrous materials and their hardness evaluation

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Determine modulus of elasticity of bars, beams and springs subjected to various loads.	K3
CO2	Calculate deflection and stiffness of helical spring.	K3
CO3	Examine the behavior of the solid bodies subjected to various types of loading.	K4
CO4	Understand the compositions of various ferrous and non- ferrous materials.	K1
CO5	Identify the various microstructures of steels and cast irons.	K3
CO6	Evaluate the hardness of treated and untreated steels.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

A) MECHANICS OF SOLIDSLAB:

1. Direct Tension test on Universal testing machine
2. Compression test on wood on Universal testing machine
3. Bending test on
    a. Simply Supported Beam
    b. Cantilever Beam
4. Torsion test.
5. Hardness test
    a. Brinell'S hardness test
    b. Rockwell hardness test
    c. Vickers hardness test
6. Test on springs
7. Compression test on springs
8. Impact test
    a. Charpy test
    b. Izod Test.
9. Punch Shear Test
10. Liquid penetration test
11. Double Shear test on Universal testing machine

B) MATERIAL SCIENCE LAB:

1. Preparation and study of the Microstructure of pure metals.
2. Preparation and study of the Microstructure of Mild steel, medium carbon steels, and High carbon steels.
3. Study of the Microstructure of Cast Irons.
4. Study of the Microstructure of Non-ferrous alloys.
5. Study of the Microstructure of Heat-Treated Steels.
6. Hardenability of steels by Jominy End Quench Test.
7. To find the hardness of various Treated and Untreated Iron with its Alloy materials.
8. To find the hardness of various Treated and Untreated Aluminum with its Alloy materials.

NOTE: Any 6 experiments to be conducted from each section A and B.

Virtual lab:

1. To investigate the principal stresses σa and σb at any given point of a structural element or machine component when it is in a state of plane stress. (https://virtual-labs.github.io/exp-rockwell-hardness-experiment-iiith/objective.html)
2. To find the impact resistance of mild steel and cast iron. (https://sm-nitk.vlabs.ac.in/exp/izod-impact-test)
3. To find the impact resistance of mild steel. (https://sm-nitk.vlabs.ac.in/exp/charpy-impact-test/index.html)
4. To find the Rockwell hardness number of mild steel, cast iron, brass, aluminum and spring steel etc. (https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test)
5. To determine the indentation hardness of mild steel, brass, aluminum etc. using Vickers hardness testing machine. (https://sm-nitk.vlabs.ac.in/exp/vickers-hardness-test)

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R23

II YEAR I SEMESTER
COMPUTER-AIDED MACHINE DRAWING

(ME)

Course Category	Professional Core	**Course Code**	23ME301P
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Engineering Drawing	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Introduce conventional representations of material and machine components.
2	Train to use software for 2D and 3D modeling.
3	Familiarize with thread profiles, riveted, welded and key joints.
4	Teach solid modeling of machine parts and their sections.
5	Explain creation of 2D and 3D assembly drawings.
6	Familiarize with limits, fits, and tolerances in mating components

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Demonstrate the conventional representations of materials and machine components.	K3
CO2	Model riveted, welded and key joints using CAD system.	K6
CO3	Create solid models and sectional views of machine components.	K6
CO4	Generate solid models of machine parts and assemble them.	K5
CO5	Translate 3D assemblies into 2D drawings.	K6
CO6	Create manufacturing drawing with dimensional and geometric tolerances.	K6

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

The following are to be done by 2D software package– AutoCAD

Conventional representation of materials and components:

Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.

Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

Couplings: Rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, Oldham's coupling.

The following exercises are to be done by 3D software package – CATIA, CREO, Solid works etc.

Sectional views:

Creating solid models of complex machine parts and sectional views.

Assembly drawings: (Any four of the following using solid model software)

Lathe tool post, tool head of shaping machine, tail-stock, machine vice, gate valve, carburetor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling.

Production drawing:

Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

Textbooks:

1. Machine Drawing by K.L. Narayana, P. Kannaiah and K. Venkat Reddy, New Age International Publishers, 3/e, 2014
2. Machine Drawing by N. Sideshwar, P. Kannaiah, V.V.S. Sastry, TMH Publishers. 2014.

Reference Books:

1. Cecil Jensen, Jay Helsel and Donald D. Voisinet, Computer Aided Engineering Drawing, Tata McGraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. N.D. Bhatt, Machine Drawing, Charotar Publishers, 50/e, 2014.

Online Learning Resources:

1. https://eeedocs.wordpress.com/wp-content/uploads/2014/02/machinedrawing.pdf
2. https://archive.nptel.ac.in/courses/112/105/112105294/
3. https://www.edx.org/learn/engineering/dassault-systemes-solidworks-solidworks-cadfundamentals?index=product&queryID=c90b35a82a6ef58b0d6f89679c63f6a1&position=2&linked_from=autocomplete&c=autocomplete
4. https://www.youtube.com/watch?v=0bQkS3_3Fq4

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R23

II YEAR I SEMETSER
PYTHON PROGRAMMING LABORATORY
(ME)

Course Category	Skill Enhancement Course	**Course Code**	**23AM302P**
Course Type		**L-T-P-C**	**0-0-0-2**
Prerequisites	**NIL**	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	

COURSE OBJECTIVES	
1	**Fundamental Understanding:** Develop a solid foundation in Python programming,covering essential syntax, semantics, and constructs.
2	**Data Manipulation:** Equip students with skills to handle and manipulate data using Python libraries like Pandas and NumPy.
3	**Problem-Solving:** Enhance problem-solving abilities by implementing various algorithms and data structures in Python.
4	**Software Development:** Foster software development skills, including version control, package management, and project documentation.
5	**Advanced Techniques:** Introduce advanced Python topics such as web scraping, API interaction, and database management.

COURSE OUTCOMES		
		Cognitive Level
CO1		
CO2		
CO3		
CO4		
CO5		

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1														
CO2														
CO3														
CO4														
CO5														

Experiment 1: Introduction to Python

- Objective: Install Python and setup the development environment.
- Tasks:
  - Install Python and an IDE (e.g., PyCharm, VS Code, or Jupyter Notebook).
  - Write and run a simple "Hello, World!"program.
  - Understand and demonstrate basic Python syntax and semantics.

Experiment 2: Basic Python Programming

- Objective: Learn basic programming constructs in Python.
- Tasks:
  - Create programs using variables, data types, and operators.
  - Implement basic input and output functions.
  - Write programs using control structures (if statements, for loops, while loops).

Experiment 3:Functions and Modules

- Objective: Understand functions and module usage in Python.
- Tasks:
  - Define and call functions with different types of arguments and return values.
  - Explore and use built-in Python modules.
  - Write a script that imports and utilizes atleast two different standard library modules.

Experiment 4: Lists and Tuples

- Objective: Work with Python lists and tuples.
- Tasks:
  - Create, modify, and iterate over lists and tuples.
  - Perform list comprehensions to create new lists.
  - Demonstrate the immutability of tuples.

Experiment 5: Dictionaries and Sets

Objective: Explore dictionaries and sets in Python.

- Tasks:
  - Create and manipulate dictionaries.
  - Use dictionary comprehension.
  - Create and perform operations on sets.

Experiment 6: Strings and File I/O

- Objective: Manipulate strings and perform file I/O operations.
- Tasks:
  - Demonstrate various string methods.
  - Write programs to read from and write to textf iles.
  - Work with different file formats, including CSV and JSON.

Experiment 7:Error Handling and Exceptions

- Objective: Implement error handling in Python programs.
- Tasks:
  - Write programs using try, except, else, and finally blocks.
  - Handle specific exceptions.
    Create and raisecustom exceptions.

Experiment 8: Object-Oriented Programming(OOP)

- Objective: Understand and implement OOP concepts in Python.
- Tasks:
  - Define classes and create objects.
  - Demonstrate inheritance and polymorphism.
  - Use class and instance variables in programs.

Experiment 9: Libraries and Packages

- Objective: Utilize third – party libraries and create Python packages.
- Tasks:
  - Install and use libraries like NumPy and Pandas.
  - Create a simple Python package and distribute it.
  - Work with virtual environments to manage dependencies.

Experiment 10: Working with Data

-Objective: Perform data manipulation and visualization.

- Tasks:
  - Use Pandas to load, manipulate, and analyze data sets.
  - Create visualizations using Matplotlib and Seaborn.
  - Conduct basic data analysis tasks and summarize findings.

Experiment 11: Web Scraping and APIs

- Objective: Extract data from the web and interact with APIs.
- Tasks:
  - Access and parse data from RESTful APIs.
  - Process and analyze JSONdata from APIs.

Experiment 12: Databases

- Objective:Work with databases in Python.

-Tasks:

  - Connect to a database using SQLite and SQLAlchemy.
- Perform CRUD operations on the database.
  - Write queries to manage and retrieve data.

Course Outcomes:

- https://www.udemy.com/course/python-the-complete-python-developer-course/?matchtype=e&msclkid=0584dfb54dc715f39c0bb9aaf74033be&utm_campaign=BG-Python_v.PROF_la.EN_cc.INDIA_ti.7380&utm_content=deal4584&utm_medium=udemyads&utm_source=bing&utm_term=_._ag_1220458320107116_._adkw_Python+language_._de_c_._dm._pl_ti_kwd-76278984197882%3Aloc-90_._li_116074_._p&couponCode=IND21PM
- https://www.w3schools.com/python/python_intro.asp
- https://www.youtube.com/watch?v=eWRfhZUzrAc
- https://onlinecourses.nptel.ac.in/noc20_cs83/preview
- https://www.edx.org/learn/python
- VirtualLabs-https://python-iitk.vlabs.ac.in/
- VirtualLabs-https://virtual-labs.github.io/exp-arithmetic-operations-iitk/
- VirtualLabs-https://cse02-iiith.vlabs.ac.in/
- https://mlritm.ac.in/assets/cse/cse_lab_manuals/R20_cse_manuals/Python%20Lab%20Manual.pdf

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II YEAR I SEMESTER
EMBEDDED SYSTEMS & IoT LABORATORY

Course Category	Skill Enhancement Course	**Course Code**	23EC301S
Course Type	Laboratory	**L-T-P-C**	0-1-2-2
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES
1. To understand the fundamentals of embedded systems and their applications in IoT.
2. To develop skills in designing and implementing IoT solutions using embedded systems.
3. To explore the integration of sensors, actuators, and communication protocols in IoT systems.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Comprehend the basics of embedded systems and apply them in IoT contexts.	K2
CO2	Acquire the ability to design and implement practical IoT solutions using embedded systems.	K3
CO3	Gain proficiency in integrating sensors, actuators, and communication protocols to develop functional IoT systems.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes(1–Low,2 -Medium,3–High)

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

List of Experiments:

List of Experiments: (Minimum of Ten Experiments has to be performed)

1. Determination of F to F a given transistor.
2. Voltage-Series Feedback Amplifier
3. Current-Shunt Feedback Amplifier
4. RC Phase Shift / Wien Bridge Oscillator
5. Hartley / Colpitt's Oscillator
6. Two Stage RC Coupled Amplifier
7. Darling ton Pair Amplifier
8. Bootstrapped Emitter Follower
9. Class A Series-fed Power Amplifier
10. Transformer-coupled Class A Power Amplifier
11. Class B Push-Pull Power Amplifier
12. Complementary Symmetry Class B Push-Pull Power Amplifier
13. Single Tuned Voltage Amplifier
14. Double Tuned Voltage Amplifier

Equipment required : Software:

i. Multisim / Equivalent Industrial Standard Licensed simulation software tool.

ii. Computer Systems with required specifications

Hardware Required:

1. Regulated Power supplies
2. Analog / Digital Storage Oscilloscopes
3. Analog / Digital Function Generators
4. Digital Multimeters
5. Decade Résistance Boxes / Rheostats
6. Decade Capacitance Boxes
7. Ammeters (Analogor Digital)
8. Voltmeters (Analogor Digital)
9. Active & Passive Electronic Components

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II YEAR I SEMESTER

ENVIRONMENTAL SCIENCE

(Common to all branches)

Course Category	BASIC SCIENCES	**Course Code**	**23BC301T**
Course Type	Theory	**L-T-P-C**	2 -0-0
prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

S.No.	**Course Objectives**
1	To make the students to get awareness on environment
2	To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
3	To save earth from the inventions by the engineers.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Grasp multi disciplinary nature of environmental studies and various renewable and non-renewable resources.	K2
CO2	Understand flow and bio-geo- chemical cycles and ecological pyramids.	K2
CO3	Understand various causes of pollution and solid waste management and related preventive measures.	K2
CO4	Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.	K2
CO5	Illustrate the casus of population explosion, value education and welfare programmes.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	1	0	1	0	0	1	2	0	0	0	1	0
CO2	0	1	0	0	0	0	1	0	0	0	0	0
CO3	0	0	0	0	2	0	1	0	0	0	0	0
CO4	0	0	0	0	1	1	3	0	0	0	0	0
CO5	0	0	0	0	0	0	3	1	0	0	0	0

COURSE CONTENT

UNIT – I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies, Energy resources-Renewable and non-renewable resources (Biomass).

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a)Forest ecosystem, b)Grassland ecosystem, c)Desert ecosystem, e)Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)(Primary Treatment)

Biodiversity and Its Conservation : Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hotspots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of: a) Air Pollution, b)Water pollution, c)Soil pollution, d)Marine pollution, e)Noise pollution, f)Thermal pollution, g)Nuclear hazards (Primary treatment)

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics (Issues and possible solutions) –Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V

Human Population and The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Viral infections -Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Textbooks:

1. Erach Bharucha,Text book of Environmental Studies for Undergraduate Courses,Universities Press (India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.
3. S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", SciTech Publications (India), Pvt. Ltd, 2010.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2. M.Anji Reddy, "Textbook of Environmental Sciences and Technology", BS Publication, 2014.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
4. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
5. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science
- http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20Files/pdf/lec07.pdf
- https://www.youtube.com/watch?v=5QxxaVfgQ3k

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II YEAR II SEMESTER
INDUSTRIAL MANAGEMENT
(ME)

Course Category	Management Course – I	**Course Code**	23ME401T
Course Type	Theory	**L-T-P-C**	2-0-0-2
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Introduce the scope and role of industrial engineering and the techniques for optimal design of layouts.
2	Illustrate how work study is used to improve productivity.
3	Explain TQM and quality control techniques.
4	Introduce financial management aspects.
5	Discuss human resource management and value analysis.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Learn about how to design the optimal layout	K1
CO2	Demonstrate work study methods	K3
CO3	Explain Quality Control techniques	K2
CO4	Discuss the financial management aspects and	K2
CO5	Understand the human resource management methods.	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT – I

Introduction: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, quantitative tools of IE and productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management.

Plant Layout: Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts, plant maintenance, preventive and break down maintenance.

UNIT – II

Work Study: Importance, types of production, applications, work study, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs.

UNIT – III

Statistical Quality Control: Quality control, Queuing assurance and its importance, SQC, attribute sampling inspection with single and double sampling, Control charts – $\bar{X}$ and R – charts $\bar{X}$ and S charts and their applications, numerical examples.

Total Quality Management: zero defect concept, quality circles, implementation, applications, ISO quality systems. Six Sigma – definition, basic concepts

UNIT – IV

Financial Management: Scope and nature of financial management, Sources of finance, Ratio analysis, Management of working capital, estimation of working capital requirements, stock management, Cost accounting and control, budget and budgetary control, Capital budgeting – Nature of Investment Decisions – Investment Evaluation criteria- NPV, IRR, PI, Payback Period, and ARR, numerical problems.

UNIT – V

Human Resource Management: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance and types, meritrating, quantitative methods, wage incentive plans, and types.

Value Analysis: Value engineering, implementation procedure, enterprise resource planning and supply chain management.

Textbooks:

1. O.P Khanna, Industrial Engineering and Management, Dhanpat Rai Publications (P) Ltd, 2018.
2. Mart and Telsang, Industrial Engineering and Production Management, S.Chand & Company Ltd. New Delhi, 2006.

Reference Books:

1. Bhattacharya DK, Industrial Management, S.Chand, publishers, 2010.
2. J.G Monks, Operations Management,3/e, McGraw Hill Publishers1987.
3. T.R. Banga, S.C. Sharma, N. K. Agarwal,Industrial Engineering and Management Science, Khanna Publishers, 2008.
4. Koontz O' Donnell, Principles of Management, 4/e, McGraw Hill Publishers, 1968.
5. R.C. Gupta, Statistical Quality Control, Khanna Publishers, 1998.
6. NVS Raju, Industrial Engineering and Management,1/e, Cengage India Private Limited, 2013.

Online Learning Sources

1. https://onlinecourses.nptel.ac.in/noc21_me15/preview
2. https://onlinecourses.nptel.ac.in/noc20_mg43/preview
3. https://www.edx.org/learn/industrial-engineering
4. https://youtube.com/playlist?list=PL299B5CC87110A6E7&si=TghLCbEobuxjEaXi
5. https://youtube.com/playlist?list=PLbjTnj-t5Gkl0z3OHOGK5RB9mvNYvnImW&si=oaX_5RG69hS3v2ll

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II YEAR II SEMESTER
COMPLEX VARIABLES, PROBABILITY AND STATISTICS
(MECH)

Course Category	Basic Sciences	**Course Code**	23ME401T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Differentiation & integration, Binomial Theorem, Probability	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To familiarize the complex variables
2	To familiarize the students with the foundations of probability and statistical method
3	To equip the students to solve application problems in their disciplines.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Apply Cauchy-Riemann equations to complex functions inorder to determine whether a given continuous function is analytic.	K3
CO2	Make use of the Cauchy residue theorem to evaluate certain integrals.	K3
CO3	Apply discrete and continuous probability distributions.	K3
CO4	Design the components of a classical hypothesistest	K3
CO5	Infer the statistical inferential methods based on smal land large sampling tests,	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT I
Functions of a complex variable and Complex integration:
Introduction – Continuity – Differentiability – Analyticity – Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne – Thompson method.
Complex integration : Line integral – Cauchy's integral theorem – Cauchy's integral formula– Generalized integral formula (all without proofs) and problems on above theorems.

UNIT II
Series expansions and Residue Theorem:
Radius of convergence – Expansion in Taylor's series, Maclaurin's series and Laurent series.
Types of Singularities : Isolated – Essential – Pole of order m–Residues – Residue theorem (without proof) – Evaluation of real integral of the types $\int_{-\infty}^{\infty} f(x)dx$ and $\int_{c}^{c+2\pi} f(\cos\theta,\ \sin\theta)d\theta$.

UNIT III
Probability and Distributions:
Review of probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions–Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance–Binomial, Poisson, Uniform and Normal distributions.

UNIT IV
Sampling Theory:
Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Representation of the normal theory distributions – Introduction to t,χ^2 and F-distributions –point and interval estimations – maximum error of estimate.

UNIT V
Tests of Hypothesis:
Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors –Level of significance – One tail and two – tail tests – Tests concerning one mean and two means (Large and Small samples) –Tests onproportions.

TEXT BOOKS
1. B.S.Grewal,HigherEngineeringMathematics,44/e,KhannaPublishers.
2. MillerandFreund's,ProbabilityandStatisticsforEngineers,7/e,Pearson,2008.
3. Complex variables and statistical methods, S.Chand publishers, Dr. T.K.V. Iyengar, 2022 Edition.

REFERENCE BOOKS
1. J.W.Brown and R.V.Churchill, Complex Variables and Applications, 9/e, Mc-Graw Hill, 2013.
2. S.C.Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
3. Jayl.Devore, Probability and Statistics for Engineering and the Sciences, 8/e, Cengage.
4. Shron L.Myers, KeyingYe, Ronald EWalpole, Probability and Statistics Engineers and the Scientists, 8/e, Pearson 2007.
5. Sheldon, M.Ross, Introduction to probability and statistics Engineers and the Scientists, 4/e, Academic Foundation,2 011.

WEB RESOURCES
1. https://archive.nptel.ac.in/courses/111/103/111103070/
2. https://biet.ac.in/pdfs/PROBABILITY%20AND%20STATISTICS%20&%20COMPLEX%20VARIABLES.pdf
3. https://archive.nptel.ac.in/courses/111/105/111105090/
4. http://acl.digimat.in/nptel/courses/video/111102160/L23.html
5. https://onlinecourses.nptel.ac.in/noc21_ma57/preview

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
Department of Mechanical Engineering

R23

II YEAR II SEMESTER
MANUFACTURING PROCESSES
(ME)

Course Category	Professional Core	**Course Code**	23ME402T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To impart basic knowledge and understanding about casting processes.
2	To impart basic knowledge and understanding about welding processes.
3	To impart basic knowledge and understanding about bulk forming processes.
4	To impart basic knowledge and understanding about sheet metal forming processes.
5	To impart basic knowledge and understanding about additive manufacturing processes.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Design the patterns and core boxes for metal casting processes	K2
CO2	Understand the different welding processes	K2
CO3	Demonstrate the different types of bulk forming processes	K1
CO4	Understand sheet metal forming processes	K2
CO5	Learn about the different types of additive manufacturing processes	K1

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT –I

Casting: Steps involved in making a casting – Advantage of casting and its applications. Patterns and Pattern making – Types of patterns – Materials used for patterns, pattern allowances and their construction, Molding, different types of cores, Principles of Gating, Risers, casting design considerations. Methods of melting and types of furnaces, Solidification of castings and casting defects – causes and remedies. Basic principles and applications of special casting processes-Centrifugal casting, Die casting, Investment casting and shell molding.

UNIT –II

Welding: Classification of welding processes, types of welded joints and their characteristics, Gas welding, Different types of flames and uses, Oxy-Acetylene Gas cutting. Basic principles of Arc welding, power characteristics, Manual metal arc welding, submerged arc welding, TIG& MIG welding. Electro–slag welding.

Resistance welding, Friction welding, Friction stir welding, Forge welding, Explosive welding; Thermit welding, Plasma Arc welding, Laser welding, electron beam welding, Soldering & Brazing.

Heat affected zones in welding; pre & post heating, welding defects – causes and remedies.

UNIT –III

Bulk Forming: Plastic deformation in metals and alloys – recovery, recrystallization and grain growth. Hot working and Cold working – Strain hardening and Annealing. Bulk forming processes: Forging – Types of Forging, forging defects and remedies; Rolling – fundamentals, types of rolling mills and products, Forces in rolling and power requirements. Extrusion and its characteristics. Types of extrusion, Impact extrusion, Hydrostatic extrusion; Wire drawing and Tube drawing.

UNIT – IV

Sheet Metal Forming: Blanking and piercing, Forces and power requirement in these operations, Deep drawing, stretch forming, Bending, Spring back and its remedies, Coining, Spinning, Types of presses and press tools.

High energy rate forming processes: Principles of explosive forming, electromagnetic forming, Electro hydraulic forming, rubber pad forming, advantages and limitations.

UNIT – V

Additive Manufacturing: Steps in Additive Manufacturing (AM), Classification of AM processes, Advantages of AM, and types of materials for AM, VAT photopolymerization AM Processes – Stereolithography Apparatus (SLA) Process, Extrusion based AM Processes – Fused Deposition Modeling (FDM) Process, Powder Bed Fusion AM Processes – Selective Laser Sintering (SLS) Process, Direct Energy Deposition AM Processes, Post Processing of AM Parts, Applications

Textbooks:
1. Manufacturing Processes for Engineering Materials – Kalpak Jain S and Steven R SchmidPearson Publications, 5thEdn.
2. Manufacturing Technology – Vol I – P.N. Rao – TMH Publishers.

Reference Books:
1. Manufacturing Science – A. Ghosh & A.K. Malik – East West Press Pvt. Ltd.
2. Process and materials of manufacture – Lindberg – PHI publishers
3. Production Technology – R.K. Jain – Khanna Publishers.
4. Production Technology – P C Sharma – S. Chand Publications.
5. Manufacturing Processes – H.S. Shaun – Pearson Publishers.
6. Manufacturing Processes – J.P. Kaushish – PHI Publishers.
7. Workshop Technology – WAJ Chapman / CBS Publishers & Distributors Pvt. Ltd.
8. Production Technology – HMT – Tata McGraw Hill Publishers
9. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing", 2nd Edition, Springer, 2015

Online Learning Resources:
1. https://www.edx.org/learn/manufacturing/massachusetts-institute-of-technology-fundamentals-of-manufacturing-processes
2. https://onlinecourses.nptel.ac.in/noc21_me81/preview
3. www.coursera.org/learn/introduction-to-additive-manufacturing-processessera
4. https://archive.nptel.ac.in/courses/112/103/112103263/
5.https://elearn.nptel.ac.in/shop/nptel/principles-of-metal-forming-technology/?v=c86ee0d9d7ed

PRAGATI ENGINEERING COLLEGE: SURAMPALEM

(Autonomous)

Department of Mechanical Engineering

R23

II YEAR II SEMESTER

FLUID MECHANICS & HYDRAULIC MACHINES

(ME)

Course Category	Professional Core	**Course Code**	23ME403T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Engineering Mechanics	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To study different fluid properties and Manometers.
2	Understand the kinematic and dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations, energy and momentum equations.
3	To study the concept of boundary layer theory.
4	To study different types of hydraulic turbines, draft tube theory, efficiency, and performance characteristics.
5	To study types of Pumps, work done, efficiency, performance of pumps & characteristic curves.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand the basic concepts of fluid properties and the concepts of Buoyancy	K2
CO2	Estimate the mechanics of fluids in static and dynamic conditions	K5
CO3	Apply the Boundary layer theory, flow separation and dimensional analysis.	K4
CO4	Estimate the hydrodynamic forces of jet on vanes in different positions.	K5
CO5	Understand the working Principles and performance evaluation of hydraulic pump and turbines.	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT – I

Fluid statics: Dimensions and units: physical properties of fluids – specific gravity, viscosity and its significance, surface tension, capillarity, vapor pressure. Atmospheric, gauge and vacuum pressure, Measurement of pressure – Manometers – Piezometer, U-tube, inverted and differential manometers. Pascal's & hydrostatic laws.

Buoyancy and floatation: Meta center, stability of floating body. Submerged bodies. Calculation of metacenter height. Stability analysis and applications.

UNIT – II

Fluid kinematics: Introduction, flow types. Equation of continuity for one dimensional flow, circulation and vorticity, Stream line, path line and streak lines and stream tube. Stream function and velocity potential function, differences and relation between them. Condition for irrotational flow, flow net, source and sink, doublet and vortex flow.

Fluid dynamics: Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.

Closed conduit flow: Reynold's experiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line – hydraulic gradient line.

UNIT – III

Boundary Layer Theory: Introduction, momentum integral equation, displacement, momentum and energy thickness, separation of boundary layer, control of flow separation, Stream lined body, Bluff body and its applications, basic concepts of velocity profiles.

Dimensional Analysis: Dimensions and Units, Dimensional Homogeneity, Non-dimensionalization of equations, Method of repeating variables and Buckingham Pi Theorem.

UNIT – IV

Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: Classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine – working proportions, work done, efficiencies, hydraulic design – draft tube – theory – functions and efficiency.

UNIT – V

Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer. Hydraulic systems – hydraulic ram, hydraulic lift, hydraulic coupling. Fluidics – amplifiers, sensors and oscillators. Advantages, limitations and applications.

Centrifugal pumps: Classification, working, work done – manometric head – losses and efficiencies specific speed – pumps in series and parallel – performance characteristic curves, cavitation & NPSH.

Reciprocating pumps: Working, Discharge, slip, indicator diagrams

Textbooks:

1. Fluid Mechanics – Fundamentals and Applications, Y.A.Cengel & J.M.Cimbala, Tata McGraw hill, 2008.
2. Fluid Mechanics – Dixon, 7th Edn, Elsevier Publishers.

Reference Books:

1. Hydraulics, fluid mechanics and Hydraulic machinery – Modi and Seth
2. Fluid Mechanics and Hydraulic Machines – RK Bansal – Laxmi Publications (P)Ltd.
3. Fluid Mechanics and Hydraulic Machines – Rajput
4. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S K Kataria & Sons.
5. Fluid Mechanics and Machinery – D. Rama Durgaiah, New Age International.

Online Learning Resources:

1. https://archive.nptel.ac.in/courses/112/105/112105206/
2. https://archive.nptel.ac.in/courses/112/104/112104118/
3. https://www.edx.org/learn/fluid-mechanics
4. https://onlinecourses.nptel.ac.in/noc20_ce30/previewnptel.ac.in
5. www.coursera.org/learn/fluid-powerera

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
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Department of Mechanical Engineering

R23

II YEAR II SEMESTER
THEORY OF MACHINES
(ME)

Course Category	Professional Core	**Course Code**	23ME404T
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	Introduce various basic mechanisms and their applications.
2	Explain importance of degree of freedom.
3	Familiarize velocity and acceleration in mechanisms.
4	Describe the cams and follower motions.
5	Explain the importance of gyroscopic couples.
6	Introduce the equation of motion for single degree of freedom system.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand different mechanisms and their inversions.	K2
CO2	Calculate velocity and acceleration of different links in a mechanism.	K3
CO3	Apply the effects of gyroscopic couple in ships, aero planes and road vehicles.	K3
CO4	Evaluate unbalance mass in rotating machines.	K4
CO5	Analyze free and forced vibrations of single degree freedom systems.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT – I

Simple Mechanisms: Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, mobility – Grashof's law, kinematic inversions of four bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission angle – Description of some common mechanisms – Quick return mechanism, straight line mechanisms – Universal Joint – Rocker mechanisms.

UNIT – II

Plane and motion analysis: Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations – kinematic analysis of simple mechanisms – slider crank mechanism dynamics – Coincident points – Coriolis component of acceleration.

UNIT – III

Gyroscope: Principle of gyroscope, gyroscopic effect in an aeroplane, ship, car and two-wheeler, simple problems

Gear Profile: Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting – helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics.

UNIT – IV

Balancing of Rotating masses: Need for balancing, balancing of single mass and several masses in different planes, using analytical and graphical methods.

Cams: Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic and cycloidal motions – derivatives of follower motions – specified contour cams – circular and tangent cams – pressure angle and undercutting.

UNIT – V

Vibrations: Introduction, degree of freedom, types of vibrations, free natural vibrations, Newton method and energy method for single degree of freedom. Damped vibrations – under damped, critically damped; and over damped systems, forced vibrations with and without damping in single degree of freedom; Vibration isolation and transmissibility.

Turning Moment Diagrams and Flywheels: Turning moment diagrams for steam engine, I.C engine and Multi Cylinder Engine. Crank effort – coefficient of fluctuation of energy, coefficient of fluctuation of speed – Fly Wheel and their design, fly wheels for punching press.

Text Books:

1. S.S. Rattan, Theory of Machines, 4/e, Tata Mc-Graw Hill, 2014.
2. P.L. Ballaney, Theory of Machines & Mechanisms, 25/e, Khanna Publishers, Delhi, 2003.

Reference Books:

1. F. Haidery, Dynamics of Machines, 5/e, Nirali Prakashan, Pune, 2003.
2. J.E. Shigley, Theory of Machines and Mechanisms, 4/e, Oxford, 2014.
3. G.K. Groover, Mechanical Vibrations, 8/e, Nemchand Bros, 2009.
4. Norton, R.L., Design of Machinery – An Introduction to Synthesis and Analysis of Mechanisms and Machines, 2/e, McGraw Hill, New York, 2000.
5. William T. Thomson, Theory of vibration with applications, 4/e, Englewood Cliffs, N.J.: Prentice Hall, 1993.

Online Learning Resources

1. www.mekanizmalar.com
2. https://nptel.ac.in/courses/112105236/21
3. https://nptel.ac.in/courses/112105236/34
4. https://nptel.ac.in/courses/112104121/
5. https://nptel.ac.in/courses/112106137/pdf/2_1.pdf.

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
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Department of Mechanical Engineering

R23

II YEAR II SEMESTER
FLUID MECHANICS & HYDRAULIC MACHINERY LABORATORY
(ME)

Course Category	Professional Core	**Course Code**	23ME403P
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES
To impart practical exposure on the performance evaluation methods of various flow measuring equipment, hydraulic turbines and pumps.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Apply the fundamental principles of fluid mechanics, calculations involving basic flow measuring devices like venture meter, Orifice meter and major and minor losses of fluid flow through the pipes.	K3
CO2	Estimate the optimum efficiency of a given turbine under different load and (or) speed conditions and to analyze the trends depicted by characteristic curves obtained from the experiments.	K4
CO3	Estimate the optimum efficiency of a given pump under different load and (or) speed conditions and to analyze the trends depicted by characteristic curves obtained from the experiments.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

LIST OF EXPERIMENTS

1. Impact of Jets on Vanes.
2. Performance test on Pelton wheel
3. Performance test on Francis turbine
4. Performance test on Kaplan turbine
5. Performance test on Single stage centrifugal pump
6. Performance test on Multi stage centrifugal pump
7. Performance test on Reciprocating pump
8. Calibration of Venturimeter
9. Calibration of Orifice meter
10. Determination of Friction factor for a given pipe line.
11. Determination of loss of head due to sudden contraction in a pipeline
12. Turbine flowmeter

NOTE: Any 10 experiments can be conducted from the above

Virtual Lab:

1. To study different patterns of a flow through a pipe and correlate them with the Reynolds number of the flow.
(https://me.iitp.ac.in/Virtual-Fluid-Laboratory/reynolds/introduction.html)

2. To calculate Total Energy at different points of venture meter.
(https://me.iitp.ac.in/Virtual-Fluid-Laboratory/bernoulli/introduction.html)

3. To calculate the flow (or point) velocity at center of the given tube using different flow rates.
(https://me.iitp.ac.in/Virtual-Fluid-Laboratory/pitot/introduction.html)

4. To determine the hydrostatic force on a plane surface under partial submerge and full submerge condition.
(https://me.iitp.ac.in/Virtual-Fluid-Laboratory/cop/introduction.html)

5. To determine the discharge coefficient of a triangular notch.
(https://me.iitp.ac.in/Virtual-Fluid-Laboratory/notch/introduction.html)

6. To determine the coefficient of impact of jet on vanes.
(https://fm-nitk.vlabs.ac.in/exp/impact-of-jet)

7. To determine friction in pipes.
(https://fm-nitk.vlabs.ac.in/exp/friction-in-pipes/index.html)

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R23

II YEAR II SEMESTER
MANUFACTURING PROCESSES LABORATORY

(ME)

Course Category	Professional Core	**Course Code**	23ME402P
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES
To impart hands-on practical exposure on manufacturing processes and equipment.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Prepare the pattern, mould and casting.	K3
CO2	Perform different welding operations and plastic parts processing operations	K3
CO3	Perform sheet metal operations and bending operations and make simple 3D printing parts	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

List of Experiments

1. Design and making of pattern
   i. Single piece pattern
   ii. Split pattern
2. Sand properties testing
   i. Sieve analysis (dry sand)
   ii. Clay content test
   iii. Moisture content test
   iv. Strength test (Compression test & Shear test)
   v. Permeability test
3. Mould preparation
   i. Straight pipe
   ii. Bent pipe
   iii. Dumble
   iv. Gear blank
4. Gas cutting and welding
5. Manual metal arc welding
   i. Lap joint
   ii. Butt joint
6. Injection Molding
7. Blow Molding
8. Simple models using sheet metal operations
9. Blanking & Piercing Operations
10. Study of deep drawing and extrusion operations
11. To make weldments using TIG/MIG welding
12. To weld using Spot welding machine
13. Bending and other operations
14. To join using Brazing and Soldering
15. To make simple parts on a 3D printing machine
16. Demonstration of metal casting.
17. Study of simple, compound and progressive dies

NOTE: Any 10 experiments can be conducted from the above

Virtual Lab:

1. To study and observe various stages of casting through demonstration of casting process. (https://virtual-labs.github.io/exp-sand-casting-process-dei/theory.html)
2. To weld and cut metals using an oxyacetylene welding setup. (https://virtuallabs.github.io/exp-gas-cutting-processes-iitkgp/index.html)
3. To simulate Fused deposition modelling process (FDM) (https://3dpdei.vlabs.ac.in/exp/simulation-modelling-process)
4. https://altair.com/inspire-mold/
5. https://virtual-labs.github.io/exp-simulation-cartesian-system-dei/theory.html

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
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Department of Mechanical Engineering

R23

II YEAR II SEMESTER
SOFT SKILLS

Course Category	Humanities	**Course Code**	20BE401S
Course Type	Laboratory	**L-T-P-C**	0-1-2-2
Prerequisites	LSRW Skills	**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To prepare to face global competition for employment and excellence in the profession.
2	To help the students understand and build intrapersonal and interpersonal skills that will enable them to lead meaningful professional lives.

S.NO	**COURSE OUTCOME**		**Cognitive Level**
1	CO1	Assimilate and understood the meaning and importance of soft kills and learn how to develop them.	K1
2	CO2	Understand the significance of skills in the working environment for Professional excellence.	K2
3	CO3	Prepare to undergo the placement process with confidence and clarity.	K3
4	CO4	Ready to face any situation in life and equip themselves to handle them effectively.	K6
5	CO5	Understand and learn the importance of etiquette in both professional and personal life.	K2

K1- Remembering, K2- Understanding, K3-Applying, K-4 Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO2	-	-	-	-	-	-	-	-	-	2	-	3	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	3	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	2	-	-	-
CO5	-	-	-	-	-	-	-	-	-	2	-	3	-	-	-

COURSE CONTENT

UNIT I
Introduction:
Introduction: Emergence of life skills, definition, Importance& need, reasons for skill gap, Analysis--Soft Skills vs. hard skills, Linkage between industry and soft skills, Challenges, Personality Developments. Soft Skills, Soft Skills vs English - Improving Techniques.

UNIT II
Intra-Personal:
Definition-Meaning–Importance- SWOT analysis, Johari windows- Goal Setting – quotient skills - Emotional Intelligence- Attitudinal skills - Right thinking- Problem Solving-Time management, stress management.

UNIT III
Inter-Personal:
Definition–Meaning–Importance-Communications skills-Teamwork, managerial skills
-Negotiation skills -Leadership skills, corporate etiquettes**.**

UNIT IV
Verbal Skills:
Definition and Meaning-Listening skills, need- types, advantages, Importance-Improving Tips for Listening, Speaking, need- types, benefits, Importance- Improving Tips, Reading- Writing Skills, Report, Resume, statement of purpose, need- types, advantages, Importance-Improving Tips.

UNIT V
Non Verbal Skills & Interview skills

Definition and Meaning – Importance- Facial Expressions- Eye Contact – Proxemics- Haptics -Posture, cross cultural body language, body language in the interview room, appearance and dress code–Kinetics-Para Language-tone, pitch, pause, neutralization of accent, use of appropriate language, Interview skills, interview methods, and questions.

TEXT BOOKS

1. Sherfield, M. Robert at al, Cornerstone Developing SoftSkills,4/e, Pearson Publication, New Delhi, 2014.
2. Alka Wadkar, Life Skills for Success, 1/e, Sage Publications India Private Limited, 2016.

REFERENCE BOOKS

1. Sambaiah .M. Technical English, Wiley Publishers India. New Delhi. 2014.
2. Gangadhar Joshi, From Campus to Corporate, SAGE TEXT.
3. Alex. K, Soft Skills, 3rd ed. S. Chand Publication, New Delhi, 2014.
4. Meenakshi Raman and Sangita Sharma, Technical Communication: Principles and Practice, Oxford University Press, 2009.
5. Shalini Varma, Body Language for Your Success Mantra, 4/e, S. Chand Publication, New Delhi, 2014.
6. Stephen Covey, Seven Habits of Highly Effective People, JMDBook, 2013.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc20_hs60/preview
2. http://www.youtube.com/@softskillsdevelopment6210
3. https://youtube.com/playlist?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q&si=Fs05Xh8ZrOPsR8F4
4. https://www.coursera.org/learn/people-soft-skills-assessment?language=English
5. https://www.edx.org/learn/soft-skills

PRAGATI ENGINEERING COLLEGE: SURAMPALEM
(Autonomous)
Department of Mechanical Engineering

R23

II YEAR II SEMESTER
DESIGN THINKING & INNOVATION
(Common to CE, EEE, ME, ECE, CSE, IT, CSE(AI&ML), CSE(AI), CSE(DS) and CSE(CYBER SECURITY)

Course Category	BS&H	**Course Code**	23HM401P
Course Type	Theory	**L-T-P-C**	1 -0 -2-2
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

Course Outcomes **Upon successful completion of the course, the student will be able to**		**Blooms Taxonomy Level**
CO 1	Define the concepts related to design thinking.	K1
CO 2	Explain the fundamentals of Design Thinking and innovation.	K2
CO 3	Apply the design thinking techniques for solving problems in various sectors.	K3
CO 4	Analyze to work in a multidisciplinary environment.	K4
CO 5	Evaluate the value of creativity.	K5

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT – I Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.

UNIT – V Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

Web Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

R23

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester

MACHINE TOOLS AND METROLOGY

(ME)

Course Category	Professional Core	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Manufacturing Processes	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn the fundamental knowledge and principles of material removal processes.
2	To understand the basic principles of lathe, shaping, slotting and planning machines
3	To demonstrate the fundamentals of drilling, milling and boring processes.
4	To discuss the concepts of super finishing processes and limits and fits.
5	To understand the concepts of surface roughness and optical measuring instruments

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the fundamental principles and mechanics of material removal processes in machining.	K2
CO2	Demonstrate the operations of conventional, automatic, Capstan, and Turret lathes with appropriate tools and attachments.	K2
CO3	Analyze the working principles and applications of shaping, slotting, planning, drilling, and boring machines.	K4
CO4	Perform gear cutting and keyway machining on milling machines and apply various indexing mechanisms.	K4
CO5	Evaluate surface roughness parameters and operate optical measuring instruments for precision measurements.	K5

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT –I

FUNDAMENTALS OF MACHINING: - Elementary treatment of metal cutting theory – element of cutting process – Single point cutting tools, nomenclature, tool signature, mechanism of metal cutting, types of chips, mechanics of orthogonal and oblique cutting –Merchant's force diagram, cutting forces, Taylor's tool life equation, simple problems - Tool wear, tool wear mechanisms, machinability, economics of machining, coolants, tool materials and properties.

UNIT –II

LATHE MACHINES: - Introduction- types of lathe - Engine lathe – principle of working - construction - specification of lathe - accessories and attachments – lathe operations – taper turning methods and thread cutting – drilling on lathes.

SHAPING, SLOTTING AND PLANNING MACHINES: Introduction - principle of working – principle parts – specifications - operations performed - slider crank mechanism - machining time calculations.

UNIT –III

DRILLING & BORING MACHINES: Introduction – construction of drilling machines – types of drilling machines - principles of working – specifications- types of drills - operations performed – machining time calculations - Boring Machines – types.

MILLING MACHINES: Introduction - principle of working – specifications – milling methods - classification of Milling Machines –types of cutters - methods of indexing- machining time calculations

UNIT – IV

FINISHING PROCESSES: Classification of grinding machines- types of abrasives- bonds, specification and selection of a grinding wheel- Lapping, Honing & Broaching operations- comparison to grinding.

SYSTEMS OF LIMITS AND FITS: Types of fits -Unilateral and bilateral tolerance system, hole and shaft basis systems- interchangeability & selective assembly- International standard system of tolerances, simple problems related to limits and fits, Taylor's principle – design of go and no go gauges; plug, ring, snap, gap, taper, profile and position gauges.

LINEAR MEASUREMENT: Length standards, end standards, slip gauges- calibration of the slip Gauges, dial indicators, micrometers.

UNIT – V

ANGULAR MEASUREMENT: Bevel protractor, angle slip gauges- angle dekkor- spirit levels- sine bar- sine table.

SURFACE ROUGHNESS MEASUREMENT: Differences between surface roughness and surface waviness – Numerical assessment of surface finish, Profilograph, Talysurf, ISI symbols.

OPTICAL MEASURING INSTRUMENTS: Tools maker's microscope, Autocollimators, Optical projector, Optical flats-working principle, construction, merits, demerits and their uses. optical comparators

TEXT BOOKS:

1.Manufacturing Processes / JP Kaushish/ PHI Publishers-2nd Edition
2.Manufacturing Technology Vol-II/P.N Rao/Tata McGraw Hill
3. Engineering Metrology – R.K. Jain/Khanna Publishers

REFERENCES BOOKS:

1.Metal cutting and machine tools /Geoffrey Boothroyd, Winston A.Knight/ Taylor & Francis
2.Production Technology / H.M.T. Hand Book (Hindustan Machine Tools).
3.Production Engineering/K.C Jain & A.K Chitaley/PHI Publishers
4.Technology of machine tools/S.F.Krar, A.R. Gill, Peter SMID/ TMH
5.Manufacturing Processes for Engineering Materials-Kalpak Jian S & Steven R Schmid/Pearson Publications 5th Edition

Web References:

1.https://nptel.ac.in/courses/112105233
2.https://nptel.ac.in/courses/112107242

R23

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester
THERMAL ENGINEERING
(ME)

Course Category	Professional Core	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Thermodynamics	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To give insight to basic principles of air standard cycles.
2	To impart knowledge about IC engines and Boilers.
3	To make the students learn the working principles of steam nozzles, turbines, and compressor.
4	To impart the knowledge about the various types of compressors and gas turbines.
5	To make the students gain insights about, rockets and jet propulsion and solar engineering.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the basic principles, thermodynamic relations, and performance parameters of air standard and actual cycles.	K2
CO2	Describe the construction, working, and performance evaluation of internal combustion engines and boilers.	K2
CO3	Analyze the operation, efficiency, and performance characteristics of steam nozzles, steam turbines, and condensers.	K4
CO4	Evaluate the working principles, classifications, and performance of compressors and gas turbines.	K5
CO5	Discuss the principles, classifications, and applications of jet propulsion systems, rockets, and solar energy technologies.	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT –I

Air standard Cycles: Otto, diesel and dual cycles, its comparison, Basic introduction to Power cycles, P-v and T-s Diagrams - Brayton cycle, Sterling Cycle, Atkinson Cycle, Ericcson Cycle, Lenoir Cycle, Rankine Cycle

Actual Cycles and their Analysis: Introduction, Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down-Loss due to Gas exchange process, Volumetric Efficiency. Loss due to Rubbing Friction, Actual and Fuel-Air Cycles of CI Engines.

UNIT –II

I.C Engines: Classification - Working principles of SI and CI engines, Valve and Port Timing Diagrams, -Engine systems – Fuel, Carburetor, Fuel Injection System, Ignition, Cooling and Lubrication, principles of supercharging and turbo charging, Measurement, Testing and Performance.

Boilers: Principles of L.P & H.P boilers, mountings and accessories, Draught- induced and forced.

UNIT –III

Steam nozzles: Functions, applications, types, flow through nozzles, condition for maximum discharge, critical pressure ratio, criteria to decide nozzle shape, Wilson line.

Steam turbines: Classification – impulse turbine; velocity diagram, effect of friction, diagram efficiency, De Laval turbine - methods to reduce rotor speed, combined velocity diagram.

Reaction turbine: Principle of operation, velocity diagram, Parson's reaction turbine – condition for maximum efficiency.

Steam condensers: Classification, working principles of different types – vacuum efficiency and condenser efficiency.

UNIT – IV

Compressors: Classification, Reciprocating type - Principle, multi-stage compression, Rotary type – Lysholm compressor –principle and efficiency considerations.

Centrifugal Compressors: Principle, velocity and pressure variation, velocity diagrams.

Axial flow Compressors: Principle, Pressure rise and efficiency calculations.

Gas Turbines: Simple gas turbine plant – ideal cycle, components –regeneration, inter cooling and reheating.

UNIT – V

Jet Propulsion: Principle, classification, T-s diagram - turbo jet engines –thermodynamic cycle, performance evaluation.

Rockets: Principle, solid and liquid propellant rocket engines.

Solar Engineering: Solar radiation, Solar collectors, PV cells, storage methods and applications

Textbooks:

1. I.C. Engines - V. Ganesan- Tata McGraw Hill Publishers
2. Thermal Engineering - Mahesh Rathore- McGraw Hill publishers.
3. Heat Engineering / V.P Vasandani and D.S Kumar/Metropolitan Book Company, New Delhi
4. Thermal Engineering / RK Rajput/ Lakshmi Publications

Reference Books:

1. Thermal Engineering- M.L. Mathur& Mehta/Jain bros. Publishers
2. Thermal Engineering- P.L. Ballaney / Khanna publishers.
3. Thermal Engineering- R.S Khurmi, &J S Gupta/S. Chand

Web References:

1. https://nptel.ac.in/courses/112104033/
2. https://nptel.ac.in/courses/112103277/
3. https://nptel.ac.in/courses/112107216/

R23

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester

DESIGN OF MACHINE ELEMENTS

(ME)

Course Category	Professional Core	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Engineering Mechanics, Mechanics of Solids	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Familiarize with fundamental approaches to failure prevention for static and dynamic loading.
2	Introduce design of bolted and welded joints.
3	Explain design procedures for shafts and couplings.
4	Discuss the principles of design for clutches and brakes and springs.
5	Explain design procedures for bearings and gears.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Apply the principles of mechanical engineering design to machine members subjected to static and dynamic loads.	K3
CO2	Design bolted and welded joints for various loading conditions, ensuring strength, reliability, and safety.	K4
CO3	Develop design solutions for shafts and couplings used in power transmission under different load conditions.	K4
CO4	Design and evaluate clutches, brakes, and springs for efficient torque transmission, braking, and energy storage.	K4
CO5	Analyze and design bearings and gears for optimum performance, durability, and load-carrying capacity.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT-I: Introduction, Design for Static and Dynamic loads

Mechanical Engineering Design: Design process, design considerations, codes and standards of designation of materials, selection of materials.

Design for Static Loads: Modes of failure, design of components subjected to axial, bending, torsional and impact loads. Theories of failure for static loads.

Design for Dynamic Loads: Endurance limit, fatigue strength under axial, bending and torsion, stress concentration, notch sensitivity. Types of fluctuating loads, fatigue design for infinite life. Soderberg, Goodman and modified Goodman criterion for fatigue failure. Fatigue design under combined stresses.

UNIT-II: Design of Bolted and Welded Joints

Design of Bolted Joints: Threaded fasteners, preload of bolts, various stresses induced in the bolts. Torque requirement for bolt tightening, gasketed joints.

Welded Joints: Strength of lap and butt welds, Joints subjected to bending and torsion.

UNIT-III: Power transmission ofshafts and Couplings

Power Transmission Shafts: Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors.

Couplings: Design of flange and bushed pin couplings, universal coupling.

UNIT-IV: Design of Clutches, Brakes and Springs

Friction Clutches: Torque transmitting capacity of disc and centrifugal clutches. Uniform wear theory and uniform pressure theory.

Brakes: Different types of brakes. Concept of self-energizing and self-locking of brake. Band and block brakes, disc brakes.

Springs: Design of helical compression, tension, torsion and leaf springs.

UNIT-V: Design of Bearings and Gears

Design of Sliding Contact Bearings: Lubrication modes, bearing modulus, McKee's equations, design of journal bearing. Bearing Failures.

Design of Rolling Contact Bearings: Static and dynamic load capacity, Stribeck's Equation, equivalent bearing load, load-life relationships, load factor, selection of bearings from manufacturer's catalogue.

Design of Gears: Spur gears, beam strength, Lewis equation, design for dynamic and wear loads.

Note: *Data book is Allowed*

Textbooks:

1. R.L. Norton, Machine Design an integrated approach, 2/e, Pearson Education, 2004.
2. V.B.Bhandari, Design of Machine Elements, 3/e, Tata McGraw Hill, 2010.
3. Dr. N. C. Pandya &Dr. C. S. Shah, Machine design, 17/e, Charotar Publishing House Pvt. Ltd, 2009.

Reference Books:

1. R.K. Jain, Machine Design, Khanna Publications, 1978.
2. J.E. Shigley, Mechanical Engineering Design, 2/e, Tata McGraw Hill, 1986.
3. M.F.Spotts and T.E.Shoup, Design of Machine Elements, 3/e, Prentice Hall (Pearson Education), 2013.

Web References:

1. https://www.yumpu.com/en/document/view/18818306/lesson-3-course-name-design-ofmachine-elements-1-npte
2. https://www.digimat.in/nptel/courses/video/112105124/L01.html
3. https://dokumen.tips/documents/nptel-design-of-machine-elements-1.html
4. http://www.nitttrc.edu.in/nptel/courses/video/112105124/L25.html

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester
DESIGN FOR MANUFACTURING
(ME)

Course Category	Professional Elective-I	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Manufacturing Processes	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand the basic concepts of design for manual assembly.
2	To interpret basic design procedure of machining processes.
3	To understand design considerations metal casting, extrusion, and sheet metal work.
4	To interpret the design considerations of various metal joining process & forging process.
5	To interpret the basic design concepts involved in the assembly automation.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the principles and methodologies of design for manual assembly and assess their impact on product design efficiency.	K2
CO2	Apply general design rules and guidelines to machined components for improved manufacturability and ease of production.	K3
CO3	Illustrate the design considerations for metal casting, extrusion, and sheet metal processes to enhance product quality and manufacturability.	K3
CO4	Interpret the design principles for metal joining and forging processes to ensure structural integrity and performance.	K5
CO5	Analyze the basic design concepts for assembly automation and additive manufacturing to optimize production systems.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT –I

Introduction to DFM, DFMA: How Does DFMA Work? Reasons for Not Implementing DFMA, What are the Advantages of Applying DFMA During Product Design? Typical DFMA Case Studies, Overall Impact of DFMA on Industry.

Design for Manual Assembly: General Design Guidelines for Manual Assembly, Development of the Systematic DFA Methodology, Assembly Efficiency, Effect of Part Symmetry, Thickness, weight on Handling Time, Effects of Combinations of Factors and application of the DFA Methodology

UNIT –II

Machining processes: Overview of various machining processes-general design rules for machining dimensional tolerance and surface roughness-Design for machining – ease –redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT –III

Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design product design rules for sand casting.

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, and deep drawing-Keeler Goodman forging line diagram – component design for blanking.

UNIT – IV

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints.

Forging: Design factors for forging – closed die forging design – parting lines of dies –drop forging die design – general design recommendations.

UNIT – V

Design for Assembly Automation: Fundamentals of automated assembly systems, System configurations, parts delivery system at workstations, various escapement and placement devices used in automated assembly systems, Quantitative analysis of Assembly systems, Multi station assembly systems, and single station assembly lines.

Design for Additive Manufacturing:

Introduction to AM, DFMA concepts and objectives, AM unique capabilities, exploring design freedoms, Design tools for AM, Part Orientation, Removal of Supports, Hollowing out parts, Inclusion of Undercuts and Other Manufacturing Constraining Features, Interlocking Features, Reduction of Part Count in an Assembly, Identification of markings/ numbers.

Textbooks:

1. Design for manufacture, John Cobert, Adisson Wesley. 1995
2. Design for Manufacture by Boothroyd,
3. Design for manufacture, James Bralla

Reference Books:

1. Molloy, E.A. Warman, S. Tilley, Design for Manufacturing and Assembly: Concepts, Architectures and Implementation, Springer, 1998
2. ASM Hand book Vol.20

Web References:

1. https://www.scribd.com/document/436469027/Design-For-Manufacturing-CASTING
2. https://testbook.com/mechanical-engineering/casting-process-definition-and-types
3. https://blog.hirebotics.com/types-of-welding-processes

R23

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester

CONVENTIONAL AND FUTURISTIC VEHICLE TECHNOLOGY

(ME)

Course Category	Professional Elective-I	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Thermal Engineering	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To study the advanced engine technologies.
2	To learn various advanced combustion technologies and its benefits.
3	To learn the methods of using low carbon fuels and its significance.
4	To learn and understand the hybrid and electric vehicle technologies.
5	To study the application of fuel cell technology in automotive.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the concepts and applications of advanced engine technologies and after-treatment systems to enhance performance and reduce emissions.	K2
CO2	Analyze various advanced combustion technologies to improve efficiency and meet emission norms.	K4
CO3	Describe the properties, technologies, and challenges of low-carbon fuels including alcohols, ammonia, methane, DME, and hydrogen for sustainable mobility.	K2
CO4	Illustrate the design and operation of hybrid and electric vehicle technologies, addressing their configurations, challenges, and future prospects.	K3
CO5	Evaluate the principles, components, and advancements in fuel cell technology for automotive applications, including hydrogen storage and control systems.	K5

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT –I
ADVANCED ENGINE TECHNOLOGY
Gasoline Direct Injection, Common Rail Direct Injection, Variable Compression Ratio Turbocharged Engines, Electric Turbochargers, VVT, Intelligent Cylinder De-activation, After Treatment Technologies, Electric EGR, Current EMS architecture.

UNIT –II
COMBUSTION TECHNOLOGY
Spark Ignition combustion, Compression Ignition Combustion, Conventional Dual Fuel Combustion, Low Temperature Combustion Concepts– Controlled Auto Ignition, Homogeneous Charge Compression Ignition, Premixed Charge Compression Ignition, Partially Premixed Compression Ignition, Reactivity Controlled Compression Ignition, Gasoline Direct Injection Compression Ignition.

UNIT –III
LOW CARBON FUEL TECHNOLOGY
Alcohol Fuels, Ammonia Fuel and Combustion, Methane Technology, Dimethyl Ether, Hydrogen Fuel Technology, Challenges, and way forward.

UNIT – IV
HYBRID AND ELECTRIC VEHICLE (BATTERY POWERED)
Conventional Hybrids (Conventional ICE + Battery), Modern Hybrids (RCCI/GDCI Engine + Battery), Pure Electric Vehicle Technology – Challenges and Way forward

UNIT – V
FUEL CELL TECHNOLOGY
Fuel cells for automotive applications - Technology advances in fuel cell vehicle systems - Onboard hydrogen storage - Liquid hydrogen and compressed hydrogen - Metal hydrides, Fuel cell control system - Alkaline fuel cell - Road map to market.

Textbooks:

4. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
5. Rakesh Kumar Maurya, Characteristics and Control of Low Temperature Combustion Engines. ISBN 978-3-319-68507-6 , SPRINGER

Reference Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003
3. Rand D.A.J, Woods, R & Dell RM Batteries for Electric vehicles, John Wiley & Sons, 1998

Web References:

1. https://www.energy.gov/sites/default/files/2022-10/VTO_2021_APR_ADV_FUEL_REPORT_FINAL_compliant.pdf
2. https://www.energy.gov/sites/prod/files/2014/03/f8/2011_adv_combustion_engine.pdf
3. https://archive.nptel.ac.in/courses/108/103/108103009/
4. https://www.ijmerr.com/v3n1/ijmerr_v3n1_24.pdf

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester

RENEWABLE ENERGY TECHNOLOGIES

(ME)

Course Category	Professional Elective-I	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Physics, Thermodynamics	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To demonstrate the importance the impact of solar radiation, solar PV modules
2	To understand the principles of storage in PV systems
3	To discuss solar energy storage systems and their applications
4	To get knowledge in wind energy and bio-mass
5	To gain insights in geothermal energy, ocean energy and fuel cells.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Illustrate solar radiation principles and PV module/system design.	K3
CO2	Discuss battery technologies and storage methods in PV systems.	K2
CO3	Explain solar energy collection, storage, and applications.	K2
CO4	Analyze wind and bio-mass energy systems.	K4
CO5	Describe geothermal, ocean, and fuel cell technologies.	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

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Department of Mechanical Engineering

COURSE CONTENT

UNIT – I

SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems.

SOLAR PV MODULES AND PV SYSTEMS:

PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems-Design of Off Grid Solar Power Plant. Installation and Maintenance.

UNIT – II

STORAGE IN PV SYSTEMS:

Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System, Battery Maintenance and Measurements, Battery Installation for PV System.

UNIT – III

SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

UNIT – IV

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

UNIT – V

GEOTHERMAL ENERGY: Origin, Applications, Types of Geothermal Resources, Relative Merits

OCEAN ENERGY: Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges

FUEL CELLS: Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.

Textbooks:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH
2. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006
3. Green Manufacturing Processes and Systems - J. Paulo Davim/Springer 2013

Reference Books:

1. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd
2. Renewable Energy Technologies -Ramesh & Kumar /Narosa
3. Non-conventional Energy Source- G.D Roy/Standard Publishers
4. Principles of Solar Engineering - D.Yogi Goswami, Frank Krieth& John F Kreider / Taylor &Francis

Web References:

1. https://www.thermopedia.com/content/839/
2. https://encr.pw/pjUsA
3. https://l1nq.com/GNCHS

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester
NON- DESTRUCTIVE EVALUATION
(ME)

Course Category	Professional Elective-I	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Engineering Physics, Material Science and Metallurgy	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn basic concepts of non-destructive testing and industrial applications
2	To understand the elements of ultrasonic test and limitations of ultrasonic test
3	To learn the concepts involved in the liquid penetrant test and eddy current test
4	To know the basic principles and operating procedures of magnetic particle testing
5	To understand the basic concepts involved in the infrared and thermal testing and industrial applications of NDE

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain various NDE techniques and the principles, requirements, and safety aspects of radiography.	K2
CO2	Interpret the principles, equipment, and procedures of ultrasonic testing.	K3
CO3	Describe the principles, procedures, and applications of liquid penetrant and eddy current testing.	K2
CO4	Illustrate the principles, procedures, and applications of magnetic particle testing.	K3
CO5	Interpret the principles, procedures, and applications of infrared and thermal testing.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

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Department of Mechanical Engineering

COURSE CONTENT

UNIT –I:

Introduction to non-destructive testingand industrial Applications of NDE: Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions, Visual Inspection,Radiographic test**,** Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography, neutron ray radiography

UNIT –II

Ultrasonic test: Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect, Ultrasonic Transducers and their Characteristics,
Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection - Effectiveness and Limitations of Ultrasonic Testing**.**

UNIT –III

Liquid Penetrant Test: Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness, DPI, FPI, Limitations of Liquid Penetrant Testing**.**
Eddy Current Test: Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current Testing Effectiveness of Eddy Current Testing

UNIT – IV

Magnetic Particle Test: Magnetic Materials, Magnetization of Materials, Demagnetization of Materials, Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test

UNIT – V

Infrared and Thermal Testing: Thermography principles, types, advantages, and limitations. Introduction and fundamentals to infrared and thermal testing–Heat transfer –Active and passive techniques –Lock in and pulse thermography, tomography-Contact and non-contact thermal inspection methods–Heat sensitive paints – Heat sensitive papers –-thermally quenched phosphors liquid crystals –techniques for applying liquid crystals – other temperature sensitive coatings –Inspection methods –Infrared radiation and infrared detectors–thermo-mechanical behaviour of materials–IR imaging in aerospace applications, electronic components, Honey comb and sandwich structures–Case studies.

Text books:

1. Non-destructive test and evaluation of Materials/J Prasad, GCK Nair/TMH Publishers
2. Ultrasonic testing of materials/ H KrautKramer/Springer
3. Nondestructive testing/Warren, J Mc Gonnagle / Godan and Breach Science publishers.
4. Nondestructive evaluation of materials by infrared thermography / X. P. V. Maldague, Springer-Verlag, 1st edition, (1993)

Reference Books:

1. Ultrasonic inspection training for NDT/E.A. Gingel /Prometheus Press,
2. ASTM Standards, Vol3.01, Metals and alloys
3. Non-destructive Evaluation, Hand Book – R. Ham Chand

Web References:

1. https://link.springer.com/journal/10921
2. https://www.tandfonline.com/journals/gnte20
3. https://archive.nptel.ac.in/courses/113/106/113106070/

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year– I Semester

CONSTRUCTION PROJECT MANAGEMENT

Course Category	**Open Elective**	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	**Building materials** **Project management basics**	**Continuous Internal assessment** **Semester End Examination** **Total Marks**	30 70 100

Course Objectives:	
1.	To introduce to the student, the concept of project management including network drawing and monitoring
2.	To introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery
3.	To introduce the importance of safety in construction projects

Course Outcomes:

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	**Explain** the principles of construction project management, including planning, scheduling, monitoring, and coordination using CPM and PERT techniques.	**K2**
CO2	**Apply** project evaluation methods, cost analysis, and resource optimization techniques using construction management software like Primavera.	**K3**
CO3	**Analyze** the selection, capacity, and productivity of various construction equipment for earthwork, compaction, hoisting, and concreting operations.	**K4**
CO4	**Demonstrate** the operation and application of concreting equipment, including batching plants, mixers, and finishing tools for quality construction.	**K3**
CO5	**Evaluate** construction methods, formwork practices, and safety measures, incorporating BIM concepts for effective civil engineering project execution	**K5**

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes :
(1 – Low, 2 - Medium, 3 – High)

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	2	1	-	1	2	2	1	3	2	1
CO2	3	3	2	2	3	1	-	1	2	3	1	3	2	1
CO3	3	3	2	2	2	2	-	1	2	2	1	3	3	1
CO4	3	2	3	2	2	2	-	2	2	2	1	3	3	1
CO5	3	3	3	3	3	3	2	2	3	3	2	3	3	2

PRAGATI ENGINEERING COLLEGE

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Department of Mechanical Engineering

COURSE CONTENT

UNIT–I

Construction project management and its relevance – qualities of project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

UNIT-II

Project evaluation and review technique– cost analysis updating crashing for optimum cost–crashing for optimum resources–allocation of resources introduction to software's for construction management, project management using PRIMAVERA (or) equivalent

UNIT-III

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers

Hoisting and earthwork equipment–hoists–cranes–tractors-bulldozers–graders–scrapers–draglines-clamshellbuckets

UNIT – IV

Concreting equipment— concrete mixers–Batching plants, mobile using plants like"Ajax"etc.mixing and placing of concrete – consolidating and finishing.

UNIT – V

Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection–quality control and safety engineering. BIM for Civil Engineers (Building Information Modeling)

Text Books:

1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder, Shapira, Tata Mc Graw hill.
2. 'Construction Project Management Theory and Practice'by Kumar Neeraj Jha (2011), Pearson.
3. 'ConstructionTechnology'bySubirK.SarkarandSubhajitSarasvati,OxfordUniversity press

References:

1. 'Construction Project Management – An Integrated Approach'by Peter Fewings,Taylor and Francis
2. 'Construction Management Emerging Trends and Technologies' by Trefor Williams , Cengage learning

Web References:

1. NPTEL :: Civil Engineering - NOC:Principles of Construction Management

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester

RENEWABLE ENERGY SOURCES

(Common to CE, ME, ECE, CSE, IT, CSE-CS, CSE-DS, CSE-AI, CSE-AIML)

Course Category	Open Elective Courses	**Course Code**	
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	Basic Electrical Engineering	**Internal Assessment**	**30**
		Semester End Examination	**70**
		Total Marks	**100**

COURSE OBJECTIVES	
1	To study the solar radiation data, equivalent circuit of PV cell and its I-V & P-V characteristics.
2	To understand the concept of Wind Energy Conversion & its applications.
3	To study the principles of biomass, hydel and geothermal energy.
4	To understand the principles of ocean Thermal Energy Conversion, waves and power associated with it.
5	To study the various chemical energy sources such as fuel cell and hydrogen energy along with their operation and equivalent circuit.

COURSE OUTCOMES		**Cognitive Level**
Upon successful completion of the course, the student will be able to:		
CO1	Analyze solar radiation data, extra-terrestrial radiation, radiation on earth's surface and solar Energy Storage.	K4
CO2	Illustrate the components of wind energy systems.	K3
CO3	Illustrate the working of biomass, hydel plants and Geothermal plants.	K3
CO4	Demonstrate the principle of Energy production from OTEC, Tidal and Waves.	K2
CO5	Evaluate the concept and working of Fuel cells & MHD power generation.	K5

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	1	-	-	-	**1**	-	-	-	-	3	3
CO2	3	2	1	-	-	-	1	-	-	-	-	2	3
CO3	3	1	1	-	-	-	1	-	-	-	-	2	3
CO4	3	1	1	-	-	-	1	-	-	-	-	3	3
CO5	3	1	1	-	-	-	1	-	-	-	-	2	3

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT 1

Solar Energy

Introduction - Renewable Sources - prospects, solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house.

UNIT 2

Wind Energy

Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications.

UNIT 3

Biomass, Hydel and Geothermal Energy

Biomass: Introduction - Biomass conversion technologies- Photosynthesis. Factors affecting Bio digestion.

Hydro plants: Basic working principle – Classification of hydro systems: Large, small, micro hydel plants.

Geothermal Energy: Introduction, Geothermal Sources – Applications - operational and Environmental problems.

UNIT 4

Energy From oceans, Waves & Tides

Oceans: Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India.

Waves: Introduction - Energy and Power from the waves - Wave Energy conversion devices.

Tides: Basic principle of Tide Energy -Components of Tidal Energy.

UNIT 5

Chemical Energy Sources

Fuel Cells: Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications.

Hydrogen Energy: Introduction - Methods of Hydrogen production - Storage and Applications.

Magneto Hydro Dynamic (MHD) Power generation: Principle of Operation - Types.

TEXT BOOKS

1 G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011.

2 John Twidell& Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013.

REFERENCE BOOKS

1 Solar Energy: Principles of Thermal Collection and Storage, S. P. Sukhatme and J. K. Nayak,TMH, New Delhi, 3rd Edition.

2 John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013.

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester

ELECTRONIC DEVICES AND CIRCUITS

Course Category	Open Elective 1	Course Code	
Course Type	Theory	L-T-P-C	3-0-0-3
Prerequisites		Continuous Internal Assessment Semester End Examination Total Marks	30 70 100

COURSEOBJECTIVES	
The student will learn:	
1	To learn and understand the basic concepts of semiconductor physics and study the physical phenomena of PN junction diode
2	Study the physical phenomena such as conduction, transport mechanism and electrical characteristics of different diodes, to learn and understand the application of diodes
3	Acquire knowledge about the principle of working and operation of Bipolar Junction Transistor, to learn and understand the purpose of transistor biasing and its significance
4	understand the small signal low frequency equivalent circuit analysis of BJT transistor amplifiers and compare different configurations
5	understand different types of FETs, their operation, characteristics, and analysis

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Apply the basic concepts of semiconductor physics and understand the formation of p-n junction and how it can be used as a p-n junction as diode in different modes of operation	K2
CO2	Know the construction, working principle of special diodes and applications of diodes	K3
CO3	Understand the construction of BJT, principle of operation of BJT with their V-I characteristics in different configurations. Apply the concepts of transistor biasing, various biasing techniques for BJT	K2
CO4	Perform the analysis of small signal low frequency transistor amplifier circuits using BJT	K3
CO5	Understand the construction of FET, principle of operation of FET with characteristics in different configurations	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	2									2	2
CO2	3	3	2									2	2
CO3	3	3	2									2	2
CO4	3	3	2									2	2
CO5	3	3	2	2								2	2

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT-I:

Review of Semi Conductor Physics: Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors

Junction Diode Characteristics :Energy band diagram of PN junction Diode, Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in PN junction Diode, diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.

UNIT-II:

Special Semiconductor Devices: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Varactor Diode, Photodiode, Tunnel Diode, UJT, PNPN Diode, SCR. Construction, operation and V-I characteristics.

Rectifiers and Filters: Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter(Series inductor), Capacitor filter(Stunt inductor), π-Filter, comparison of various filter circuits in terms of ripple factors.

UNIT- III: Transistor Characteristics:

BJT: Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.

FET: FET types, construction, operation, characteristicsμ, g_m, $r_d$parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

UNIT- IV:

Transistor Biasing and Thermal Stabilization :Need for biasing, operating point, load line analysis, BJT biasing-methods, basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in V_{BE}, Ic, and β, Stability factors, (S,S',S''), Bias compensation, Thermal runaway, Thermal stability.FET Biasing- methods and stabilization.

UNIT- V: Small Signal Low Frequency Transistor Amplifier Models:

BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.

FET: Generalized analysis of small signal model, Analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

Text Books:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, SecondEdition,2007
2. Electronic Devices and Circuits by David A. Bell, Oxford University Press
3. Electronics devices & circuit theory- Robert L.Boylestad and LouiNashelsky, Pearson/Prentice hall, tenth edition,2009

References:

1. Integrated Electronics-J. Millman, C. Halkias,Tata Mc-Graw Hill, Second Edition,2009
2. Electronic Devices and Circuits-K. Lal Kishore, BS Publications, Fourth Edition,2016

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester

INTRODUCTION TO CLOUD COMPUTING

(Common to CE, EEE, ME & ECE)

Course Category	**Open Elective - 1**	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	To explain the evolving utility computing model called cloud computing.
2	To introduce the various levels of services offered by cloud.
3	To discuss the fundamentals of cloud enabling technologies such as distributed computing, service-oriented architecture and virtualization.
4	To emphasize the security and other challenges in cloud computing.
5	To introduce the advanced concepts such as containers, serverless computing and cloud-centric Internet of Things.

COURSE OUTCOMES		
Up on successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Understand cloud computing fundamentals, service models, and deployment types.	K2
CO2	Understand enabling technologies including distributed systems and virtualization techniques.	K2
CO3	Demonstrate virtualization, containers, and orchestration using modern cloud tools.	K4
CO4	Analyze cloud challenges including security, scalability, and interoperability issues.	K4
CO5	Apply advanced cloud concepts like serverless, IoT, and DevOps.	K2

K1-Remembering,K2-Understanding,K3-Applying,K4-Analyzing,K5-Evaluating,K6-Creating

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	2	0	2	0	0	0	0	0	0
CO2	3	2	3	0	2	0	0	0	0	0	0
CO3	3	3	3	0	2	0	0	0	0	0	0
CO4	3	3	3	0	3	0	0	0	0	0	0
CO5	3	2	3	0	3	0	0	0	0	0	0

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT -I: Introduction to Cloud Computing Fundamentals

Cloud computing at a glance, defining a cloud, cloud computing reference model, types of services (IaaS, PaaS, SaaS), cloud deployment models (public, private, hybrid), utility computing, cloud computing characteristics and benefits, cloud service providers (Amazon Web Services, Microsoft Azure, Google AppEngine).

UNIT-II: Cloud Enabling Technologies

Ubiquitous Internet, parallel and distributed computing, elements of parallel computing, hardware architectures for parallel computing (SISD, SIMD, MISD, MIMD), elements of distributed computing, Inter-process communication, technologies for distributed computing, remote procedure calls (RPC), service-oriented architecture (SOA), Web services, virtualization.

UNIT-III: Virtualization and Containers

Characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud Computing, pros and cons of virtualization, technology examples (XEN, VMware), building blocks of containers, container platforms (LXC, Docker), container orchestration, Docker Swarm and Kubernetes, public cloud VM (e.g. Amazon EC2) and container (e.g. Amazon Elastic Container Service) offerings.

UNIT-IV: Cloud computing challenges

Economics of the cloud, cloud interoperability and standards, scalability and fault tolerance, energy efficiency in clouds, federated clouds, cloud computing security, fundamentals of computer security, cloud security architecture, cloud shared responsibility model, security in cloud deployment models.

UNIT -V: Advanced concepts in cloud computing

Serverless computing, Function-as-a-Service, serverless computing architecture, public cloud (e.g. AWS Lambda) and open-source (e.g. OpenFaaS) serverless platforms, Internet of Things (IoT), applications, cloud-centric IoT and layers, edge and fog computing, DevOps, infrastructure-as-code, quantum cloud computing.

Text Books:

1. Mastering Cloud Computing, 2nd edition, RajkumarBuyya, Christian Vecchiola, ThamaraiSelvi, ShivanandaPoojara, Satish N. Srirama, McGraw Hill, 2024.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.

Reference Books:

1. Cloud Computing, Theory and Practice, Dan C Marinescu, 2nd edition, MK Elsevier, 2018.
2. Essentials of cloud Computing, K. Chandrasekhran, CRC press, 2014.
3. Online documentation and tutorials from cloud service providers (e.g., AWS, Azure, GCP)

e-Resources:https://onlinecourses.nptel.ac.in/noc21_cs14/preview

R23

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester

THERMAL ENGINEERING LABORATORY

(ME)

Course Category	Professional Core	**Course Code**	
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Thermal engineering	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To provide practical exposure to internal combustion engine operations, including valve and port timing analysis, performance evaluation, and frictional and heat balance testing.
2	To equip students with skills to assess fuel and lubricant properties—such as viscosity, flash point, and fire point—and to analyze the performance of air compressors under diverse operating conditions using standard laboratory equipment.
3	To introduce students to renewable energy systems and advanced automotive technologies

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Analyze valve and port timing in internal combustion (IC) engines, and perform friction and heat balance tests to assess engine performance.	K3
CO2	Evaluate fuel and lubricant properties using standard laboratory instruments, and conduct performance and load tests on engines and compressors to determine operational efficiency.	K5
CO3	Demonstrate understanding of auxiliary systems including boilers, solar photovoltaic (PV) cells, and automotive electronic control systems, highlighting their integration and functionality in thermal and automotive applications.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

1. To determine the actual Valve Timing diagram of a four stroke Compression/Spark Ignition Engine.
2. To determine the actual Port Timing diagram of a two stroke Compression/Spark Ignition Engine.
3. Determination of Flash & Fire points of Liquid fuels / Lubricants using (i) Abels Apparatus; (ii) Pensky Martin's apparatus and (iii) Cleveland's apparatus.
4. Determination of Viscosity of Liquid lubricants/Fuels using (i) Saybolt Viscometer and (ii) Redwood Viscometer.
5. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder Petrol/diesel engine.
6. To perform the Heat Balance Test on Single Cylinder four Stroke Petrol/Diesel Engine.
7. To conduct a load test on a single cylinder Petrol/Diesel engine to study its performance under various loads.
8. To conduct a performance test on a VCR engine, under different compression ratios and determine its heat balance sheet.
9. To conduct a performance test on an air compressor and determine its different efficiencies.
10. Study of boilers with accessories and mountings
11. Experimentation on installation of Solar PV Cells
12. Demonstration of electronic controls in an automobile.

NOTE:*Any **10** Experiments can be conducted from the above list of Experiments.*

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester

THEORY OF MACHINES LABORATORY

(ME)

Course Category	Professional core	**Course Code**	
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Theory of Machines	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand the principles of gyroscope and governor
2	To analyze the vibrations in Mechanical systems
3	To study and analyze various machine components and mechanisms

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Evaluate the performance of mechanical systems	K5
CO2	Study and characterize fundamental machine components	K3
CO3	Analyze the dynamics of rotating systems	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

1. To determine whirling speed of shaft theoretically and experimentally.
2. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
3. To analyze the motion of a motorized gyroscope when the couple is applied along its spin axis
4. To determine the frequency of undamped free vibration of an equivalent spring mass system.
5. To determine the frequency of damped force vibration of a spring mass system
6. To study the static and dynamic balancing using rigid blocks.
7. To find the moment of inertia of a flywheel
8. To plot follower displacement vs cam rotation for various Cam Follower systems.
9. To plot slider displacement, velocity, and acceleration against crank rotation for single slider crank mechanism/Four bar mechanism
10. To find the coefficient of friction between the belt and pulley.
11. To study simple and compound screw jack and determine the mechanical advantage, velocity ratio, and efficiency
12. To study various types of gears- Spur, Helical, Worm and Bevel Gears

NOTE:*Any **10** Experiments can be conducted from the above list of Experiments.*

Virtual Labs:

1. https://sites.google.com/view/vlab-bnmitmech/home/design-lab/whirling-of-shafts
2. http://vlabs.iitkgp.ac.in/kdm/

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester

MACHINE TOOLS & METROLOGY LABORATORY

(ME)

Course Category	Skill Enhancement course	**Course Code**	
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Machine Tools and Metrology	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand the parts of various machine tools and about different shapes of products that can be produced on them.
2	To measure bores, angles, and tapers
3	To perform alignment tests on various machines

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Identify the parts of various machine tools and the shapes of products they can produce.	K3
CO2	Measure bores, angles, and tapers using appropriate instruments.	K3
CO3	Perform alignment tests on different machine tools.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

MACHINE TOOLS LAB(Part-A)

1. Introduction of general-purpose machines -Lathe, drilling machine, Milling machine, Shaper, Planing machine, Slotting machine, cylindrical grinder, Surface grinder and Tool and cutter grinder.
2. Operations on Lathe machines- Step turning, Knurling, Taper turning, Thread cutting and Drilling.
3. Operations on Drilling machine - Drilling, reaming, tapping, rectangular drilling, circumferential drilling.
4. Operations on Shaping machine - (i) Round to square (ii) Round to Hexagonal.
5. Operations on Slotter - (i) Keyway (T–slot) (ii) Keyway cutting.
6. Operations on milling machines - (i) Indexing (ii) Gear manufacturing
7. Operations on Tool and cutter grinding machine – To generate a single point cutting tool edge

METROLOGY LAB(Part-B)

1. Calibration of vernier calipers, micrometers, vernier height gauge and dial gauges.
2. Measurement of bores by internal micrometers and dial bore indicators.
3. Use of gear tooth vernier caliper for tooth thickness inspection and flange micrometer for checking the chordal thickness of spur gear.
4. Machine tool alignment test on the lathe.
5. Machine tool alignment test on drilling machine.
6. Machine tool alignment test on milling machine.
7. Angle and taper measurements with bevel protractor, Sine bar, rollers and balls.
8. Use of spirit level in finding the straightness of a bed and flatness of a surface.
9. Thread inspection with two wire/ three wire method & tool makers microscope.
10. Surface roughness measurement with roughness measuring instrument.

NOTE:*Any **5** Experiments can be conducted from each part.*

Virtual Labs:

1. http://vlabs.iitkgp.ac.in/metro/loe.html#

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester

SALESFORCE ADMINISTRATOR EXPLORER

(Common to All Branches)

Course Category	Skill Enhancement Course	**Course Code**	
Course Type	Laboratory	**L-T-P-C**	0-1-2-2
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

COURSE OBJECTIVES	
1	Help in collaborating with business and technical stake holders to design, configure, and implement Salesforce
2	Develop a mind set in solving business problems using the Salesforce Platform
3	Hands on practice on provide reporting on a regular basis to help users and executives gain insights and make decisions from Salesforce data
4	Learn how to create human-centered user experiences in Salesforce
5	UnderstandhowtoCreate,maintain,andenhanceautomatedbusinessprocesses

COURSE OUTCOMES		
Up on successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Be able to understand how to manage changes to business processes, technology, and people with Salesforce.	K1
CO2	Be able to improve the efficiency of business operations by proactively undertaking regular process analysis and documentation.	K2
CO3	Be able to manage the end-to-end implementation of Salesforce, including the overall strategy and day-to-day activities involved in administering Salesforce.	K3

K1-Remembering,K2-Understanding,K3-Applying,K4-Analyzing,K5-Evaluating,K6-Creating

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	2	2	0	3	1	1	1	2	3	2
CO2	2	3	2	0	2	1	1	1	2	2	1
CO3	3	3	3	0	3	1	1	2	3	3	2

COURSE CONTENT

Experiment 1:

Salesforce Platform Basics: Get Started with the Salesforce Platform, Discover Use Cases for the Platform, Understand the Salesforce Architecture, Navigate Setup, Power Up with AppExchange.

Prepare Your Salesforce Org for Users: Set Up the Exchange Rate, Update the Exchange Rate with ACM, Customize the Home Page, Create a Unique Account List View, Create Chatter Groups.

User Management: Add New Users, Control What Your Users Can Access — (3 Sessions)

Experiment 2:

Customize an Org to Support a New Business Unit: Manage User Access, Manage Chatter, Modify Your Data Model, Configure an Email Letterhead and Template, Automate Your Business Process.

Identity Basics: Get to Know Salesforce Identity, Get to Know Your Salesforce Identity Users, Learn the Language of Identity — (4 Sessions)

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

Experiment 3:

Data Security: Overview of Data Security, Control Access to the Org, Control Access to Objects, Control Access to Fields, Control Access to Records, Create a Role Hierarchy, Define Sharing Rules.

Permission Set Groups: Get Started with Permission Set Groups, Create a Permission Set Group, Mute Permissions in Permission Set Groups.

Protect Your Data in Salesforce: Restrict Login Hours and IP Ranges, Create New Users and Allow a User to Delete Accounts, Set Organization-Wide Defaults and Create a Role Hierarchy, Create Sharing Rules, Set Up Account Teams — (5 Sessions)

Experiment 4:

Data Modeling: Understand Custom & Standard Objects, Create Object Relationships, Work with Schema Builder.

Lightning Experience Customization: Set Up Your Org, Create and Customize Lightning Apps, Create and Customize List Views, Customize Record Highlights with Compact Layouts, Customize Record Details with Page Layouts, Create Custom Buttons and Links, Empower Your Users with Quick Actions.

Customize a Salesforce Object: Work with Standard and Custom Fields, Create Picklists and Field Dependencies, Create Lookup Filters, Create Formula Fields, Create Record Types, Create Account Page Layouts, Enable Account Field History Tracking, Create Validation Rules — (5 Sessions)

Experiment 5:

Lightning App Builder: Get Started with the Lightning App Builder, Build a Custom Home Page for Lightning Experience, Build a Custom Record Page for Lightning Experience and Salesforce Mobile App, Build an App Home Lightning Page, Work with Custom Lightning Components.

Formulas and Validations: Use Formula Fields, Implement Roll-Up Summary Fields, Create Validation Rules — (4 Sessions)

Experiment 6:

Accounts & Contacts for Lightning Experience: Store Information About Your Customers, Understand Account and Contact Relationships.

Leads & Opportunities for Lightning Experience: Create and Convert Leads as Potential Customers, Work Your Opportunities, Sell as a Team and Split the Credit, Visualize Success with Path and Kanban.

Products, Quotes, & Contracts: Create Price Books to Track Your Products, Configure Quotes for Your Customers, and Track Contracts.

Campaign Basics: Meet Salesforce Campaigns, Organize Campaigns, Determine Who You're Marketing To, Report on Your Campaigns.

Customize a Sales Path for Your Team: Customize a Sales Path, Customize Opportunity Stages, Work with Opportunities in the Kanban View — (5 Sessions)

Experiment 7:

Service Cloud for Lightning Experience: Begin Your Customer Service Journey, Administer Service Cloud, Automate Case Management, Create Digital Engagement on Multiple Channels.

Set Up the Service Console: Set Up the Lightning Service Console, Customize Your Lightning Service Console Pages, Add the Softphone Utility to Your App, Set Up Web Chats for Your Console.

Create a Process for Managing Support Cases: Create Support Processes, Create Record Types, Create an Escalation Rule.

Set Up Case Escalation and Entitlements: Create Support Processes, Create Case Queues and Assignment Rules, Create a Case Escalation Rule, Create an Automation with Flow Builder, Enable Entitlements and Set Up Service Contracts, Create an Entitlement Process, Create Service Contracts with Entitlements — (5 Sessions)

Experiment 8:

Chatter Administration for Lightning Experience: Get Started with Chatter, Work with Chatter Groups, Enable Feed Tracking, Approve Records from a Chatter Feed, Develop a Rollout Strategy.

App Exchange Basics: Get Started with AppExchange, Navigate AppExchange, Explore App Exchange Listings, Install App Exchange Packages, Connect and Contribute to the AppExchange Community — (3 Sessions)

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

Experiment 9:
Data Management: Import Data, Export Data.
Duplicate Management: Improve Data Quality in Salesforce, Resolve and Prevent Duplicate Data in Salesforce.
Import and Export with Data Management Tools: Use the Data Import Wizard, Use Data Loader.io to Export Data, Use Data Loader.io to Update Data — (3 Sessions)

Experiment 10:
Reports & Dashboards for Lightning Experience: Introduction to Reports and Dashboards in Lightning Experience, Create Reports with the Report Builder, Format Reports, Visualize Your Data with the Lightning Dashboard Builder, Extend Your Reporting Strategy with AppExchange.
Create Reports and Dashboards for Sales and Marketing Managers: Create Report and Dashboard Folders, Create a Simple Custom Report, Filter Your Reports, Group and Categorize Your Data, Use Summary Formulas in Your Reports, Manage Reported Data, Visualize Your Data — (3 Sessions)

Experiment 11:
Approve Records with Approval Processes: Customize How Records Get Approved, Build an Approval Process.
Build a Discount Approval Process: Prepare Your Org, Create an Approval Process, Create Initial Submission Actions, Specify Final Approval and Rejection Actions.
Build a Simple Flow: Collect Contact Info from Your User, Check for a Matching Contact in Your Org, Branch the Flow, Create or Update a Contact.
Flow Builder Basics: Get Started with Automation, Go with the Flow, Meet Flow Builder, Learn About Flow Variables — (3 Sessions)

Experiment 12:
Case Studies and Capstone Project: Complete the Capstone Project by taking a user case and working on the Trailhead Playground — (5 Sessions)

Text Books:

1. Sharif Shaalan and Timothy Royer, *"Salesforce for Beginners: A Step-by-Step Guide to Optimize Sales and Marketing and Automate Business Processes with the Salesforce Platform"*, 2nd Ed, 2022, PACKT Publishers.
2. Sharif Shaalan, *"Salesforce for Beginners: A Step-by-Step Guide to Creating, Managing, and Automating Sales and Marketing Processes"*, 2020, PACKT Publishers.
3. Paul Goodey, *"Salesforce CRM – The Definitive Admin Handbook: Build, Configure, and Customize Salesforce CRM and Mobile Solutions"*, 5th Ed, 2019, PACKT Publishers.
4. Rakesh Gupta, *"Mastering Salesforce CRM Administration"*, 2017, PACKT Publishers.
5. Felicia Duarte, Rachelle Hoffman, *"Learn Salesforce Lightning: The Visual Guide to the Lightning UI"*, 2018, Wiley Apress.

Reference Books:

1. Johan Yu, *"Salesforce Lightning Reporting and Dashboards: Create, Customize, and Manage Your Salesforce Reports and Dashboards in Depth with Lightning Experience"*, 2017, PACKT Publishers.
2. Ahsan Zafar, *"Salesforce Data Architecture and Management: A Pragmatic Guide for Aspiring Salesforce Architects and Developers to Manage, Govern, and Secure Their Data Effectively"*, 2021, PACKT Publishers.
3. Saifullah Saifi and Ashwini Kumar Raj, *"Cloud Computing Using Salesforce"*, 2021, BPB.

e-Resources:

1. Use the Trailhead Platform: https://www.salesforce.com/blog/what-is-trailhead/
2. The Salesforce Administrator Trailmix: https://trailhead.salesforce.com/users/srebello7/trailmixes/salesforce-administrator-explorer

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year I Semester
TINKERING LAB
(Common to Civil, EEE & ME)

Course Category		**Course Code**	
Course Type	Laboratory	**L-T-P-C**	0-0-2-1
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
The student will learn:	
1	Encourage Innovation and Creativity
2	Provide Hands-on Learning
3	Impart Skill Development
4	Foster Collaboration and Teamwork
5	Enable Interdisciplinary Learning
6	Impart Problem-Solving mind-set
7	Prepare for Industry and Entrepreneurship

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Build and demonstrate basic electronic circuits and IoT projects using breadboards, sensors, microcontrollers, and simulation tools.	K3
CO2	Apply Arduino, ESP32, and related platforms to develop and control hardware-based applications.	K3
CO3	Design and fabricate mechanical prototypes using 3D printing and apply design thinking for innovative product development.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

List of experiments:

1. Make your own parallel and series circuits using breadboard for any application of your choice.
2. Demonstrate a traffic light circuit using breadboard.
3. Build and demonstrate automatic Street Light using LDR.
4. Simulate the Arduino LED blinking activity in Tinkercad.
5. Build and demonstrate an Arduino LED blinking activity using Arduino IDE.
6. Interfacing IR Sensor and Servo Motor with Arduino.
7. Blink LED using ESP32.
8. LDR Interfacing with ESP32.
9. Control an LED using Mobile App.
10. Design and 3D print a Walking Robot
11. Design and 3D Print a Rocket.
12. Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.
13. Demonstrate all the steps in design thinking to redesign a motor bike. Students need to refer to the following links:
    - **i.** https://aim.gov.in/pdf/equipment-manual-pdf.pdf
    - **ii.** https://atl.aim.gov.in/ATL-Equipment-Manual/
    - **iii.**https://aim.gov.in/pdf/Level-1.pdf
    - **iv.**https://aim.gov.in/pdf/Level-2.pdf
    - **v.** https://aim.gov.in/pdf/Level-3.

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester
HEAT TRANSFER
(ME)

Course Category	Professional Core	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Thermodynamics, Thermal Engineering	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn the different modes of heat transfer and conduction heat transfer through various solid bodies
2	To learn the one-dimensional steady state heat conduction heat transfer and one-dimensional transient heat conduction
3	To learn the basic concepts of convective heat transfer and forced convection heat transfer of external flows and internal flow
4	To learn the free convection heat transfer concepts and heat transfer processes in heat exchangers
5	To learn the concepts of radiation heat transfer.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the concepts of various heat transfer modes, conduction mechanisms, and associated governing equations.	K2
CO2	Apply dimensional analysis and empirical correlations to convection heat transfer in internal and external flows.	K3
CO3	Analyze boiling and condensation processes and assess heat exchanger performance using LMTD and NTU methods.	K4
CO4	Evaluate radiation heat transfer between black and grey bodies, including radiation shields.	K5
CO5	Solve practical heat transfer problems using appropriate analytical and empirical methods.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT – I

Introduction: Modes and mechanisms of heat transfer – Basic laws of heat transfer –General discussion about applications of heat transfer.

Conduction Heat Transfer: Fourier rate equation – General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates – simplification and forms of the field equation – steady, unsteady and periodic heat transfer – Initial and boundary conditions

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres- Composite systems– overall heat transfer coefficient – Electrical analogy – Critical radius of insulation. Variable Thermal conductivity – systems with heat sources or Heat Generation-Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin, Application to error measurement of Temperature.

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

UNIT – II

One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers –Infinite bodies- Chart solutions of transient conduction systems- Concept of Semi-infinite body.

Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham π Theorem and method, application for developing semi – empirical non- dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity, Momentum and Energy Equations

UNIT – III

Forced convection:

External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer -Flat plates and Cylinders.

Internal Flows:

Concepts about Hydrodynamic and Thermal Entry Lengths – Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.

Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate - Use of empirical relations for Vertical plates and pipes.

UNIT – IV

Heat Transfer with Phase Change:

Boiling: Pool boiling – Regimes – Calculations on Nucleate boiling, Critical Heat flux and Film boiling

Condensation: Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate - Film condensation on vertical and horizontal cylinders using empirical correlations.

Heat Exchangers: Classification of heat exchangers – overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods - Problems using LMTD and NTU methods.

UNIT – V

Radiation Heat Transfer: Emission characteristics and laws of black-body radiation – Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchhoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

Note: Heat transfer data book by C P Kothandaraman and Subrahmanyan is allowed.

Textbooks:

1. Heat Transfer by HOLMAN, Tata McGraw-Hill
2. Heat Transfer by P.K.Nag, TMH
3. Fundamentals of Engineering, Heat& Mass Transfer by R.C.Sachdeva, New Age.

Reference Books:

1. Fundamentals of Heat Transfer by Incropera& Dewitt, John Wiley
2. Heat& Mass Transfer by Amit Pal – Pearson Publishers
3. Heat Transfer by Ghoshadastidar, Oxford University press.
4. Heat Transfer by a Practical Approach, Yunus Cengel, Boles, TMH
5. Engineering Heat and Mass Transfer by Sarit K. Das, Dhanpat Rai Pub

Web References:

1. https://nptel.ac.in/courses/112106315
2. https://nptel.ac.in/courses/112101097
3. https://nptel.ac.in/courses/112106170
4. https://onlinecourses.nptel.ac.in/noc23_ch65/preview

R23

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester
FINITE ELEMENT METHODS
(ME)

Course Category	Professional Core	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Basics of Mathematics, Mechanics of Solid, Dynamics of Machinery, Heat Transfer	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn basic principles of finite element analysis procedure
2	To learn how to solve the bar and truss problems
3	To learn how to solve beam problems
4	To understand the formulation of 2D problems
5	To get knowledge in heat transfer analysis and dynamic analysis.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain variational and weighted residual methods in finite element analysis.	K2
CO2	Solve bar and truss problems using finite element formulation.	K3
CO3	Analyze beam problems applying Hermite beam element formulation.	K4
CO4	Apply boundary conditions for 2D stress analysis and formulate axisymmetric and higher order iso-parametric elements.	K3
CO5	Evaluate steady state heat transfer and dynamic problems using FEM.	K5

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT –I:

INTRODUCTION TO FINITE ELEMENT METHODS: Basic concepts, historical back ground, applications of FEM, general description, Comparison of FEM with other methods,stress and equilibrium, strain–displacement relations, stress–strain relations, plane stress and plane strain conditions, variational and weighted residual methods, concept of potential energy, one-dimensional problems.

UNIT –II

Bar element formulation, Discretization of domain, element shapes, discretization procedures, assembly of stiffness matrix, band width, node numbering, mesh generation, interpolation functions, local and global coordinates, convergence requirements, treatment of boundary conditions.

ANALYSIS OF TRUSSES: Finite element modeling, coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, strain and support reaction calculations.

UNIT –III

ANALYSIS OF BEAMS: Element stiffness matrix for Hermite beam element, derivation of load vector for concentrated and UDL, simple problems on beams.

UNIT – IV

Finite element modeling of two-dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems.

HIGHER ORDER AND ISO-PARAMETRIC ELEMENTS: One dimensional, quadratic and cubic elements in natural coordinates, two-dimensional four nodeiso-parametric elements and numerical integration.

UNIT – V

STEADY STATE HEAT TRANSFER ANALYSIS: One dimensional analysis of a fin.

DYNAMIC ANALYSIS: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors, free vibration analysis.

Text books:

1. Introduction to Finite Elements in Engineering, Second Edition/ Tirupati Reddy Chandrupatla/Prentice-Hall.
2. The Finite Element Methods in Engineering /S.S.Rao /Pergamon.

Reference Books:

1. Finite Element Method with applications in Engineering / YM Desai, Eldho & Shah /Pearson publishers
2. An introduction to Finite Element Method /JN Reddy/McGraw-Hill
3. Finite Element Analysis: Theory and Application with Ansys, Saeed Moaveniu, Pearson Education.
4. The Finite Element Method for Engineers–Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smith and Ted G. By rom/John Wiley & sons (ASIA) Pvt Ltd.
5. Finite Element Analysis: for students & Practicing Engineers / G. Lakshmi Narasaiah

Web References:

1. https://archive.nptel.ac.in/courses/112/105/112105308/
2. https://archive.nptel.ac.in/courses/112/104/112104193/
3. https://www.finiteelements.org/

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester
MECHANICAL VIBRATIONS
(ME)

Course Category	Professional Elective-II	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Engineering mechanics, Mathematics, Physics	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn basic principles of mathematical modeling of vibrating systems
2	To understand the basic concepts free and forced multi degree freedom systems
3	To get concepts involved in the torsional vibrations
4	To learn the principals involved in the critical speed of shafts
5	To understand the basic concepts of Laplace transformations response to different inputs

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the concepts and mathematical modeling of single degree of freedom vibrational systems.	K2
CO2	Analyze free and forced vibrations of multi-degree freedom systems using matrix and energy methods.	K4
CO3	Describe torsional, longitudinal, and transverse vibrations in mechanical components.	K2
CO4	Solve problems related to critical speeds of rotating shafts using analytical methods.	K3
CO5	Apply Laplace transformation techniques to determine system responses to various inputs.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

CO	PO1	PO2	P3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	-	1	-	-	-	-	-	-
CO2	3	3	1	-	2	-	-	1	1	-	1
CO3	3	2	1	-	1	-	-	1	2	-	1
CO4	3	3	2	-	2	-	-	1	1	-	2
CO5	3	3	2	-	2	-	-	1	1	-	1

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT – I

Relevance of and need for vibrational analysis – Basics of SHM - Mathematical modelling of vibrating systems - Discrete and continuous systems - single-degree freedom systems - free and forced vibrations, damped and undamped systems.

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UNIT – II

Free and forced vibrations of multi-degree freedom systems in longitudinal, torsional, and lateral modes - Matrix methods of solution- normal modes - Orthogonality Principle-Energy methods, Eigen values and Eigen vectors, modal analysis.

UNIT – III

Torsional vibrations - Longitudinal vibration of rods - transverse vibrations of beams – Governing equations of motion - Natural frequencies and normal modes - Energy methods, Introduction to non- linear and random vibrations.

UNIT – IV

Vibration Measuring Instruments and Critical Speeds of Shafts: Vibrometers, Accelerometer, Frequency measuring instruments and Problems. Critical speed of a light shaft having a single disc without damping and with damping, critical speeds of shaft having multiple discs, secondary critical speed, critical speeds light cantilever shaft with a large heavy disc at its end.

UNIT – V

Laplace transformations response to an impulsive input, response to a step input, response to pulse (rectangular and half sinusoidal pulse), phase plane method

Text books:

1. S.S.Rao, “Mechanical Vibrations ", 5th Edition, Prentice Hall, 2011.
2. L.Meirovitch, “Elements of vibration Analysis", 2nd Edition, McGraw-Hill, New York, 1985.

References:

1. W.T. Thomson, M.D. Dahleh and C Padmanabhan, “Theory of Vibration with Applications”, 5th Edition,Pearson Education, 2008.
2. M.L.Munjal, “Noise and Vibration Control”, World Scientific, 2013.
3. Beranek and Ver, “Noise and Vibration Control Engineering: Principles and Applications”,JohnWiley and Sons, 2006.
4. Randall F. Barron, “Industrial Noise Control and Acoustics”, Marcel Dekker, Inc., 2003.

Web References:

1. nptel.ac.in/courses/112107087
2. https://l1nq.com/Gfv6P
3. https://l1nq.com/oDLUW

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester
ADVANCED MANUFACTURING PROCESSESS
(ME)

Course Category	Professional Elective-II	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Material Science & Metallurgy	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn the basic principle of advanced machining processes
2	To know about the various additive manufacturing processes
3	To understand the principles of coating and processing of ceramics.
4	To get insights about processing of composites and nanomaterials
5	To know the fabrication of microelectronic components.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	**Explain** the principles, operations, and applications of various advanced machining processes.	K2
CO2	**Describe** the working principles and methods of additive manufacturing techniques.	K2
CO3	**Analyze** laser-based material processing and advanced surface treatment techniques.	K4
CO4	**Apply** suitable processing methods for ceramics, composites, and nanomaterials.	K3
CO5	**Demonstrate** fabrication methods for microelectronic devices and related manufacturing processes.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT –I

ADVANCED MACHINING PROCESSES: Introduction, Need, AJM, WJM, Wire-EDM, ECM, LBM, EBM, PAM – Principle, working, advantages, limitations, Process Parameters & capabilities and applications.

UNIT –II

ADDITIVE MANUFACTURING: Working Principles, Methods, Stereo Lithography, LENS, LOM, Laser Sintering, Fused Deposition Method, 3DP Applications and Limitations, Direct and Indirect Rapid tooling techniques.

UNIT –III

SURFACE TREATMENT: Scope, Cleaners, Methods of cleaning, Surface coating types, Electro forming, Chemical vapour deposition, Physical vapour deposition, thermal spraying methods, Ion implantation, diffusion coating, ceramic and organic methods of coating, and cladding methods.

PROCESSING OF CERAMICS: Applications, characteristics, classification Processing of particulate ceramics, Powder preparations, consolidation, hot compaction, drying, sintering, and finishing of ceramics, Areas of application.

UNIT – IV

PROCESSING OF COMPOSITES: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, processing methods for MMC, CMC, Polymer matrix composites.

PROCESSING OF NANOMATERIALS: Introduction, Top down Vs Bottom up techniques-Ball milling, Lithography, Plasma Arc Discharge, Pulsed Laser Deposition, Sputtering, Sol-Gel, Molecular beam Epitaxy.

UNIT – V

FABRICATION OF MICROELECTRONIC DEVICES:

Crystal growth and wafer preparation, Film Deposition, oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, surface mount technology, Integrated circuit economics.

Textbooks:

1. Manufacturing Engineering and Technology / Kalpakijian / AdissonWesley, 1995.
2.Process and Materials of Manufacturing / R. A. Lindburg / 1th edition, PHI 1990.

Reference Books:

1.Microelectronic packaging handbook / Rao. R. Thummala and Eugene, J. Rymaszewski / Van Nostrand Renihold,
2.MEMS & Micro Systems Design and manufacture / Tai — Run Hsu / TMGH
3.Advanced Machining Processes / V.K.Jain / Allied Publications.
4.Introduction to Manufacturing Processes / John A Schey*I*McGraw Hill.
5.Introduction to Nanoscience and Nanotechnology/ Chattopadhyay K.K/A.N.Banerjee/ PHI Learning

Web References:

1. https://archive.nptel.ac.in/courses/112/107/112107078/
2. https://archive.nptel.ac.in/courses/112/107/112107077/

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester

MICRO ELECTRO MECHANICAL SYSTEMS

(ME)

Course Category	Professional Elective-II	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	NIL	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand basics of Micro Electro Mechanical Systems (MEMS), mechanical sensors and actuators
2	To illustrate thermal sensors and actuators used in MEMS.
3	To apply the principle and various devices of Micro-Opto-Electro Mechanical Systems (MOEMS), magnetic sensors and actuators.
4	To analyze applications and considerations on micro fluidic systems.
5	To illustrate the principles of chemical and biomedical microsystems.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the fundamentals of MEMS, including mechanical sensors and actuators.	K2
CO2	Illustrate the working principles of thermal sensors and actuators in MEMS.	K3
CO3	Apply the principles of MOEMS, magnetic sensors, and actuators to relevant applications.	K3
CO4	Analyze the applications and operational considerations of microfluidic systems.	K4
CO5	Describe the principles and functions of chemical and biomedical microsystems.	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT –I:

INTRODUCTION: Definition of MEMS, MEMS history and development, micromachining, lithography principles &methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micromachining, wafer bonding, LIGA.

MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitive, piezo-electric, strain, pressure, flow, pressure measurement by micro phone, MEMS gyroscopes, shear mode piezo actuator, gripping piezo actuator, Inch worm technology.

UNIT –II

THERMAL SENSORS AND ACTUATORS: Thermal energy basics and heat transfer processes, thermistors, thermo devices, thermo couple, micro machined thermo couple probe, Peltier effect heat pumps, thermal flow sensors, micro hot plate gas sensors, MEMS thermo vessels, pyro electricity, shape memory alloys (SMA), U-shaped horizontal and vertical electro thermal actuator, thermally activated MEMS relay, micro spring thermal actuator, datastorage cantilever.

UNIT –III

MICRO-OPTO-ELECTROMECHANICALSYSTEMS: Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch, wave guide and tuning, shear stress measurement.

MAGNETIC SENSORS AND ACTUATORS: Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, mag MEMS actuators, by directional micro actuator, feedback circuit integrated magnetic actuator, large force reluctance actuator, magnetic probe-based storage device.

UNIT – IV

MICRO FLUIDIC SYSTEMS: Applications, considerations on micro scale fluid, fluid actuation methods, dielectro-phoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, opto electro wetting (OEW), tuning using micro fluidics, typical micro fluidic channel, micro fluid dispenser, micro needle, molecular gate, micro pumps.

RADIOFREQUENCY (RF) MEMS: RF – based communication systems, RF MEMS, MEMS inductors, tuner/filter, resonator, clarification of tuner, filter, resonator, MEMS switches, phase shifter.

UNIT – V

CHEMICAL AND BIOMEDICAL MICRO SYSTEMS: Sensing mechanism &principle, membrane-transducer materials, chem.-lab-on-a-chip (CLOC) chemo-resistors, chemo-capacitors, chemo-transistors, electronic nose (E-nose), mass sensitive chemo-sensors, fluorescence detection, calorimetric spectroscopy.

Text books:

1. MEMS, Nitaigour Prem chand Mahalik, TMH
2. Foundation of MEMS, Chang Liu, Prentice Hall Ltd.

Reference Books:

1. MEMS and NEMS, Sergey Edward Lyshevski, CRC Press, Indian Edition.
2. MEMS and Micro Systems: Design and Manufacture, Tai-RanHsu, TMH Publishers.
3. Introductory MEMS, Thomas M Adams, Richard A Layton, Springer International Publishers.

Web References:

1. https://archive.nptel.ac.in/courses/112/105/112105308/
2. https://archive.nptel.ac.in/courses/112/104/112104193/
3. https://www.finiteelements.org/

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester
SENSORS AND INSTRUMENTATION
(ME)

Course Category	Professional Elective-II	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Basic Knowledge on Instrument usage	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To understand the concepts of measurement technology.
2	To learn the various sensors used to measure various physical parameters.
3	To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development
4	To learn about the optical, pressure and temperature sensor
5	To understand the signal conditioning and DAQ systems

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Recognize various calibration techniques and signal types for sensors.	K2
CO2	Describe the principles and characteristics of force, magnetic, heading, pressure, temperature, smart, and other sensors and transducers.	K2
CO3	Apply sensors and transducers in diverse engineering applications.	K3
CO4	Select appropriate sensors for specific application requirements.	K2
CO5	Acquire and process signals from sensors using data acquisition systems.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT –I

INTRODUCTION

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

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

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

UNIT – IV

OPTICAL, PRESSURE AND TEMPERATURE SENSORS

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

SIGNAL CONDITIONING AND DAQ SYSTEMS

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi-channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

Textbooks:

1. Ernest O Doebelin, “Measurement Systems – Applications and Design”, Tata McGraw- Hill, 2009.
2. Sawney A K and Puneet Sawney, “A Course in Mechanical Measurements and Instrumentation and Control”, Dhanpat Rai & Co, 12th edition New Delhi, 2013.

Reference Books:

1. C. Sujatha ... Dyer, S.A., Survey of Instrumentation and Measurement, John Wiley & Sons, Canada, 2001.
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 References:

1. https://archive.nptel.ac.in/courses/108/105/108105064/

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester

ENERGY STORAGE TECHNOLOGIES

(ME)

Course Category	Professional Elective-III	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Engineering Chemistry, Engineering Physics	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Get the insights into importance of energy storage systems
2	Understand the chemical and electromagnetic storage systems
3	Know the principles of electrochemical storage systems
4	Learn the working of supercapacitors and fuel cells
5	Know how to design batteries for transportation

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the importance and applications of energy storage systems in power and transportation sectors.	K2
CO2	Compare chemical and electromagnetic energy storage systems with respect to principles, advantages, and limitations.	K2
CO3	Describe the working principles and performance evaluation of electrochemical storage systems.	K3
CO4	Analyze the operation and characteristics of supercapacitors and fuel cells.	K3
CO5	Design battery systems for transportation considering performance, safety, and lifecycle aspects.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT 1:

Energy storage systems overview - Scope of energy storage, needs and opportunities in energy storage, Technology overview and key disciplines, comparison of time scale of storages and applications, Energy storage in the power and transportation sectors. Importance of energy storage systems in electric vehicles, Current electric vehicle market. Thermal storage system-heat pumps, hot water storage tank, solar thermal collector, application of phase change materials for heat storage-organic and inorganic materials, efficiencies, and economic evaluation of thermal energy storage systems.

UNIT 2:

Chemical storage system- Hydrogen, methane etc., concept of chemical storage of solar energy, application of chemical energy storage system, advantages and limitations of chemical energy storage, challenges, and future prospects of chemical storage systems.

Electromagnetic storage systems - Double layer capacitors with electrostatically charge storage, superconducting magnetic energy storage (SMES), concepts, advantages and limitations of electromagnetic energy storage systems, and future prospects of electrochemical storage systems.

UNIT 3:

Electrochemical storage system

Batteries-Working principle of battery, primary and secondary (flow) batteries, battery performance evaluation methods, major battery chemistries and their voltages- Li-ion battery& Metal hydride battery vs lead-acid battery

UNIT 4:

Supercapacitors- Working principle of supercapacitor, types of supercapacitors, cycling and performance characteristics, difference between battery and supercapacitors, Introduction to Hybrid electrochemical supercapacitors

Fuel cell- Operational principle of a fuel cell, types of fuel cells, hybrid fuel cell-battery systems, hybrid fuel cell-supercapacitor systems.

UNIT 5:

Battery design for transportation, Mechanical Design and Packaging of Battery Packs for Electric Vehicles, Advanced Battery, Assisted Quick Charger for Electric Vehicles, Charging Optimization Methods for Lithium-Ion Batteries, Thermal run-away for battery systems, Thermal management of battery systems, State of Charge and State of Health Estimation Over the Battery Lifespan, Recycling of Batteries from Electric Vehicles.

Textbooks:

1. Frank S. Barnes and Jonah G. Levine, Large Energy Storage Systems Handbook (Mechanical and Aerospace Engineering Series), CRC press (2011)
2. Ralph Zito, Energy storage: A new approach, Wiley (2010)

Reference Books:

1. Pistoia, Gianfranco, and Boryann Liaw. Behaviour of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost. Springer International Publishing AG, 2018.
2. 2.Robert A. Huggins, Energy storage, Springer Science & Business Media (2010)

Web References:

1. https://onlinecourses.nptel.ac.in/noc21_mm34
2. https://www.iitmandi.ac.in/pdf/senate_courses/EN503.pdf

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester

INDUSTRIAL HYDRAULICS AND PNEUMATICS

(ME)

Course Category	Professional Elective-III	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Fluid Mechanics and Hydraulic Machinery	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To learn basic concepts of fluid power.
2	To understand the functions and working of basic elements of Hydraulic and Pneumatic system.
3	To get knowledge about the basic components and their functions of Hydraulic and Pneumatic circuits.
4	To learn the operating principles and working of hydraulic and pneumatic devices.
5	To gain knowledge about the procedures of installation, maintenance and troubleshooting of Hydraulic and pneumatic systems.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the fundamental concepts and governing laws of fluid power systems.	K2
CO2	Describe the components and functions of hydraulic and pneumatic elements.	K2
CO3	Analyze the operation of hydraulic and pneumatic circuits using standard symbols and design methods.	K3
CO4	Illustrate the working principles and applications of various hydraulic and pneumatic devices.	K2
CO5	Demonstrate the procedures for installation, maintenance, and troubleshooting of hydraulic and pneumatic systems.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

UNIT – 1

Fluid Power: Power transmission modes, hydraulic systems, pneumatic systems, laws governing fluid flow: Pascal's law, continuity equation, Bernoulli's theorem, Boyle's, Charles', Gay-Lussec' laws, flow through pipes - types, pressure drop in pipes, Working fluids used in hydraulic and pneumatic systems- types, ISO/BIS standards and designations, properties.

UNIT – 2

Hydraulic and Pneumatic Elements: Hydraulic pipes-Types, standards, designation methods and specifications, pressure ratings, applications and selection criteria, pumping theory, Hydraulic Pumps - types, construction, working principle, applications, selection criteria and comparison, hydraulic Actuators, Control valves, Accessories - their types, construction and working, pneumatic Pipes - materials, designations, standards, properties and piping layout, air compressors, Air receivers, air dryers, Air Filters, Regulators, Lubricators (FRL unit): their types, construction, working, specifications and selection criteria of following air preparation and conditioning elements, pneumatic Actuators and Control valves - types, construction, working, materials and specifications

PRAGATI ENGINEERING COLLEGE

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UNIT – 3

Hydraulic and Pneumatic Circuits:

ISO symbols used in hydraulic and pneumatic circuit, basic Hydraulic Circuits – types (such as intensifier, regenerative, synchronizing, sequencing, speed control, safety), circuit diagram, components, working and applications, basic Pneumatic Circuits – types (such as speed control, two step feed control, automatic cylinder reciprocation, time delay, quick exhaust), circuit diagram, components, working and applications, pneumatic Logic circuit design - classic method, cascade method, step counter method, Karnaugh- veitch maps and combinational circuit design.

UNIT – 4

Hydraulic and Pneumatic Devices:

Hydraulic and Pneumatic devices – Concept and applications, construction, working principle, major elements, performance variables of: Automotive hydraulic brake, Industrial Fork lift, Hydraulic jack, Hydraulic press, Automotive power steering, Automotive pneumatic brake, Automotive air suspension, Pneumatic drill, Pneumatic gun.

UNIT – 5

Installation, Maintenance and Trouble-Shooting:

Installation of hydraulic and pneumatic system causes and remedies for common troubles arising in hydraulic elements, maintenance of hydraulic systems, causes and remedies for troubles arising in pneumatic elements, maintenance of pneumatic systems.

Textbooks:

1. Majumdar, S.R. Oil Hydraulic Systems Tata McGraw-Hill Publication, New Delhi,3/e, 2013
2. Majumdar, S.R. Pneumatic Systems Tata McGraw-Hill Publication, New Delhi,3/e, 2013

Reference books:

1. Srinivasan, R. Hydraulic and Pneumatic Controls Vijay Nicole Imprints Private, New Delhi, Limited, 2/e, 2008
2. Jagadeesha, T. Fluid Power Generation, Transmission and Control Universities Press (India) Private Limited, New Delhi,1/e, 2014
3. Jagadeesha, T. Pneumatics Concepts, Design and Applications Universities Press (India) Private Limited, New Delhi,1/e, 2014
4. Parr, Andrew Hydraulic and Pneumatics, A Technician's and Engineer's Guide, Jaico Publishing House, New Delhi,2/e, 2013
5. Shanmuga Sundaram, K. Hydraulic and Pneumatics Controls - Understanding Made Easy S. Chand Company Ltd., New Delhi, 1/e, 2006

Web References:

1. https://archive.nptel.ac.in/courses/112/105/112105047/
2. https://nptel.ac.in/courses/112105046

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester
INDUSTRIAL ROBOTICS
(ME)

Course Category	Professional Elective-III	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Engineering Mechanics, Manufacturing Processes, Design of Machine Members, Heat Transfer.	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Discuss various applications and components of industrial robot systems.
2	Learn about the types of actuators used in robotics.
3	Calculate the forward kinematics and inverse kinematics.
4	Learn about programming principles and languages for a robot control system
5	Discuss the applications of image processing and machine vision in robotics.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Describe the applications, classifications, and components of industrial robotic systems.	K2
CO2	Explain the types, working principles, and selection criteria of robotic actuators and feedback components.	K2
CO3	Compute forward and inverse kinematics of robotic manipulators using appropriate mathematical methods.	K3
CO4	Apply programming principles and path planning techniques for robot control systems.	K3
CO5	Analyze the applications of image processing and machine vision in robotics.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

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Department of Mechanical Engineering

COURSE CONTENT

UNIT –I

INTRODUCTION: Automation and Robotics, CAD/CAM and Robotics – An overview of Robotics –present and future applications – classification by coordinate system and control system.

COMPONENTS OF THE INDUSTRIAL ROBOTICS:

Robot anatomy, work volume, components, number of degrees of freedom - robot drive systems, function line diagram representation of robot arms, common types of arms– requirements and challenges of end effectors, determination of the end effectors.

UNIT –II

ROBOT ACTUATORS AND FEED BACK COMPONENTS:

Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Comparison of Electric, Hydraulic and Pneumatic types of actuation devices.

Feedback components: position sensors–potentiometers, resolvers, encoders–Velocity sensors.

UNIT –III

MOTION ANANALYSIS: Homogeneous transformations as applicable to rotation and translation –problems.

MANIPULATOR KINEMATICS: Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics–problems.

UNIT – IV

GENERAL CONSIDERATIONS IN PATH DESCRIPTION AND GENERATION: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion–Robot programming, languages and software packages-description of paths with a robot programming language.

UNIT – V

IMAGE PROCESSING AND MACHINE VISION: Introduction to Machine Vision, Sensing and Digitizing function in Machine Vision, Training and Vision System, Robotic Applications.

Text books:

1. Industrial Robotics/GrooverMP/Pearson Edu.
2. Robotics and Control /MittalR K &Nagrathi J /TMH.
3. Robotics: Control, Sensing, Vision, and Intelligence" by K.S. Fu, R.C. Gonzalez, C.S.G. Lee

Reference Books:

1. Robotics/Fu KS/ McGraw Hill.
2. Robotic Engineering /Richard D. Klafter, PrenticeHall
3. Robot Analysis and Control/ H. Asada and J.J.E. Slotine/BSP Books Pvt.Ltd.
4. Introduction to Robotics/John J Craig/PearsonEdu.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_de11/preview
2. https://onlinecourses.nptel.ac.in/noc25_ee42/preview
3. https://archive.nptel.ac.in/courses/112/107/112107298/

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester

REFRIGERATION AND AIR-CONDITIONING

(ME)

Course Category	Professional Elective-III	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites	Thermodynamics Thermal engineering	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To illustrate the operating cycles and different systems of refrigeration
2	To analyze cooling capacity and coefficient of performance of vapor compression refrigeration systems and understand the fundamentals of cryogenics
3	To calculate coefficient of performance by conducting test on vapor absorption and steam jet refrigeration system and understand the properties refrigerants.
4	To calculate cooling load for air conditioning systems and identify the requirements of comfort air conditioning
5	To describe different component of refrigeration and air conditioning systems

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain the operating cycles and different systems used in refrigeration.	K2
CO2	Analyze the cooling capacity and coefficient of performance of vapor compression refrigeration systems and summarize the fundamentals of cryogenics.	K3
CO3	Calculate the coefficient of performance of vapor absorption and steam jet refrigeration systems and evaluate refrigerant properties.	K3
CO4	Determine cooling loads for air conditioning systems and identify the requirements for comfort air conditioning.	K3
CO5	Demonstrate the functions and working of various components in refrigeration and air conditioning systems.	K2

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

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Department of Mechanical Engineering

COURSE CONTENT

UNIT –I

INTRODUCTION TO REFRIGERATION: Necessity and applications – unit of refrigeration and C.O.P. – Mechanical refrigeration – types of ideal cycles of refrigeration. air refrigeration: Bell Coleman cycle - open and dense air systems – refrigeration systems used in air crafts and problems.

UNIT –II

VAPOUR COMPRESSION REFRIGERATION SYSTEM &COMPONENTS: Working principle and essential components of the plant – simple vapor compression refrigeration cycle – COP – representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – actual cycle influence of various parameters on system performance – use of p-h charts – numerical problems.

INTRODUCTION TO CRYOGENICS: Joule-Thomson expansion, refrigerant mixtures**,** multi stage vapor compression refrigeration.

UNIT –III

REFRIGERANTS– Desirable properties – classification - refrigerants –green refrigerants- nomenclature – ozone depletion – global warming.

VAPOR ABSORPTION SYSTEM: Calculation of maximum COP – description and working of NH_3 – water system and Li Br –water (Two shell & four shell) System, principle of operation three fluid absorption system, salient features.

STEAM JET REFRIGERATION SYSTEM: Working Principle and basic components, principle and operation of thermoelectric refrigerator and vortex tube.

UNIT – IV

INTRODUCTION TO AIR CONDITIONING: Psychometric properties & processes – characterization of sensible and latent heat loads — need for ventilation, consideration of infiltration – load concepts of RSHF, GSHF-problems, concept of ESHF and ADP temperature.

Requirements of human comfort and concept of effective temperature- comfort chart –comfort air conditioning – requirements of industrial air-conditioning, air-conditioning load calculations.

UNIT – V

AIR CONDITIONING SYSTEMS: Classification of equipment's, cooling, heating humidification and dehumidification, filters, grills and registers, fans, and blowers. heat pump – heat sources – different heat pump circuits.

Textbooks:

1. A Course in Refrigeration and Air conditioning / SC Arora & Domkundwar / Dhanpatrai
2. Refrigeration and Air Conditioning / CP Arora / TMH.
3. Refrigeration and Air Conditioning /R.K.Khurmi & J.K.Gupta
4. Refrigeration and Air Conditioning /R.K.Rajput

Reference Books:

1. Refrigeration and Air Conditioning / Manohar Prasad / New Age.
2. Principles of Refrigeration /Dossat / Pearson Education.
3. Basic Refrigeration and Air-Conditioning / Ananthanarayanan / TMH

Web References:

1. https://www.youtube.com/watch?v=9uCeFhO8H40
2.https://www.youtube.com/watch?v=PjcdqAkP0UA
3. https://www.youtube.com/watch?v=PjcdqAkP0UA&t=145s
4. https://www.youtube.com/watch?v=1p6dgGVnS2w
5. https://www.youtube.com/watch?v=SfuSzBja8QA

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester

Disaster Management

Course Category	Engineering Science	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment**	30
		Semester End Examination	70
		Total Marks	100

Course Objectives:	
1.	Develop an understanding of why and how the modern disaster manager is involved with pre- disaster and post-disaster activities
2.	Describe the three planning strategies useful in mitigation.
3.	Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
4.	Describe public awareness and economic incentive possibilities.
5.	Understand the tools of post-disaster management.

Course Outcomes:

Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Affirm the usefulness of integrating management principles in disaster mitigation work	**K3**
CO2	Distinguish between the different approaches needed to manage pre- during and post-disaster periods	**K2**
CO3	Understanding the functioning of national disaster management authority	**K2**
CO4	Explain the process of risk management	**K3**
CO5	Relate to risk transfer	**K3**

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

Contribution of Course Outcomes towards achievement of Program Outcomes :
(1 – Low, 2 - Medium, 3 – High)

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	--	--	3	3	2	2	3	2	2	--	3
CO2	2	3	2	2	--	3	3	2	2	3	2	2	--	3
CO3	2	2	2	--	--	3	3	2	--	2	2	2	--	3
CO4	3	3	3	2	2	3	3	2	--	2	3	2	--	3
CO5	2	2	2	--	--	3	2	--	--	3	2	2	--	2

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT-I : Natural Hazards and Disaster Management: Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.

UNIT-II: Man Made Disaster and Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism - threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management.

UNIT-III: Risk and Vulnerability: Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition – Financial management of disaster – related losses.

UNIT-IV: Role of Technology in Disaster Managements: Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations- roads and bridges-mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS.

UNIT-V: Multi-sectional Issues, Education and Community Preparedness: Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction- Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action.

TEXT BOOKS:

1. An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazards– S.Vaidyanathan: CBS Publishers& Distributors Pvt. Ltd.
2. Natural Hazards & Disaster Management, Vulnerability and Mitigation by RB Singh- Rawat Publications
3. 'Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
4. 'Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt.Ltd.

REFERENCE BOOKS:

1. 'Disaster Management' edited by H K Gupta (2003), Universities press.
2. 'Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R R Krishnamurthy (2009), Universities press.R. Nishith, Singh AK

WEBREFERENCE:

1) https://archive.nptel.ac.in/courses/124/107/124107010/

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester

Fundamentals of Electric Vehicles

(Common to CE, ME, ECE, CSE, IT, CSE-CS, CSE-DS, CSE-AI, CSE-AIML)

Course Category	Open Elective Courses	**Course Code**	
Course Type	Theory	**L-T-P-C**	**3-0-0-3**
Prerequisites	Basic knowledge in Physics, Chemistry and Basics of Electrical and Electronics.	**Internal Assessment** **Semester End Examination** **Total Marks**	**30** **70** **100**

COURSE OBJECTIVES	
1	To familiarize the students with the need and advantages of electric and hybrid electric vehicles.
2	To understand various power converters used in electric vehicles.
3	To be familiar all the different types of motors suitable for electric vehicles.
4	To know various architecture of hybrid electric vehicles.
5	To have knowledge on latest developments in batteries and other storage systems.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Illustrate the use and advantages of different types of electric vehicles.	K2
CO2	Use suitable power converters for EV application.	K2
CO3	Select suitable electric motor for EV power train.	K3
CO4	Design HEV configuration for a specific application.	K3
CO5	Analyse various storage systems and battery management system for EVs.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	1	-	-	-	-	2	2	-	-	-	2	1	1
CO2	2	3	-	-	-	1	1	-	-	-	-	2	2
CO3	-	3	-	-	-	1	-	-	-	2	2	1	2
CO4	3	2	-	-	-	2	1	-	-	2	-	1	2
CO5	2	-	-	-	-	2	-	-	-	-	2	2	2

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Department of Mechanical Engineering

COURSE CONTENT

UNIT 1

Fundamentals of vehicles: Vehicle model – Calculation road load and tractive force – Components of conventional vehicles – Drawbacks of conventional vehicles – Need for electric vehicles– Advantages and applications of Electric Vehicles – History of Electric Vehicles – EV Market in India and outside India – Types of Electric Vehicles.

UNIT 2

Components of Electric Vehicles

Main components of Electric Vehicles – Electric Traction Motor and Controller – Power Converters – Rectifiers used in EVs – Bidirectional DC–DC Converters – Voltage Source Inverters – PWM inverters used in EVs.

UNIT 3

Motors for Electric Vehicles

Characteristics of traction drive – requirements of electric machines for EVs – Comparison of Different motors for Electric and Hybrid Vehicles – Induction Motors – Synchronous Motors – Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only).

UNIT 4

Hybrid Electric Vehicles

Evolution of Hybrid Electric Vehicles – Advantages and Applications of Hybrid Electric Vehicles – Architecture of HEVs – Series and Parallel HEVs – Complex HEVs – Range extended HEVs – Examples – Merits and Demerits.

UNIT 5

Energy Sources for Electric Vehicles

Batteries– Types of Batteries – Lithium-ion – Nickel-metal hydride – Lead-acid – Comparison of Batteries – Battery Charging – Fast Charging –Battery Management System – Ultra capacitors – Flywheels – Compressed air energy storage (CAES)– Fuel Cell – it's working.

TEXT BOOKS

1. Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2021.
2. Tom Denton, Hayley Pells - Electric and hybrid vehicles, Third Edition, 2024

REFERENCE BOOKS

1. Kumar - L. Ashok - and S. Albert Alexander. Power Converters for Electric Vehicles. CRC Press - 2020.
2. Chau - Kwok Tong. Electric vehicle machines and drives: design – analysis and application. John Wiley & Sons - 2015.
3. Berg - Helena. Batteries for electric vehicles: materials and electrochemistry. Cambridge university press - 2015.

WEB RESOURCES (Suggested)

1. https://www.edx.org/learn/electric-cars

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester

PRINCIPLES OF COMMUNICATIONS

Course Category	Open Elective	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
Thestudentwilllearn:	
1	Understand basic communication tools such as Fourier analysis, spectral properties, and AM concepts.
2	Know the principles and features of DSB-SC, SSB, and VSB modulation schemes.
3	Understand FM and PM systems, their bandwidth rules, and demodulation methods.
4	Understand sampling, quantization, and reconstruction techniques for digital signal representation.
5	Know probability and random processes for modeling noise in wireless communication.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Explain Fourier analysis, autocorrelation, and AM parameters for given communication signals.	K2
CO2	Apply DSB-SC, SSB, and VSB modulation schemes using spectrum and demodulation methods.	K3
CO3	Analyze FM and PM signals using modulation index and Carson's rule.	K4
CO4	Apply sampling and quantization to reconstruct signals meeting Nyquist and noise requirements.	K3
CO5	Evaluate wireless channel noise using probability theory and Gaussian process concepts.	K4

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

COURSE CONTENT

UNIT1 : Basic tools for communication, Fourier Series/Transform, Properties, Autocorrelation, Energy Spectral Density, Parsevals Relation, Amplitude Modulation (AM), Spectrum of AM, Envelope Detection, Power Efficiency, Modulation Index.

UNIT2 : Double Sideband Suppressed Carrier (DSB-SC) Modulation, Demodulation, Costas Receiver, Single Sideband Modulation (SSB), Hilbert Transform, Complex Pre-envelope/ Envelope, Demodulation of SSB, Vestigial Sideband Modulation (VSB)

UNIT 3 : Angle Modulation, Frequency Modulation (FM), Phase Modulation (PM), Modulation Index, Instantaneous Frequency, Spectrum of FM Signals, Carsons Rule for FM Bandwidth, Narrowband FM Generation, Wideband FM Generation via Indirect Method, FM Demodulation

UNIT 4 : Introduction to Sampling, Spectrum of Sampled Signal, Aliasing, Nyquist Criterion, Signal Reconstruction from Sampled Signal, Pulse Amplitude Modulation**,** Quantization, Uniform Quantizers – Midrise and Midtread, Quantization noise, , Non uniform Quantizers, Delta Modulation, Differential Pulse Code Modulation (DPCM)

UNIT 5: : Basics of Probability, Conditional Probability, MAP Principle, Random Variables, Probability Density Functions, Applications in Wireless Channels, Basics of Random Processes ,Gaussian Random Process, Noise.

TEXTBOOKS:

1. Simon Haykin, Communications Systems, 4th Edition. John Wiley and Sons, Inc
2. Fundamentals of Wireless Communication by David Tse

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester

Object Oriented Programming Through Java

(Common to CE, EEE, ME & ECE)

Course Category	**Open Elective - II**	**Course Code**	
Course Type	Theory	**L-T-P-C**	3-0-0-3
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
The learning objectives of this course are to:	
1	Identify Java language components and how they work together in applications
2	Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
3	Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
4	Understand how to design applications with threads in Java
5	understand how to use Java APIs for program development

COURSEOUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Apply the fundamentals of Java to solve problems	K3
CO2	Differentiate the application of decision and iteration control structures	K2
CO3	Implement classes and method overloading concepts	K3
CO4	Apply the concepts of inheritance and packages	K3
CO5	Implement Java programs using exceptions and multithreading	K3

K1-Remembering,K2-Understanding,K3-Applying,K4-Analyzing,K5-Evaluating,K6-Creating

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	0	3	0	0	0	0	0	0
CO2	3	3	3	0	3	0	0	0	0	0	0
CO3	3	3	3	0	3	0	0	0	0	0	0
CO4	3	3	3	0	3	0	0	0	0	0	0
CO5	3	3	3	0	3	0	0	0	0	0	0

COURSE CONTENT

UNIT I

Object Oriented Programming: Basic concepts, Principles,

Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, **Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators,

Boolean Logical Operators, Bitwise Logical Operators.

Control Statements:Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

UNIT II

Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

UNIT III

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV

Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Auto-unboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

UNIT V

String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads. **Java Database Connectivity:** Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface **Java FX GUI:** Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events

Text Books:

1) JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2) Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3) JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

References Books:

1) The complete Reference Java, 11thedition, Herbert Schildt,TMH
2) Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

e- Resources:

1) https://nptel.ac.in/courses/106/105/106105191/
2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01288046454761881634 7_shared/overview

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester

ENTREPRENEURSHIP AND VENTURE CREATION

III YEAR II SEMESTER (Common to CE, EEE, ME, ECE)

Course Category	Open Elective	**Credits**	3
Course Type	Theory	**L-T-P-C**	3 -0 -0-3
Prerequisites		**Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

Course Outcomes		**BTL**
Upon successful completion of the course, the student will be able to		
CO 1	Classify entrepreneurial and intrapreneurial concepts, attributes, and mindset to identify personal entrepreneurial potential using classroom discussions and case studies.	K2
CO 2	Apply design thinking principles to identify and validate problems and customer segments to achieve accurate problem–customer fit through field research and simulated venture activities.	K3
CO 3	Analyze solution designs and feasibility prototypes to determine their effectiveness in achieving proof-of-concept validation under iterative testing conditions.	K4
CO 4	Analyze business and revenue models along with financial plans to evaluate their potential for sustainability and profitability under simulated business planning scenarios.	K4
CO 5	Analyze investor pitch content to assess its effectiveness in communicating venture scale potential under simulated pitching conditions.	K4

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

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

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Department of Mechanical Engineering

COURSE CONTENT

Unit – I Entrepreneurship Fundamentals & Context: Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skillsets, attributes and networks while on campus.

Unit – II Problem & Customer Identification: Understanding and analysing the macro-Problem and Industry perspective, technological, socio economic and urbanization trends and their implication on new opportunities. Identifying passion, identifying and defining problem using Design thinking principles. Analysing problem and validating with the potential customer. Iterating problem-customer fit. Understanding customer segmentation, creating and validating customer personas. Competition and Industry trends mapping and assessing initial opportunity.

Unit – III Solution design, Prototyping & Opportunity Assessment and Sizing: Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition. Developing Problem-solution fit in an iterative manner. Understanding prototyping and MVP. Developing a feasibility prototype with differentiating value, features and benefits. Initial testing for proof-of-concept and iterate on the prototype. Assess relative market position via competition analysis, sizing the market and assess scope and potential scale of the opportunity.

Unit – IV Business & Financial Model, Go-to-Market Plan: Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach. **Business planning:** components of Business plan- Sales plan, People plan and financial plan. **Financial Planning:** Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analysing financial performance.
Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of funds: Debt & Equity, Map the Start-up Lifecycle to Funding Options.

Unit – V Scale Outlook and Venture Pitch readiness: Understand and identify potential and aspiration for scale vis a vis your venture idea.
Persuasive Storytelling and its key components. Build an Investor ready pitch deck.

Textbooks:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition.
2. Ries, E. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business

Reference Books :

1. Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons.
2. Simon Sinek (2011) Start with Why, Penguin Books limited
3. Brown Tim (2019) Change by Design Revised & Updated: How Design Thinking Transforms Organizations and Inspires Innovation, Harper Business
4. Namita Thapar (2022) The Dolphin and the Shark: Stories on Entrepreneurship, Penguin Books Limited
5. Saras D. Sarasvathy, (2008) Effectuation: Elements of Entrepreneurial Expertise, Elgar Publishing Ltd

Web References:

Learning resource- Ignite 5.0 Course Wadhwani platform (Includes 200+ components of custom created modular content + 500+ components of the most relevant curated content)

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester
HEAT TRANSFER LABORATORY
(ME)

Course Category	Professional Core	**Course Code**	
Course Type	Laboratory	**L-T-P-C**	0-0-3-1.5
Prerequisites	Heat transfer	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	The laboratory course is aimed to provide the practical exposure to the students with regard to the determination of amount of heat exchange in various modes of heat transfer including condensation & boiling for several geometries.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Perform steady-state conduction experiments to determine thermal conductivity and overall heat transfer coefficient of materials.	K3
CO2	Determine heat transfer coefficients in forced convection, free convection, and condensation, and compare with theoretical values.	K3
CO3	Perform Radiation experiments: Determine Surface emissivity of a test plate and verification of Stefan-Boltzman constant and determine thermal properties and performance of Heat exchanger.	K3

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes

(1 – Low, 2 - Medium, 3 – High)

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

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Department of Mechanical Engineering

COURSE CONTENT

1. Determination of overall heat transfer co-efficient of a composite slab
2. Determination of heat transfer rate through a lagged pipe.
3. Determination of heat transfer rate through a concentric sphere
4. Determination of thermal conductivity of a metal rod.
5. Determination of efficiency of a pin-fin
6. Determination of heat transfer coefficient in natural and forced convection
7. Determination of effectiveness of parallel and counter flow heat exchangers.
8. Determination of emissivity of a given surface.
9. Determination of Stefan-Boltzmann constant.
10. Determination of heat transfer rate in drop and film wise condensation.
11. Determination of critical heat flux.
12. Determination of Thermal conductivity of liquids and gases.
13. Investigation of Lambert's cosine law.

NOTE: *Any **10** experiments can be conducted from the above list of Experiments*

Virtual Labs (https://mfts-iitg.vlabs.ac.in/) on

i. Conduction Analysis of a Single Material Slab
ii. Conduction Analysis of a single Material Sphere
iii. Conduction Analysis of a single Material Cylinder
iv. Conduction Analysis of a Double Material Slab
v. Conduction Analysis of a Double Material Sphere
vi. Conduction Analysis of Double Material Cylinder
vii. To determine the overall heat transfer coefficient (U) in the
(a) parallel flow heat exchanger and (b) Counter flow heat exchanger
viii. To investigate the Lambert's distance law.
ix. To investigate the Lambert's direction law (cosine law).

Note:*Virtual labs are only for learning purpose, and are not for external examination.*

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester

ROBOTICS AND DRONE TECHNOLOGIES LABORATORY

(ME)

Course Category	Skill Enhancement course	**Course Code**	
Course Type	Lab	**L-T-P-C**	0-0-4-2
Prerequisites	Kinematics of machinery	**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	Provide hands-on experience in designing, simulating, and programming robotic and drone systems using relevant hardware and software tools.
2	Introduce microcontrollers, sensors, actuators, and control strategies for developing intelligent robotic and aerial platforms.
3	Develop problem-solving, teamwork, and project-based skills through real-time prototyping and testing of robotics and drone applications.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Simulate robotic and drone systems to analyze their kinematic, dynamic, and control characteristics using appropriate software tools.	K3
CO2	Design and develop microcontroller-based robotic and drone prototypes integrating sensors, actuators, and control algorithms for defined tasks.	K4
CO3	Collaborate to create innovative robotics and drone solutions addressing real-world problems with effective communication and teamwork.	K5

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Contribution of Course Outcomes towards achievement of Program Outcomes

(1 – Low, 2 - Medium, 3 – High)

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

COURSE CONTENT

1. Simulation of Mathematical Model of Robot.
2. Forward and Inverse Dynamic Analysis of a 2-DOF Robotic Manipulator using Software Tools.
3. Building and Programming a Simple Arduino-Based Robot for basic movement.
4. Build a robot that can navigate through a maze or an environment by using sensors to detect obstacles and avoid them.
5. Construct a robotic arm using servo motors or stepper motors and program the arm to perform various tasks, such as picking up objects, sorting the colour, or drawing shapes.
6. Build a robot that follows a black line on a contrasting surface using line-following sensors.
7. Designing a 3D Model of a Robotic Arm and Grippers Using Software
8. Implement a PID controller for a robotic arm or mobile robot and simulate its performance in tracking a desired trajectory.
9. Demonstration of parts and functions of a drone.
10. Demonstration of effects of forces, maneuvers of a drone by roll, pitch and yaw.
11. Demonstration of various sensors and battery management used in drones.
12. Build a prototype drone to record videos and photos.
13. Make a drone for a certain payload.

NOTE: *Any **10** experiments can be conducted from the above list of Experiments*

Virtual Labs: http://vlabs.iitkgp.ac.in/mr/index.html

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester

SALESFORCE DEVELOPER CATALYST

(Common to All Branches)

Course Category	Skill Enhancement Course	**Course Code**	
Course Type	Laboratory	**L-T-P-C**	0-1-2-2
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSE OBJECTIVES	
1	To be intended for an individual who has experience developing and deploying basic business logic and user interfaces.
2	Train the individuals to the next level, who have the knowledge, skills, and experience in building custom applications on the Lightning Platform.
3	To learn the fundamental programmatic capabilities of the Lightning Platform to develop custom business logic and interfaces to extend Salesforce using Apex, Visualforce, and basic Lightning Components.
4	To use the programmatic capabilities in practice with the Lightning Platform, including practical application of the skills and concepts.

COURSE OUTCOMES		
Up on successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Acquire a fundamental understanding of the CRM and Salesforce tools necessary to effectively generate useful applications on the Salesforce platform to support the customer requirements.	K3
CO2	Gain experience in using the Salesforce tools and techniques of CRM to complete projects focused on obtaining actionable insights from complex data.	K3
CO3	Dive deeply into a Salesforce Developer practice to fully prepare to use knowledge gained in the course to add significant value in a professional setting.	K3

K1-Remembering,K2-Understanding,K3-Applying,K4-Analyzing,K5-Evaluating,K6-Creating

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	1	0	2	0	0	0	0	0	1
CO2	2	2	1	0	1	0	0	0	0	0	1
CO3	2	2	1	0	1	0	0	0	0	0	1

COURSE CONTENT :

Experiment 1

Platform Developer I Exam Overview; Apex & .NET Basics: Map .NET Concepts to the Lightning Platform, Understand Execution Context, Use Asynchronous Apex, Debug and Run Diagnostics. Formulas and Validations: Use Formula Fields, Implement Roll-Up Summary Fields, Create Validation Rules.

Data Modeling: Understand Custom & Standard Objects, Create Object Relationships, Work with Schema Builder.

Data Management: Import Data, Export Data. (Sessions- 04)

Experiment-2

Approve Records with Approval Processes: Customize How Records Get Approved, Build an Approval Process.

Record-Triggered Flows: Triggered Flows, Build a Record-Triggered Flow, Add a Scheduled Task to Your Flow, Meet Flow Trigger Explorer.

Search Solution Basics: Choose the Right Search Solution, Build Search for Common Use Cases, Optimize Search Results.

Apex Basics & Database: Get Started with Apex, Uses Objects, Manipulate Records with DML, Write SOQL Queries, Write SOSL Queries.

Apex Triggers: Get Started with Apex Triggers, Bulk Apex Triggers. (Sessions-07)

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Department of Mechanical Engineering

Experiment 3 :
Triggers and Order of Execution: Performing a sequence of events in an order when a record is saved with an insert, update, or upsert statement.
Asynchronous Apex: Asynchronous Processing Basics, Use Future Methods, Use Batch Apex, Control Processes with Queueable Apex, Schedule Jobs Using the Apex Scheduler, Monitor Asynchronous Apex. (Sessions-06)

Experiment 4:
Visual force & Lightning Experience: Use Visualforce in Lightning Experience, Develop Visual force Pages for Lightning Experience, Explore the Visualforce App Container, Share Visual force Pages Between Classic and Lightning Experience, Manage Navigation, Understand Important Visual Design Considerations, Know Which Features to Avoid in Lightning Experience.
Visual force Basics: Get Started with Visual force, Create & Edit Visual force Pages, Use
Simple Variables and Formulas, Use Standard Controllers, Display Records, Fields, and Tables, Input Data Using Forms, Use Standard List Controllers, Use Static Resources, Create & Use Custom Controllers. (Sessions-06)

Experiment 5:
Lightning Web Components Basics: Discover Lightning Web Components, Create Lightning Web Components, Deploy Lightning Web Component Files, Handle Events in Lightning Web Components, Add Styles and Data to a Lightning Web Component.
Secure Server-Side Development: Write Secure Apex Controllers, Mitigate SOQL Injection, Mitigate Cross-Site Request Forgery. (Sessions-04)

Experiment 6:
Developer Console Basics: Get Started with the Developer Console, Navigate and Edit
Source Code, Generate and Analyze Logs, Inspect Objects at Checkpoints, Execute SOQL and SOSL Queries.
Command-Line Interface: Learn About the Command-Line Interface, Explore Command Structure and Navigation, Set Up Command-Line Tools.
Org Development Model: Plan for Changes to Your Org, Develop and Test Changes Locally, Test and Deploy Changes. (Sessions-04)

Experiment 7:
Apex Testing: Get Started with Apex Unit Tests, Test Apex Triggers, Create Test Data for Apex Tests.
Find and Fix Bugs with Apex Replay Debugger: Launch Your Trailhead Playground, Set
Up Visual Studio Code, Set Up Apex Replay Debugger, Debug Your Code.
Debug Logs: Debug Log Details, Debug Log Order of Precedence, Debug Log Levels,
Searching a Debug Log, Delete Debug Logs, Debug Log Filtering for Apex. (Sessions-05)

Experiment 8:
Project with Case Study:
Apex Specialist: Concepts Tested in This Superbadge, Apex Triggers, Asynchronous Apex, Apex Integration, Apex Testing. (Sessions-12)

TEXTBOOKS:
1. Michael Wicherski, “Beginning Salesforce Developer”, 2018, Wiley Apress Publisher.
2. Paul Battisson, “Learning Salesforce Development with Apex”, 2020, BPB Publishers.
3. Dan Appleman, “Advanced Apex Programming in Salesforce”, 2018, PACKT Publisher.
4. Paul Battisson, “Mastering Apex Programming”, 2020, PACKT Publisher.

REFERENCE BOOKS:
1. Mohith Shrivastava, “Learning Salesforce Lightning Application Development: Build and test
Lightning Components for Salesforce Lightning Experience using Salesforce DX”, 2018, PACKT.
2. Brian Cline, “Lightning Web Components (LWC) Development on the Salesforce Platform: A
Salesforce developer's guide to building, testing, and deploying Lightning Web Components”, 2023, PACKT Publisher.
3. Saifullah Saifi and Ashwini Kumar Raj, “Cloud Computing Using Salesforce”, 2021 BPB.

e-Resources :
1. Use the Trailhead Platform: https://www.salesforce.com/blog/what-is-trailhead/
The Salesforce Developer Trailmix:
2. https://trailhead.salesforce.com/users/trjha3/trailmixes/salesforce-developer-catalyst-v-3-0

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PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

III Year II Semester

TECHNICAL PAPER WRITING & IPR

(Common to CSE, IT, CSE (AIML), CSE (AI), CSE (DS),CSE (CS), ECE,ME & CE)

Course Category	Audit Course	**Course Code**	
Course Type	Theory	**L-T-P-C**	2-0-0-
Prerequisites		**Continuous Internal Assessment** **Semester End Examination** **Total Marks**	30 70 100

COURSEOBJECTIVES	
1	To develop the ability to write and present technical research papers.
2	To impart knowledge on IPR and its importance in innovation and research.
3	To guide students in understanding patents, copyrights, trademarks, and their application in computing and engineering.

COURSE OUTCOMES		
Up on successful completion of the course, the student will be able to:		**Cognitive Level**
CO1	Identify and apply the structure and principles of technical writing to prepare clear and well-organized technical documents.	K2
CO2	**Conduct a literature survey** using academic databases and reference management tools to support research and identify gaps in existing knowledge.	K2
CO3	Draft and format technical papers suitable for submission to conferences and journals, adhering to ethical and publication standards.	K3
CO4	**Explain the fundamental concepts of Intellectual Property Rights (IPR)** including patents, copyrights, trademarks, and trade secrets, especially in the context of computing and innovation.	K2
CO5	**Analyze patentability criteria** and outline the procedure for filing a patent in India and internationally.	K4

K1-Remembering, K2-Understanding,K3-Applying,K4-Analyzing,K5-Evaluating,K6-Creating

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	3	1	0	1	3	1	1	1	1	1
CO2	1	2	3	0	1	2	1	1	1	1	1
CO3	1	3	1	0	1	3	1	1	1	1	1
CO4	3	2	1	0	3	1	1	1	2	2	2
CO5	1	2	2	0	3	1	1	1	2	2	2

PRAGATI ENGINEERING COLLEGE

(AUTONOMOUS)

Department of Mechanical Engineering

CURSE CONTENT

UNIT 1:

Introduction to Technical Writing

Meaning and importance of technical writing in research and development Types of technical documents: journal papers, conference papers, white papers, reportsStructure of a technical paper (IMRAD format) Characteristics of effective writing: clarity, conciseness, coherence Common mistakes in technical writing Tools for writing and formatting (LaTeX, MS Word)

Practical: Write a 300-word abstract on a chosen technical topic

UNIT 2:

Research Methodology and Literature Survey

Research problem identification and formulation Research process and ethics Literature review: importance, sources (journals, patents, databases) Referencing styles (APA, IEEE, MLA) Use of digital tools (Google Scholar, Scopus, Mendeley, Zotero) Plagiarism: types, detection tools (Turnitin, Grammarly)

Practical: *Conduct a literature survey and create a reference list for a chosen topic*

UNIT 3:

Manuscript Preparation and Publication

Components of a manuscript: abstract, keywords, introduction, methodology, results, discussion, conclusion, references Guidelines for authors (IEEE, Springer, Elsevier, ACM) Peer review process and revisions Journal selection and impact factor Ethics in publishing and copyright issues Predatory journals and conferences

Practical*: Draft a technical paper on a mini-project done in earlier semesters*

UNIT 4:

Introduction to Intellectual Property Rights (IPR)

Definition and need for IPR Categories of IPR: patents, copyrights, trademarks, trade secrets Indian and international IPR laws (WIPO, TRIPS) Role of IPR in academic and industrial R&D Case studies of IPR in computer science and software

P*ractical****: Identify the IPR involved in a case study (e.g., a software product or invention)***

UNIT 5:

Patent Filing and Commercialization :

Patentability criteria: novelty, inventive step, industrial application Patent filing procedure in India and USA Provisional vs complete specification Patent databases: Espacenet, INPADOC, IP India Patent search and analysis Commercialization of IP: licensing, technology transfer, startups

Practical: *Draft a simple provisional patent specification based on a student project*

Textbooks *:*

1.M.A. Jayaram, Technical Communication, *Himalaya Publishing House*

2.Deborah B. Stanley, Practical Guide to Writing Technical Reports, *OUP*

3.R. Subbaram, Handbook of Indian Patent Law and Practice

Reference Books

*1.****P. Narayanan***, Intellectual Property Law

2.WIPO & Indian Patent Office websites for updates and resources