CONTENT

Program Educational Objectives (PEOs):

PEO 1	Apply the principles of Mechanical Engineering in a variety of areas practically
PEO 2	Prepare the diploma students with employability skills
PEO 3	Motivate the students to pursue higher education Such as graduate education or other training programs in engineering science or other professional fields.
PEO 4	Inculcate the entrepreneurship skills among the students
PEO 5	Prepare the students with professional background and ethical behavior, social responsibility, and diversity, both as individuals and in team environments.

Program Outcomes (POs):

The students of Diploma in Mechanical Engineering will be able to demonstrate the following:

PO 1	An ability to apply knowledge of mathematics, science, and engineering to design, conduct experiments, analyze and provide solution for engineering problems
PO 2	An ability to apply discipline - specific knowledge with an understanding of the limitations to solve core and/or applied engineering problems
PO 3	Demonstrate knowledge to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
PO 4	Understand and apply professional ethics and responsibilities and norms of the engineering practice.
PO 5	An ability to function as an individual, and as a member or leader in diverse/multidisciplinary teams.
PO 6	An ability to identify, formulate, and solve engineering problems
PO 7	An ability to communicate effectively
PO 8	A recognition of the need for, and an ability to engage in lifelong learning
PO 9	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
PO 10	Ability to engage in independent and life-long learning in the context of technological changes.

STRUCTURE OF DIPLOMA IN MECHANICAL ENGINEERING PROGRAM

S. No.	Category of Courses	Code of Courses	Credits
1.	Humanities & Social Science Courses	HS	8
2.	Basic Science Courses	BS	14
3.	Engineering Science Courses	ES	21
4.	Program Core Courses (Branch specific)	PC	48
5.	Program Elective Courses (Branch specific)	PE	12
6.	Open Elective Courses (from other technical and/or emerging subjects)	OE	6
7.	Project	PR	11
	Seminar	SE	
	Summer Internship (in industry or elsewhere)	SI	
8.	Audit Courses	AU	Nil
		Total	**120**

EVALUATION SCHEME FOR THREE YEARS
DIPLOMA COURSE IN MECHANICAL ENGINEERING
(*DAY COURSES*) - 1 YEAR

First Semester

Sr. No	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1.	MEHS101	Communication Skills	HS	2	1	0	3	60	90	150
2.	MEBS102	Applied Physics	BS	2	1	0	3	60	90	150
3.	COES103	IT System & Computer Programming	ES	2	0	0	2	40	60	100
4.	EEES104	Fundamentals of Electrical Engineering	ES	2	0	0	2	40	60	100
5.	MEBS105	Applied Mathematics-I	BS	2	1	0	3	60	90	150
Practical Courses										
1.	MEHS111	Communication Skills Lab	HS	0	0	2	1	30	20	50
2.	MEBS112	Applied Physics Lab	BS	0	0	2	1	30	20	50
3.	COES113	IT System & Computer Programming Lab	ES	0	0	4	2	60	40	100
4.	EEES114	Fundamentals of Electrical Engineering Lab	ES	0	0	2	1	30	20	50
5.	MEES116	Engineering Graphics	ES	0	0	4	2	60	40	100
						Total	**20**	**470**	**530**	**1000**

HS: Humanities & Social Science Courses BS: Basic Science Courses

ES: Engineering Science Courses

EVALUATION SCHEME FOR THREE YEARS
DIPLOMA COURSE IN MECHANICAL ENGINEERING
(*DAY COURSES*) - 1 YEAR

Second Semester

Sr. No	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1.	CEES201	Engineering Mechanics	ES	2	1	0	3	60	90	150
2.	MEBS202	Applied Chemistry	BS	2	1	0	3	60	90	150
3.	MEES203	Fundamentals of Mechanical Engineering	ES	2	1	0	3	60	90	150
4.	ECES204	Fundamentals of Electronics Engineering	ES	2	0	0	2	40	60	100
5.	MEBS205	Applied Mathematics-II	BS	2	1	0	3	60	90	150
Practical Courses										
1.	CEES211	Engineering Mechanics Lab	ES	0	0	2	1	30	20	50
2.	MEBS212	Applied Chemistry Lab	BS	0	0	2	1	30	20	50
3.	ECES214	Fundamentals of Electronics Engineering Lab	ES	0	0	2	1	30	20	50
4.	MEES216	Engineering Workshop Practice	ES	0	0	4	2	60	40	100
5.	MEHS217	Sports & Yoga	HS	0	0	2	1	30	20	50
Audit Courses										
1.	MEAU200	Environmental Science	AU	2	0	0	0			
						Total	**20**	**460**	**540**	**1000**

HS: Humanities & Social Science Courses
BS: Basic Science Courses
ES: Engineering Science Courses
AU: Audit Courses

Note: Summer Internship-I of 4 weeks after 2nd semester

EVALUATION SCHEME FOR THREE YEARS
DIPLOMA COURSE IN MECHANICAL ENGINEERING
(*DAY COURSES*) - 2 YEAR

Third Semester

Sr. No	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1.	MEPC301	Applied Thermodynamics	PC	2	1	0	3	60	90	150
2.	MEPC302	Fluid Mechanics & Fluid Machines	PC	2	1	0	3	60	90	150
3.	MEPC303	Material Science & Engineering	PC	2	0	0	2	40	60	100
4.	MEPC304	Manufacturing Process	PC	3	0	0	3	60	90	150
5.	MEPC305	Mechanics of Solid	PC	3	0	0	3	60	90	150
Practical Courses										
1.	MEPC311	Applied Thermodynamics Lab	PC	0	0	2	1	30	20	50
2.	MEPC312	Fluid Mechanics & Hydraulic Machinery Lab	PC	0	0	2	1	30	20	50
3.	MEPC313	Material Testing Lab	PC	0	0	2	1	30	20	50
4.	MEPC314	Manufacturing Process I Lab	PC	0	0	2	1	30	20	50
5.	MESI316	Summer Internship I (4 weeks) after 2nd Semester	SI	0	0	0	2	100		100
						Total	**20**	**500**	**500**	**1000**

PC: Program Core Courses

SI: Summer Internship Courses

EVALUATION SCHEME FOR THREE YEARS
DIPLOMA COURSE IN MECHANICAL ENGINEERING
(*DAY COURSES*) - 2 YEAR

Fourth Semester

Sr. No	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1.	MEPC401	Advanced Manufacturing Processes	PC	3	0	0	3	60	90	150
2.	MEPC402	Theory of Machines & Mechanisms	PC	2	0	0	2	40	60	100
3.	MEPC403	Thermal Engineering	PC	3	0	0	3	60	90	150
4.	MEPE404	Material Handling System	PE	2	0	0	2	40	60	100
5.	MEPE405	Hybrid Vehicle	PE	3	0	0	3	60	90	150
Practical Courses										
1.	MEPC411	Manufacturing Engineering -II Lab	PC	0	0	2	1	30	20	50
2.	MEPC412	Machine & Mechanism Lab	PC	0	0	2	1	30	20	50
3.	MEPC413	Thermal Engineering Lab	PC	0	0	2	1	30	20	50
4.	MEPC414	Advance Engineering Graphics	PC	0	0	4	2	60	40	100
5.	MEPR416	Minor Project	PR	0	0	4	2	60	40	100
Audit Courses										
1.	MEAU400	Indian Knowledge & Tradition	AU	2	0	0	0			
						Total	**20**	**470**	**530**	**1000**

PC: Program Core Courses
PE: Program Elective Courses
PR: Project Courses
AU: Audit Courses

Note: Summer Internship-II of 4 weeks after 4th semester

EVALUATION SCHEME FOR THREE YEARS
DIPLOMA COURSE IN MECHANICAL ENGINEERING
(*DAY COURSES*) - 3 YEAR

Fifth Semester

Sr. No	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1.	MEPC501	Design of Machine Elements	PC	2	1	0	3	60	90	150
2.	MEPC502	Measurements & Metrology	PC	2	1	0	3	60	90	150
3.	MEPC503	Automobile Engineering	PC	2	0	0	2	40	60	100
4.	MEPE504	Power Plant Engineering	PE	2	0	0	2	40	60	100
5.	MEOE505	Renewable Energy Technologies	OE	3	0	0	3	60	90	150
Practical Courses										
1.	MEPC511	Machine Drawing	PC	0	0	4	2	60	40	100
2.	MEPC512	Measurements & Metrology Lab	PC	0	0	2	1	30	20	50
3.	MEPC513	Automobile Engineering Lab	PC	0	0	2	1	30	20	50
4.	MESI516	Summer Internship II	SI	0	0	0	2	60	40	100
5.	MEPR517	Major Project-I	PR	0	0	2	1	50		50
						Total	**20**	**490**	**510**	**1000**

PC: Program Core Courses
PE: Program Elective Courses
OE: Open Elective Courses
HS: Humanities & Social Science Courses
SI: Summer Internship Courses
PR: Project Courses

EVALUATION SCHEME FOR THREE YEARS
DIPLOMA COURSE IN MECHANICAL ENGINEERING
(*DAY COURSES*) - 3 YEAR

Sixth Semester

Sr. No	Code No	Subject	Course Type	Periods/Week			Credits	Distribution of Marks		
				L	T	P		IA	UE	Total
Theory Courses										
1.	MEHS601	Entrepreneurship and Start-ups	HS	3	0	0	3	60	90	150
2.	MEPC602	Computer Aided Design & Manufacturing	PC	3	0	0	3	60	90	150
3.	MEPE603	Refrigeration & Air-conditioning	PE	3	0	0	3	60	90	150
4.	MEOE604	Mechatronics	OE	3	0	0	3	60	90	150
Practical Courses										
1.	MEPC612	Auto CAD Lab	PC	0	0	4	2	60	40	100
2.	MEPE613	Refrigeration & Air-conditioning Lab	PE	0	0	2	2	60	40	100
3.	MESE616	Seminar	SE	2	0	0	1	50	0	50
4.	MEPR617	Major Project-II	PE	0	0	6	3	90	60	150
Audit Courses										
1.	MEAU600	Indian Constitution	AU	2	0	0	0			
						Total	**20**	**500**	**500**	**1000**

PC: Program Core Courses
PE: Program Elective Courses
OE: Open Elective Courses
SE: Seminar Courses
PR: Project Courses
AU: Audit Courses

Course Code	:	MEHS101
Course Title	:	Communication Skills
Number of Credits	:	3 (L:2, T: 1, P: 0)
Prerequisites	:	Nil
Course Category	:	BS

COURSE OBJECTIVES:

- To develop confidence and proficiency in speaking English with correct pronunciation, while enhancing the four key areas of communication: listening, speaking, reading and writing.
- To build confidence in public speaking, group discussions and presentations, enabling students to express their ideas effectively and prepare for academic, professional and social success.
- To introduce personality development practices by fostering qualities such as self-confidence, adaptability, emotional intelligence and resilience to help students handle personal and professional challenges effectively.
- To enhance leadership and teamwork skills by promoting collaboration, efficient team management and the ability to take initiative, empowering students to thrive in group dynamics and leadership roles.
- To align communication and interpersonal skills with professional ethics and career aspirations, equipping students with the ability to engage effectively in workplace environments and contribute to organizational goals.

COURSE CONTENT

UNIT-I: BASICS OF COMMUNICATION SKILLS IN ENGLISH

- Introduction to Communication: Meaning, definition and process of communication.
- Types of Communication: Formal and informal; verbal, non-verbal and written.
- Barriers to Effective Communication: Physical, linguistic, psychological, cultural, organisational, semantic and technical barriers.
- 7 Cs of Effective Communication: Considerate, Concrete, Concise, Clear, Complete, Correct, Courteous.
- Art of Effective Communication: Choosing words, voice modulation, clarity, time management and simplification of words.
- Technical Communication.

UNIT-II: SOFT SKILLS AND LIFE SKILLS FOR PERSONAL EXCELLENCE

- **Soft Skills**: Personal attributes and interpersonal abilities that enhance job performance and career prospects and interpersonal interactions. Soft skills help build effective relationships, clear communication and adaptability in professional environments.

- **Life Skills: T**ools for managing personal and professional challenges, developing self-awareness and self-analysis, understanding one's strengths and weaknesses. Life skills also encompass adaptability with a positive attitude, resilience to overcome setbacks and stress; emotional intelligence to recognise, understand and manage one's emotions while responding to others, and empathy which promotes better relationships by understanding and sharing others' feelings.

UNIT-III: READING COMPREHENSION

Comprehension, Vocabulary Enrichment, Grammar Exercises based on reading of the following texts:

Section-1 (Stories)

- Sparrows by K. A. Abbas
- The Gift of the Magi by O. Henry
- The Happy Prince by Oscar Wilde
- Games at Twilight by Anita Desai

Section-2 (Poems)

- Night of the Scorpion by Nissim Ezekiel
- Stopping by Woods on a Snowy Evening by Robert Frost
- Where the Mind is Without Fear by Rabindranath Tagore
- My Mother at Sixty Six by Kamla Das

UNIT-IV: PROFESSIONAL WRITING

- The Art of Paragraph Writing
- Letters: Business and Personnel
- Drafting notices, minutes of a meeting, etc.

UNIT-V: VOCABULARY AND GRAMMAR

- Commonly used words: Word Meaning and Usage, Synonyms and Antonyms, Dictionary skills, Contextual Vocabulary
- Glossary of Official Correspondence
- One-word substitution, Idioms and Phrases
- Tenses and Verbs Usage (Through Translation between English and Hindi)
- Transformation of sentences: Interchange of Degrees of Comparison, Active and Passive Voice, Direct and Indirect Speech

- Common errors: Grammatical errors, Pronunciation errors, Vocabulary errors, Wrong use of Idiomatic Expressions, etc.

REFERENCE BOOKS:

1. O'Connor, J. D. Better English Pronunciation. Cambridge University Press, 1980.
2. Murray, Lindley. An English Grammar: Comprehending Principles and Rules. Wilson and Sons, 1980.
3. Tiwari, Anjana. Communication Skills in English. Khanna Book Pub, 2022.
4. Kumar, Kulbhushan. Effective Communication Skills. Khanna Pub. House, 2018.
5. Maison, Margaret M. Examine Your English. Orient Longman, 1964.
6. Rizvi, M. Ashraf. Effective Technical Communication. McGraw Hill, 2002.
7. Nielson, John. Effective Communication Skills. Xlibris, 2008.
8. Cambridge Advanced Learner's Dictionary. 4th ed., Cambridge Uni. Press, 2018.
9. Roget, Peter Mark. Roget's Thesaurus of English Words and Phrases. Edited by George Davidson, Penguin Books, 2004.
10. Raman, Meenakshi, and Sangeeta Sharma. Technical Communication: Principles and Practice. 2nd ed., Oxford University Press, 2011.
11. Swan, Michael. Practical English Usage. 4th ed., Oxford University Press, 2016.
12. Balasubramanian, T. A, Textbook of English Phonetics for Indian Students. Macmillan, 1981.
13. Murphy, Raymond. Intermediate English Grammar. Cambridge Univ. Press.
14. https://wordpowermadeeasy.files.wordpress.com/2007/12/gre_wordlist.pdf

COURSE OUTCOMES:

The students will be able to:

CO1	Develop conceptual clarity on communication and its components, identify and overcome barriers to effective communication, apply the 7 Cs for clarity and precision; refine verbal and non-verbal skills through word choice, voice modulation and master technical communication for professional excellence.
CO2	Acquire essential soft and life skills to enhance personal and professional effectiveness, foster strong interpersonal relationships, cultivate adaptability and resilience, apply and demonstrate emotional intelligence and empathy for meaningful interactions and career success.
CO3	Enhance reading comprehension through diverse literary texts, enrich vocabulary, strengthen grammar and develop critical thinking and analytical skills for deeper textual interpretation. Foster a lifelong learning mindset, develop and promote empathy, resilience, cultural awareness and values such as patriotism, familial bonds, scientific attitude and self-awareness, logic and rationality.
CO4	Attain proficiency in professional writing by mastering paragraph structuring, composing effective business and personal letters and drafting formal documents such as notices and meeting minutes with clarity and precision.
CO5	Strengthen vocabulary and grammar skills through word usage, synonyms, antonyms, and contextual vocabulary, master official correspondence terminology, enhance accuracy in sentence transformation, tense usage and translation and rectify common errors in grammar, pronunciation and idiomatic expressions for effective communication.

Course Code	:	MEBS102
Course Title	:	Applied Physics
Number of Credits	:	3 (L:2, T: 1, P: 0)
Prerequisites	:	High School Physics Course
Course Category	:	BS

COURSE OBJECTIVES:

- Develop a foundational understanding of concepts of physics.
- Enhance observational and analytical skills to predict and explain the behaviour of physical systems using laws of physics.
- Emphasize the practical application of physical laws and concepts in solving broad-based engineering problems across diverse fields.
- Foster an appreciation of technology-driven applications by linking theoretical knowledge to real-world engineering problems and technological innovations.

COURSE CONTENT:

UNIT-I: PHYSICAL WORLD, UNITS, AND MEASUREMENTS

Physical Quantities: Fundamental and derived units, Systems of units (FPS, CGS, SI). Dimensions: Dimensional formulae, principle of homogeneity, derivation of simple equations and correctness of physical equations; Measurements: Least count, significant figures, error analysis and measuring instruments.

UNIT-II: VECTORS AND MECHANICS

Scaler and vector quantities: Addition and subtraction of vectors, scaler and vector product, resolution of vector, Conservation of momentum, Work and energy, kinetic and potential energy, work-energy theorem.

UNIT-III: ELECTROMAGNETISM

Electric Field: Coulomb's law, electrostatic field, Gauss's law, and its applications (charged sheet, sphere etc.), electrostatic potential; Capacitance: parallel plate capacitor, series and parallel combinations, energy stored in capacitor; Electric Current: Resistance, Kirchhoff's laws and their applications; Generation of Magnetic Field: Biot-Savart law, magnetic field due to current carrying straight wire and circular loop. Permanent magnets; Effect of Magnetic Field: Force on current-carrying wires, torque on current-carrying loop; Devices: Moving coil galvanometer and its conversion to ammeter and voltmeter.

UNIT-IV: HEAT AND THERMAL PROPERTIES:

Heat, modes of heat transfer, specific heat (C_p and C_v), Scales of temperature and thermometer, thermocouple and Seebeck effect. Thermal conductivity, thermal expansion, engineering applications

UNIT-V: WAVES AND OPTICS

Simple Harmonic Motion: Time period, frequency, amplitude, transverse and longitudinal waves, superposition, principle of inference, Reflection and Refraction: Total internal

reflection and its application in fiber optics. Lens formula, magnification; optical instruments: simple microscope, compound microscope and astronomical telescope; LASER and applications.

REFERENCE BOOKS:

1. Physics Textbook for Class XI (Part 1 and Part 2) & XII (Part 1 and Part 2), NCERT.
2. David Halliday, Robert Resnick & Jearl Walker, Principles of Physics, John Wiley and Sons.
3. Vivek Talati & Vinod Kumar Yadav, Applied Physics-I (with Lab manual), Khanna Book Publishing Co. (P) Ltd.
4. Hussain Jeevakhan, Applied Physics-II (with lab manual), Khanna Book Publishing Co. (P) Ltd.
5. A Manual of Higher Secondary Physics Laboratory Kit, NCERT.
6. Mudassir M. Husain & M. Rafat, Physics Through Laboratory Exercises, Cadplan Publishers.
7. e-books/e-tools/learning physics software/YouTube videos/websites etc.

COURSE OUTCOMES:

The students will be able to:

CO1	Identify physical quantities and their dimensions, use accurate units in engineering contexts, apply rules of errors propagation and significant figures in calculations.
CO2	Demonstrate the ability to perform vector addition and subtraction, resolve vectors, and calculate scalar and vector products; analyze mechanical systems using the principles of conservation of momentum and work-energy theorem
CO3	Understand the basics of electrostatics, current electricity, and electromagnetism; utilise Kirchhoff's laws to solve DC circuits problems; appreciate the application of basic laws of electromagnetism in device applications.
CO4	Understand the principles of heat transfer, specific heat (Cp and Cv) and the Seebeck effect; analyze temperature scales and thermometers; evaluate thermal conductivity, thermal expansion, and their engineering applications in real-world scenarios.
CO5	Describe the working of optical instruments based on reflection and refraction of light; identify the applications of lasers in various fields, such as medicine, telecommunications, and manufacturing; understand the fundamental principles of simple harmonic motion and wave motion, including time period, frequency, amplitude, and the differences between transverse and longitudinal waves

Course Code	:	COES103
Course Title	:	IT System & Computer Programming
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	Nil
Course Category	:	Engineering Science Course

COURSE OBJECTIVES:

- To understand the fundamentals of computers, information technology and data representation
- To analyze computer system based on hardware, software, and different types of memories
- To apply algorithms and flowchart for writing programs using C language
- To understand C programming using arrays and functions
- To apply structures and pointers for writing programs using C language

COURSE CONTENTS:

UNIT-I: INFORMATION TECHNOLOGY AND DATA PERESENTATION

Digital computer systems, Characteristics, Digital vs. Analog computer systems, History, Computer generations, Types of computers and their classifications, Application of computer in various fields, Types of Personal Computers (PC), PC setup and Basic Input Output System; Working knowledge of PC software including Word Processor; Introduction to Information Technology (IT), Components of an IT system: Hardware, Software, Networks, Data, People, and Processes; Data representation: Number systems, radix, decimal, binary, octal, hexadecimal, conversion, and Complements: 1's complement, 2's complement, 9's complement, and 10's complement.

UNIT-II: COMPUTER HARDWARE, SOFTWARE, AND MEMORIES

Elements of computer hardware, CPU, I/O devices, storage and media used in PCs, Computer software: Types of software, System software, Application software, Introduction to Operating System (OS), Functions and types of OS, DOS commands, Memory system of a PC, Primary memory, Random access memory, Read only memory, Secondary memory, Types of secondary Storage, Access mechanism of storage devices.

UNIT-III: ELEMENTS OF ALGORITHMS AND PROGRAMMING IN C

Computer languages, Generation of languages, Translators- Assemblers, Interpreters, Compilers, Algorithm, Pseudo-code, Flowcharts rules and symbols, Structured programming concepts, Introduction to 'C', importance of C, basic structure of a C program, constants, variables and data types, Operators and expressions, managing I/O operations, Control statement: 'IF' statement and its various forms, goto statement, for, while and do- while loops, Switch decision making statement.

UNIT-IV: ARRAY AND FUNCTIONS

Introduction to array, array notation, storage and representation, manipulating array elements, using multidimensional arrays, Functions: Built-in and user defined functions and their applications; Use of built-in graphics functions to draw 2D objects.

UNIT-V: STRUCTURES AND POINTERS

Introduction to structures, Purpose, and usage of structures, declaring structures, assigning of structures, Pointers: Introduction, Address operator, and Basic programs using pointers, File handling, sequential and random-access files, Memory allocation, Command line parameters.

REFERENCE BOOKS:

1. Thareja R., "Computers Fundamentals and Programming in C," Oxford University Press 3rd Edition, 2023, ISBN-10: 9354977898
2. Kanetkar Y., "Let Us C: Authentic Guide to C Programming Language," BPB Publications, 20th Edition, 2024, ISBN-10: 9355515510
3. Ram B. and Kumar S., "Computer Fundamentals: Architecture and Organization," New Age International Private Limited, 6th Edition, 2020, ISBN-10: 9388818555
4. Balagurusamy E., "Computing Fundamentals and C Programming," McGraw Hill Education, 2nd Edition, 2017, ISBN-10: 9352604164

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1	Explain about computer system, components of IT system and different ways of data representation
CO2	Differentiate among computer hardware, computer software, and memories

CO3	Write C programs based on algorithm and flowchart
CO4	Implement algorithms using array and functions of C programming language
CO5	Demonstrate the use of structures and pointers in C programming language

Course Code	:	EEES104
Course Title	:	Fundamentals of Electrical Engineering
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	ES

COURSE OBJECTIVES:

- To provide basic knowledge of electric and magnetic quantities and their units.
- To teach the basic concepts of electric and magnetic circuits as well as their inter-relations.
- To learn the various electrical rules/laws/theorems to help students deal with electrical engineering applications in industrial processes of different fields.
- To understand the concepts of alternating current and voltage, impedance, and phase angle.
- To learn the construction and principle of different types of transformers and rotating machines.

COURSE CONTENTS:

UNIT I: ELECTRIC CIRCUITS

Basic concepts of charge; Electrical quantities and their units, Ohm's law; Resistance, Resistances in series; Resistances in parallel; Kirchhoff's laws & their applications; Network theorems; Laws of resistance; Temperature coefficient of resistance; Grouping of cells; Numerical problems.

UNIT-II: ELECTROMAGNETISM

Introduction to electromagnetism; Magnetic field at the axis of a solenoid; Force on a current carrying conductor placed in the magnetic field; Force between two parallel current carrying conductors.

Faraday's laws of electromagnetic induction; Lenz's law; Dynamically and statically induced emfs; Self and mutual inductances; Coefficient of coupling; Simple numerical problems.

UNIT III: MAGNETIC CIRCUITS

Magnetic flux & flux density; Magnetizing force; Magneto motive force (MMF); Absolute and relative permeability; Reluctance; Series and parallel magnetic circuits; Ampere-turn calculations; Leakage flux; Leakage factor; Analogy between electric and magnetic circuits; Numerical problems.

UNIT IV: A.C. CIRCUITS

Concept of alternating current and voltage; Cycle; Frequency; Periodic time; Amplitude; Angular velocity; Average value; RMS value; Form factor; Peak factor; Impedance; Phase angle; Mathematical and phasor representation of alternating emf and current; A.C. through pure resistance, pure inductance & pure capacitance; Concept of conductance, susceptance & admittance; Power factor, A.C in R-L, R-C, R-L-C series and parallel circuits.

UNIT V: TRANSFORMER AND ROTATING MACHINES

General construction and principle of different type of transformers; Emf equation and transformation ratio of transformers; Auto transformers; Construction and working principle of motors; Basic equations and characteristic of motors; B-H curve; Concept of eddy current and hysteresis; Hysteresis loop; Eddy current and hysteresis losses.

REFERENCE BOOKS:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House
2. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN: 978-0- 07-0088572-5
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition ISBN: 9781107464353
4. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405
5. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924375
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN : 97881236529513

COURSE OUTCOMES:

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

CO1	Analyze electric circuits using Ohm's law, Kirchhoff's laws, and network theorems.
CO2	Understand the fundamental principles of electromagnetism, including electromagnetic induction and magnetic forces.
CO3	Design and analyze magnetic circuits, including magnetizing force, reluctance, and permeability.
CO4	Analyze and design AC circuits, including impedance, phase angle, and power factor.
CO5	Understand the construction, principle, and operation of transformers and rotating machines.

Course Code	:	MEBS105
Course Title	:	Applied Mathematics-I
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Nil
Course Category	:	BS

COURSE OBJECTIVES:

- To introduce the concepts of angles, trigonometric ratios, and their applications in solving problems involving allied angles, sum and difference formulas, and transformations between trigonometric identities.
- To provide a thorough understanding of sequences, series, and partial fractions to solve problems involving arithmetic and geometric progressions, and decomposition of rational expressions for real-world applications.
- To equip students with the knowledge of permutations, combinations, and the binomial theorem to analyze and compute mathematical problems efficiently, including approximations and expansions.
- To teach the properties and operations of determinants and matrices, including their application to solving linear simultaneous equations using Cramer's rule and the inverse matrix method.
- To enable students to understand and manipulate complex numbers in Cartesian and polar forms, perform operations using De-Moivre's theorem, and apply these concepts in advanced mathematical and engineering problems.

COURSE CONTENTS:

UNIT-I: TRIGONOMETRY

Grades, radians and their conversions, Trigonometrical ratios of allied angles (without proof), sum, difference formulae and their applications (without proof), Product formulae (transformation of product to sum, differences and vice-versa), Trigonometrical ratios of multiple and sub-multiple angles, Statement of cosine formula, sine formula, Napier's, half angle formula and Heron's formula

UNIT-II: ALGEBRA

Sequences and series: Arithmetic progression, its nth term, sum to n terms. Geometric progression, its n^{th} term, sum to n terms and sum of infinite terms. Finite sum of squares and cubes of natural numbers; Partial fraction: Definition of polynomial fraction and partial fractions, proper and improper fraction. To resolve proper fraction into partial fraction with denominator containing non-repeated linear factors, repeated linear factor and irreducible non-repeated quadratic factors.

UNIT-III: COMBINATORY AND BINOMIAL THEOREM

Permutations and Combinations: Basic Counting techniques, Value of P (n, r) and C (n, r), and their applications; Binomial Theorem: Binomial theorem (without proof) for positive

integral index (expansion, general term, and middle term). Binomial theorem (without proof) for any index (expansion and general term), Binomial approximation of first and second-degree terms

UNIT-IV: DETERMINANTS AND MATRICES

Matrices : Definition and examples of matrices, types of matrices, Basic operations, Equality of matrices, addition, multiplication of two matrices, scalar multiplication of a matrix, Transpose of a matrix, symmetric, skew-symmetric matrices, singular and non-singular matrices, cofactor matrix, adjoint of a matrix, inverse of a matrix; Determinants: Determinants (up to 3^{rd} order only), minors, co-factors, Properties of determinants, Solution of linear simultaneous equations in three variables by Cramer's rule and matrix inverse methods.

UNIT-V: COMPLEX NUMBERS

Modulus and amplitude of a complex number, Conjugate of a complex number, Polar and cartesian representation of a complex number and its conversion from one form to other, Operations on complex numbers; De-Moiver's theorem and its application, cube roots and n-th roots of unity.

REFERENCE BOOKS:

1. H.K. Dass, Rama Verma & Rajnish Verma, Mathematics for Polytechnics, CBS Publishers.
2. R.D. Sharma, Applied Mathematics, DhanPat Rai Publications.
3. Deepak Singh, Mathematics-I, Khanna Book Publishing Co. (P) Ltd.
4. Garima Singh, Mathematics-II, Khanna Book Publishing Co. (P) Ltd.

COURSE OUTCOMES:

The students will be able to:

CO1	Apply trigonometric identities and formulas to solve problems involving angles, including those related to sum, difference, product, multiple, and sub-multiple angles.
CO2	Solve problems involving sequences and series, including arithmetic progression, geometric progression, and partial fractions, to analyze and simplify expressions.
CO3	Apply the principles of permutations and combinations to solve counting problems and use the binomial theorem for expansion and approximations.
CO4	Use matrices and determinants to solve systems of linear equations, perform matrix operations, and understand key properties and types of matrices.
CO5	Perform operations on complex numbers in both polar and Cartesian forms and apply De Moivre's theorem to solve problems involving powers and roots of complex numbers.

Course Code	:	MEHS111
Course Title	:	Communication Skills Lab
Number of Credits	:	1(L:0, T:0, P:2)
Prerequisites	:	Nil
Course Category	:	BS

COURSE OBJECTIVES:

- Enhancing Listening Skills: To cultivate active listening skills that improve comprehension and facilitate effective communication across various media and environments.
- Developing Speaking Skills: To refine pronunciation, fluency and clarity of speech, empowering students to articulate their thoughts confidently and effectively in both formal and informal settings.
- Fostering Personality Development: To nurture qualities such as emotional intelligence, self-confidence, resilience and adaptability, equipping the students to handle personal, academic and professional challenges.
- Leadership and Teamwork: To build leadership skills and qualities, encourage collaborative work and develop the ability to manage group dynamics through activities such as group discussions, extempore speaking, role play and debates.
- Public Speaking and Presentation Excellence: To provide students with opportunities to build proficiency in public speaking and effective presentation delivery, making them more persuasive and engaging speakers.

COURSE CONTENT:

Listening Skills – Enhancing Comprehension and Interpretation

- Introduction to active listening strategies, focusing on listening for main ideas, details and inferences.
- Practice with a variety of audio-visual materials such as recorded lectures, podcasts, interviews, TED talks, speeches and debates.
- Listening tests based on different accents, dialects and speech patterns to improve listening comprehension in diverse settings.
- Exercises to differentiate between tone, mood and intent in spoken language to strengthen interpretative skills.

Phonetics and Pronunciation – Mastering Sounds for Clarity

- Study of the International Phonetic Alphabet (IPA) for accurate word transcription and pronunciation.
- Practice with consonants, vowels, diphthongs, stress patterns and weak forms to ensure precise and clear speech.
- Syllable division and understanding of stress patterns to enhance fluency and speech rhythm.

- Focus on intonation, voice modulation and pitch for effective communication and expressiveness.
- Techniques to improve accent reduction and pronunciation for clearer, more confident speech.

Speaking Skills – Effective Expression and Interaction

- Focus on formal and standard speech practices in various contexts: academic, business and public communication.
- Development of oral presentation skills with emphasis on structure, clarity and audience engagement.
- Training in group discussions, debates and impromptu speaking to build confidence and articulation.
- Mock interviews and role-playing exercises to prepare students for real-world professional situations.
- Techniques for effective communication in business settings, including business presentations and public speaking engagements.
- Practice in conveying ideas clearly, assertively and persuasively in both individual and group settings.

Vocabulary Enhancement – Building Lexical Resource

- Construction of new words through affixes, prefixes and suffixes to enhance word formation skills.
- Extensive practice with phrasal verbs, idioms and foreign phrases to build fluency in diverse communication settings.
- Introduction to jargon and specialized vocabulary related to organisational structures, industries and professional settings.
- Development of contextual vocabulary for accurate and appropriate word choices in different settings (formal vs. informal, professional vs. casual).

Digital and Virtual Communication – Handling Online Platforms

- Techniques for effective communication in virtual settings, including webinars, video conferencing and digital presentations.
- Introduction to virtual communication etiquette: body language, tone and engagement in online meetings and webinars.
- Practice with writing and responding to professional emails, creating formal online presentations and using digital tools for effective communication.
- Developing skills to manage cross-cultural communication in global digital platforms.

Soft Skills and Emotional Intelligence – The Key to Success in Communication

- Developing empathy and emotional intelligence in communication for effective relationship-building.
- Focus on active listening and emotional regulation during interactions.

- Exercises to enhance self-awareness, adaptability and resilience in challenging communication situations.

REFERENCE BOOKS:

1. Jones, Daniel. The Pronunciation of English. Cambridge University Press, 1956.
2. Hartman, James, et al. English Pronouncing Dictionary. Cambridge University Press, 2006.
3. Kumar, Kulbhushan. Effective Communication Skills. Revised ed., Khanna Publishing House, 2018.
4. O'Connor, J. D. Better English Pronunciation. Cambridge University Press, 1980.
5. Murray, Lindley. An English Grammar: Comprehending Principles and Rules. Wilson and Sons, 1908.
6. Maison, Margaret M. Examine Your English. Orient Longman, 1964.
7. Sethi, J., et al. A Practice Course in English Pronunciation. Prentice Hall, 2004.
8. Pfeiffer, William Sanborn, and T. V. S. Padmaja. Technical Communication: A Practical Approach. 6th ed., Pearson, 2007.
9. Bansal, R. K., and J. B. Harrison. Spoken English: A Manual of Speech and Phonetics. Orient Blackswan, 2013.

COURSE OUTCOME:

The Students will be able to:

CO1	Apply active listening strategies to understand key ideas and inferences, analyse speech patterns, interpret tone and intent, adapt to diverse audio-visual materials and enhance listening proficiency for effective communication in academic, professional and social contexts.
CO2	Master the International Phonetic Alphabet (IPA) for precise pronunciation, refine speech clarity through phonetic practice, enhance fluency with stress and rhythm control and develop effective intonation, modulation and accent refinement for confident, articulate communication.
CO3	Develop formal speech proficiency across contexts, enhance presentation clarity, build confidence through discussions, debates and impromptu speaking, refine professional communication through mock interviews and role-plays, and master persuasive, assertive expression in diverse settings.
CO4	Expand and enrich lexical proficiency through word formation, improve fluency with idioms, phrases and phrasal verbs, acquire professional vocabulary and develop precise word choice across formal and informal communication.
CO5	Develop proficiency in virtual and cross-cultural communication, refine non-verbal skills and enhance fluency through exposure to diverse accents with personalised feedback. Cultivate emotional intelligence, resilience and adaptability to navigate personal and professional challenges while acquiring essential tools for success in academic and professional environments.

Course Code	:	MEBS112
Course Title	:	Applied Physics Lab
Number of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	High School Physics Course
Course Category	:	BS

COURSE OBJECTIVES:

This course provides practical exposure to fundamental physics concepts, enhances hands-on skills with laboratory equipment, and bridges theoretical knowledge with real-world problems.

COURSE CONTENT:

S. No. Topics for practice

1. To measure the volume of a cylinder using a Vernier caliper and calculate the associated uncertainty in the volume.
2. To measure the area of cross-section of a wire using a screw gauge and calculate the associated uncertainty in the area.
3. To determine radius of curvature of a spherical surface using spherometer.
4. To determine the spring constant of helical spring using dynamic method.
5. Verification of Ohm's law.
6. Conversion of galvanometer into Ammeter/Voltmeter of desired range.
7. To determine focal length of a convex lens.
8. To determine temperature of room and hot bath using thermometer and convert the value into different scales.

Reference Books:

1. Vivek Talati & Vinod Kumar Yadav, Applied Physics-I (with Lab manual), Khanna Book Publishing Co. (P) Ltd.
2. Hussain Jeevakhan, Applied Physics-II (with lab manual), Khanna Book Publishing Co. (P) Ltd.
3. A Manual of Higher Secondary Physics Laboratory Kit, NCERT.
4. Mudassir M. Husain & M. Rafat, Physics Through Laboratory Exercises, Cadplan Publishers.

COURSE OUTCOMES:

The students will be able to:

CO1	Demonstrate the importance of precision and accuracy in physical measurements, while performing experiments and report the results with appropriate error analysis.
CO2	Measure the volume of a cylinder, area of cross-section of a wire, and the radius of curvature of a spherical surface using appropriate instruments and calculate the Associated uncertainties.

CO3	Identify the relationship between current and voltage in resistive circuits, and calibrate an ammeter and a voltmeter using a galvanometer.
CO4	Demonstrate accurate temperature reading and conversion skills.
CO5	Apply the concept of parallax to determine image distance.

Course Code	:	COES113
Course Title	:	IT System & Computer Programming Lab
Number of Credits	:	2 (L: 0, T: 0, P: 4)
Prerequisites	:	IT System & Computer Programming
Course Category	:	Engineering Science Course

COURSE CONTENT:

S. NO. Topics for practice

1. Identify various word options dialog and make your resume to showcase your skills and experience.
2. Make a question paper of applied mathematics of your course using equation editor of word.
3. Make a power point presentation to discuss the importance of IT system and computer programming.
4. Design a spreadsheet using Excel to convert Celsius to Fahrenheit and Fahrenheit to Celsius.
5. Write an algorithm and program in C to check whether a given number is even or odd.
6. Write an algorithm and program in C to input marks of five subjects, i.e., Physics, Applied Mathematics, Information Technology, Digital Electronics, and Workshop; and compute the percentage as well as grade according to the following conditions: If percentage >= 90%: Grade A; If percentage >= 80%: Grade B; If percentage >= 70%: Grade C; If percentage >= 60%: Grade D; If percentage >= 40%: Grade E; If percentage < 40%: Grade F (Failed). Modify this program using logical AND operator.
7. Draw a flowchart to print the multiplication table of a number entered by the users; also write a program for generating the multiplication table using different types of loops.

8. Write an algorithm and program in C to add "n" numbers using two-dimensional array.
9. Write a program in C using function to calculate the factorial of a given number.
10. Write a program in C to draw any two-dimensional object using built-in graphics functions.
11. Write a program in C using structure to store and display the information of a book.
12. Write a program in C using pointers to swap two numbers entered by user.

Course Code	:	EEES114
Course Title	:	Fundamentals of Electrical Engineering lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	NIL
Course Category	:	ES

COURSE CONTENT:

S. No. Topics for practice

1. To verify the Ohm's law and draw its I-V characteristics.
2. To verify the relation $R_T = R_1 + R_2 + R_3 + \ldots\ldots\ldots + R_N$ in series combination of resistances.
3. To verify the relation: $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots\ldots\ldots \frac{1}{R_N}$ in parallel combination of resistances.
4. To determine the permeability of magnetic material by plotting its B-H curve.
5. To measure the voltage, current and power in single phase R-L series circuit. Draw its voltage, impedance and power triangle.
6. To measure the voltage, current and power in single phase R-C series circuit. Draw its voltage, impedance and power triangle.
7. To measure the voltage, current and power in single phase R-L-C series circuit. Draw its voltage, impedance and power triangle.
8. To determine the transformation ratio of single phase transformer.

Course Code:	:	MEES116
Course Title	:	Engineering Graphics
Number of Credits	:	2 (L: 0, T: 0, P: 4)
Prerequisites	:	NIL
Course Category	:	ES

COURSE OBJECTIVES:

- To understand the language of graphics which is used to express ideas, convey instructions while carrying out engineering jobs.
- To develop drafting and sketching skills, to know the applications of drawing equipment and get familiarize with Indian Standards related to engineering drawings.
- To develop skills to visualize actual object or a part of it, on the basis of drawings.
- To develop skills to translate ideas into sketches and to draw and read various engineering curves, projections and dimensioning styles.
- To understand common symbols used in engineering.

COURSE CONTENT:

Introduction to Engineering Drawing:
Drawing Instruments and supporting materials, Sizes and layout of standard drawing sheets, Sizes of drawing boards, Method to use them with applications.

Lines:
Convention of lines and their applications, Different types of lines in engineering drawing as per BIS Specifications, Practice of vertical, horizontal and inclined lines.

Lettering:
Free hand and instrumental lettering (Alphabet and numerals) – upper case (Capital Letter), single stroke, vertical and inclined at 75 degrees, series of 5,8,12 mm of free hand and instrumental lettering of height 25 to 35 mm in the ratio of 7:4.

Dimensioning Techniques:
Necessity of dimensioning, Dimensioning techniques as per BIS (Board of Indian standard) SP-46:2003 – types and applications of chain, parallel and coordinate dimensioning. Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches.

Scales:
Scales and their need and importance, type of scales, Representative Fractions – reduced, enlarged and full-size scales; Engineering Scales such as plain, diagonal scale and Vernier scale.

Geometrical Constructions:
Construction of ellipse, parabola and hyperbola by eccentricity method and other methods, cycloids, epicycloids and hypocycloids, regular polygons, involute.

Projections:
Introduction to projections. Basic concepts of projection techniques, projection of points and lines. Projection of Points in different quadrant, Projection of Straight Line (First angle and Third angle) Line parallel to both the planes, Line perpendicular to any one of the reference planes, Line inclined to any one of the reference planes.

Common Symbols and Conventions used in Engineering: Important Terms used in Building Drawing, Civil Engineering sanitary fitting symbols, Electrical fitting symbols for domestic interior installations.

S. No.	Practical Exercises
1	Draw horizontal, Vertical, 30-degree, 45 degrees, 60- and 75-degrees lines, different types of lines, dimensioning styles using Tee and Set squares/ drafter.
2	Letter writing single stroke and double stoke
3	Drawing of scales: plain, diagonal and vernier
4	Draw ellipse, parabola, and hyperbola by eccentricity method
5	Draw ellipse by arcs of a circle, oblong and concentric circle methods
6	Draw parabola and hyperbola using other methods
7	Draw regular polygons and involute
8	Draw various figures on projections of points
9	Draw some problems on projection of lines
10	Common symbols and conventions used in Engineering

TEXT BOOKS:

1. Bhatt, N. D. Engineering Drawing. Charotar Publishing House, Anand, Gujrat
2. P S Gill, Engineering Drawing, SK Kataria and sons. Delhi.

REFERENCE BOOKS:

1. Bureau of Indian Standards. Engineering Drawing Practice for Schools and Colleges IS: Sp-46. BIS. Government of India, Third Reprint
2. Jain & Gautam, Engineering Graphics & Design, Khanna Publishing House, New Delhi Siddiquee, Arshad N. , Khan, Zahid A. , Ahmad, Mukhtar Engineering Drawing With A Primer On Autocad, PHI Learning Pvt. Ltd.
3. Jolhe, D. A. Engineering Drawing. Tata McGraw Hill Edu. New Delhi
4. Dhawan, R. K. Engineering Drawing. S. Chand and Company, New Delhi
5. Shah, P. J. Engineering Drawing. S. Chand and Company, New DelhiKulkarni, D. M.; Rastogi, A. P.; Sarkar, A. K. Engineering Graphics with AutoCAD. PHI Learning Private Limited-New Delhi
6. Jeyapoovan, T. Essentials of Engineering Drawing and Graphics using AutoCAD. Vikas Publishing House Pvt. Ltd, Noida,

COURSE OUTCOMES:

The student will be able to:

CO1	Draw lines and letter writing in single and double stroke
CO2	Select and construct appropriate drawing scales, use drawing equipment's, and understand Indian Standards of engineering drawing
CO3	Construct the various curves
CO4	Draw views of given object and components
CO5	Understand various symbols and convention used in engineering

Course Code	:	CEES 201
Course Title	:	Engineering Mechanics
Number of Credits	:	3 (L:2, T: 1, P: 0)
Prerequisites	:	NIL
Course Category	:	ES

COURSE OBJECTIVES:

Following are the objectives of this course:

- To obtain resultant of various forces and support reactions through condition of equilibrium
- To know the centre of gravity and moment of inertia of composite
- To understand motion, work, power and energy
- To understand role of friction in equilibrium problems
- To know fundamental laws of machines and their applications to various engineering problems

COURSE CONTENTS:

UNIT–I: BASICS OF MECHANICS AND FORCE SYSTEM

Basics of Mechanics: Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body, scalar and vector quantity, units of measurement (SI units) - Fundamental units and derived units.

Force Systems: units, representation as a vector and by Bow's notation, characteristics and effects of a force, principle of transmissibility of force, force system and its classification, resolution of a force -orthogonal components of a force, Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems– Law of triangle, parallelogram and polygon of forces.

UNIT–II: EQUILIBRIUM

Force: Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analyzing equilibrium, Lami's Theorem – statement and explanation, Application for various engineering problems.

Moment: Moment of a force, Varignon's theorem, Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple), Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of point load and uniformly distributed load, beam reaction graphically for simply supported beam subjected to vertical point loads only.

UNIT–III: CENTRE OF GRAVITY AND MOMENT OF INERTIA

Centre of Gravity: Centre of gravity and centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle). Centroid of composite figures composed of not more than three geometrical figure. Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere), Centre of Gravity of composite solids composed of not more than two simple solids.

Moment of Inertia: Definition, M.I. of plane lamina, Radius of gyration, section modulus, Parallel and Perpendicular axes theorems (without derivations), M.I. of rectangle, square, circle, semi-circle, quarter circle and triangle section (without derivations), M.I. of symmetrical and unsymmetrical I-section, Channel section, T-section, Angle section, Hollow sections and built up sections about centroidal axes and any other reference axis, Polar moment of Inertia of solid circular sections.

UNIT-IV: MOTION, WORK, POWER AND ENERGY

Rectilinear Motion: Newton's law of motion, momentum, conservation of momentum, impulse, torque

Circular motion: Angular motion, Equation of motion, angular momentum, torque, centripetal and centrifugal force.

Work, Power & Energy: Definition of terms, Work Energy principles, Conservation of Mechanical Energy, simple numerical problems.

UNIT–V: FRICTION AND SIMPLE LIFTING MACHINE

Friction: Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between coefficient of friction and angle of friction, equilibrium of bodies on level surface subjected to force parallel and inclined to plane, equilibrium of bodies on inclined plane subjected to force parallel to the plane only.

Simple lifting machine: Simple lifting machine, load, effort, mechanical advantage, applications and advantages, velocity ratio, efficiency of machines, law of machine, Ideal machine, friction in machine, maximum mechanical advantage and efficiency, reversible and non-reversible machines, conditions for reversibility, velocity ratios of Simple axle and wheel, Differential axle and wheel, Worm and worm wheel, Single purchase and double purchase crab winch, Simple screw jack, Weston's differential pulley block, geared pulley block.

REFERENCE BOOKS:

1. D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi(2008)
2. Khurmi, R.S., Applied Mechanics, S. Chand & Co. NewDelhi.

3. Bansal RK, A text book of Engineering Mechanics, Laxmi Publications.
4. Ramamrutham, Engineering Mechanics, S. Chand & Co. NewDelhi.
5. Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.
6. Meriam, J.L.,Kraige, L.G., Engineering Mechanics-Statics, Vol. I, Wiley Publication, New Delhi.
7. Upadhay A.K, Applied Mechanics, S.K. Kataria & Sons, N. Delhi

COURSE OUTCOMES:
After completing this course, student will be able to:

CO1	Determine unknown forces and support reactions of different engineering systems.
CO2	Find the centroid, centre of gravity and moment of inertia of various components in engineering systems.
CO3	Apply work, power, energy concept to solve rectilinear and circular motion problems
CO4	Apply the principles of friction in various conditions for useful purposes.
CO5	Select the relevant simple lifting machine(s) for given purposes.

Course Code	:	MEBS202
Course Title	:	Applied Chemistry
Number of Credits	:	3 (L:2, T: 1, P: 0)
Prerequisites	:	High School Chemistry Course
Course Category	:	BS

COURSE OBJECTIVES:

- Understand Atomic Structure and Chemical Bonding: Students will gain a comprehensive understanding of atomic structure, including Rutherford's model, Bohr's theory, and quantum numbers. They will understand the nature of chemical bonding, the types of bonds such as ionic, covalent, and coordination, and learn how molecular structures of H2O, NH3 and CH4 exhibit different bonding properties. The course will also cover the concept of solutions and methods for expressing concentration, such as molarity, normality, and mole fraction.

- To Analyse Water Chemistry and Softening Techniques: Students will explore the classification of water as soft or hard, the salts responsible for hardness, and the effects of hard water on boilers and industrial processes. They will learn quantitative methods for determining water hardness, as well as various water-softening techniques like soda lime, zeolite, and ion exchange processes. The course will also cover municipal water treatment processes, including filtration, sterilization, and standards for drinking water quality.
- To Understand Engineering Materials and Their Properties: Students will study the natural occurrence of metals and the process of extracting them from ores, focusing on iron-based materials like cast iron and steel, along with heat treatment methods. They will learn the fundamentals of alloys, the purposes of alloying, and the composition, properties, and uses of various alloys such as brass, bronze, and duralumin. The course will also cover polymers, including their preparation, types, and applications in everyday life.
- To Explore the Chemistry of Fuels, Lubricants: This course will focus on understanding the classification and combustion of fuels, calculation of calorific values using Dulong's formula, and the properties of various fuels like LPG and CNG. Students will also gain insight into the function of lubricants, including their physical and chemical properties.
- To Explore the Chemistry Electrochemistry: The course will introduce the principles of electrochemistry, including oxidation-reduction reactions, types of corrosion, and methods for preventing metal corrosion (by proper designing, alloying, cathodic protection and coating techniques).

COURSE CONTENT:

UNIT-I: ATOMIC STRUCTURE, CHEMICAL BONDING AND SOLUTIONS

Rutherford model of atom, Bohr's theory, Quantum numbers – orbital concept. Shapes of *s, p* and *d* orbitals, Pauli's exclusion principle, Hund's rule of maximum multiplicity Aufbau rule, electronic configuration; Concept of chemical bonding – cause of chemical bonding, types of bonds: ionic bonding (NaCl example), covalent bond (H_2, F_2, HF, $BeCl_2$, BF_3, CH_4, NH_3, H_2O), coordination bond in NH_4^+, and anomalous properties of NH_3, H_2O due to hydrogen bonding; Solution – idea of solute, solvent and solution, methods to express the concentration of solution- molarity, normality, strength, ppm, mass percentage, volume percentage, mass by volume percentage and mole fraction.

UNIT-II: WATER

Classification of soft and hard water, salts causing water hardness, unit of hardness and simple numerical on water hardness; Problems caused by the use of hard water in boiler (scale and sludge, foaming and priming, corrosion etc), and quantitative measurement of water hardness by EDTA method. Estimation of dissolved oxygen, free chlorine, chloride ion

and alkalinity; Water softening techniques – soda lime process, zeolite process and ion exchange process. Municipal water treatment (in brief only) – sedimentation, coagulation, filtration, sterilisation. Water for human consumption for drinking and cooking purposes from any water sources and enlist Indian standard specification of drinking water (collecting data and understand standards).

UNIT-III: ENGINEERING MATERIALS

Natural occurrence of metals: minerals & ores of iron. Pig Iron, Cast iron, Steel and Heat treatment of steal Alloys: definition, purposes of alloying. Composition, properties and uses of Brass, Bronze, gun metal, Invar and Duralumin; Polymers: monomer, homo and co polymers, simple reactions involved in preparation and their application of thermoplastics and thermosetting polymers (PVC, PS, PTFE, nylon–6, nylon-6,6 and Bakelite), rubber and vulcanization of rubber.

UNIT-IV: CHEMISTRY OF FUELS AND LUBRICANTS

Definition of fuel and combustion of fuel, classification of fuels, calorific values (HCV and LCV), Calculation of HCV and LCV using Dulong's formula, Fractional distillation of crude petroleum, octane number and cetane number; Chemical composition, calorific values and applications of LPG, CNG, Water gas, Coal gas and Producer gas; Lubrication: function and characteristic properties of good lubricant, classification with examples, lubrication mechanism – hydrodynamic and boundary lubrication, physical properties (viscosity and viscosity index, oiliness, flash and fire point, cloud and pour point) and chemical properties of lubricant (acid number, saponification value).

UNIT-V: ELECTRO CHEMISTRY

Electronic concept of oxidation, reduction and redox reactions, Definition of terms: electrolytes, non-electrolytes with suitable examples; Faraday's law of electrolysis; Introduction to Corrosion of metals: Definition, types of corrosion: Chemical and Electrochemical corrosion, Galvanic corrosion, Concentration corrosion, Pitting corrosion and Stress corrosion; Protection of corrosion by Proper designing, Alloying, Cathodic and anodic protection and Coating methods, Primary and Secondary Cells

REFERENCE BOOKS:

1. Anju Rawlley & Devdatta Vinayakrao Saraf, Applied Chemistry (with lab manual), Khanna Book Publishing Co. (P) Ltd. Delhi.
2. Chemistry for Class XI& XII (Part-I, Part-II), N.C.E.R.T., Delhi.
3. Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press, New Delhi.
4. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd.
5. Dara, S. S. & S.S.Umare, Engineering Chemistry, S.Chand. Publication, New Delhi.
6. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons, New Delhi.
7. S. Vairam, Engineering Chemistry, Wiley India Pvt.Ltd., New Delhi.
8. G. H. Hugar & A. N. Pathak, Applied Chemistry Laboratory Practices (Vol. I and Vol. II), NITTTR Publications, Chandigarh.
9. Rajesh Agnihotri, Chemistry for Engineers, Wiley India Pvt. Ltd.

Open-source software and website address:

1. www.chemguide.co.uk/atommenu.html (Atomic structure and chemical bonding)
2. www.visionlearning.com (Atomic structure and chemical bonding)
3. www.chem1.com (Atomic structure and chemical bonding)
4. https://www.wastewaterelearning.com/elearning/ (Water Treatment)
5. www.capital-refractories.com (Metals, Alloys, Cement, and Refractory Materials)
6. www.em-ea.org/guide%20books/book-2/2.1%20fuels%20and%20combustion.pdf (Fuel and Combustion)
7. www.chemcollective.org (Metals, Alloys)

COURSE OUTCOMES:

The students will be able to:

CO1	Explain atomic models, describe the concept of quantum numbers, and predict the shape and properties of molecules based on different types of chemical bonding, including ionic, covalent, and coordination bonds, as well as calculate the concentration of solutions using various methods.
CO2	Classify water as hard or soft, understand the causes of water hardness, calculate water hardness, and describe methods of water softening and municipal water treatment processes, while adhering to Indian standards for drinking water.
CO3	Identify the natural occurrence of metals, understand the properties and uses of alloys like brass, bronze, and duralumin, and explain the characteristics and applications of polymers, including thermoplastics, thermosetting plastics, and rubber.
CO4	Classify fuels based on their combustion properties, calculate calorific values using Dulong's formula, and describe the types of lubrication, the properties of lubricants, and their functions in industrial applications.
CO5	Explain redox reactions, differentiate between electrolytes and non-electrolytes, identify types of corrosion, and outline methods for preventing corrosion in metals.

Course Code	:	MEES203
Course Title	:	Fundamentals of Mechanical Engineering
Number of Credits	:	3 (L:2, T: 1, P: 0)
Prerequisites	:	NIL
Course Category	:	ES

COURSE OBJECTIVES:

- To demonstrate the safety care and precautions in various mechanical shops, while working with tools and machines.
- To understand working principles of lathe operations and power transmission.
- To understand laws of thermodynamics and heat transfer Processes.
- To understand the working principles of heat engines
- To understand working principles of power developing and power absorbing devices

COURSE CONTENTS:

UNIT-I INTRODUCTION TO MECHANICAL SHOPS:

Introduction to workshop practice, safety, care and precaution in workshop, Material, operations & tools used in carpentry shop, fitting shop, smithy shop, Welding Shop, Principle of operation of Arc welding and gas welding, tools and equipment used in arc and gas welding, soldering and brazing.

UNIT-II LATHE & ITS OPERATIONS:

Description and function of various parts of a lathe, Classification and specification of various types of lathe, Lathe operations - Plain and step turning, facing, taper turning, drilling, reaming, boring, threading and knurling, Milling Machine, Shaper and Planer Machines, Drilling Machine, Grinding Machine

Modes of Power Transmission: Transmission of Power through belt: flat belt V belt open belt and cross belt device, Derivation of tension ratio for flat belt, power transmission through chain and gears, Spur, Helical, Bevel, Rack and Pinion

UNIT-III BASIC THERMODYNAMICS:

Fundamental concept of Thermodynamics: Introduction, Define Systems, Thermodynamic Equilibrium, Properties, State, Process and Cycle, Elementary introduction to Zeroth, First and Second laws of thermodynamics, Practical application of thermodynamics;

Steam boiler: Introduction, classification, boiler accessories and mountings, construction and working of Cochran boiler, Babcock & Wilcox boiler; Steam turbine: Impulse and Reaction Turbines

UNIT-IV HEAT ENGINES:

Heat Engines: Introduction, classifications, Components of IC engines, Cylinder, crankcase, crankpin, crank, crankshaft, connecting rod, wrist pin, piston, cooling pins cylinder heads, exhaust valve, inlet valve; Working of four-stroke and two-stroke petrol and diesel engines; Comparison of two stroke and four stroke engines; Comparison of C. I. and S. I. engines

UNIT-V THERMAL & FLUID SYSTEMS:

Refrigeration and Air Conditioning System: Introduction and applications, Ton of refrigeration (TR), coefficient of performance, vapour compression cycle, vapour absorption cycle, Window air conditioner

Pumps: working principle of Reciprocating and centrifugal pump

Air compressor: working principle of rotary air compressor (root blower, vane blower), Fluid systems: Working principle of hydraulic jack, hydraulic lift, hydraulic coupling

TEXT BOOKS:

1. M.P. Poonia & S.C. Sharma, Basic Mechanical Engineering, Khanna Pub. House, Delhi
2. M. L. Mathur, F. S. Mehta and R. P. Tiwari , Elements of Mechanical Engineering, Jain Brothers, New Delhi
3. B. S. Raghuvanshi, Workshop Technology (Vol.1 & 2), Dhanpath Rai and Sons, New Delhi.

REFERENCE BOOKS:

1. J. Benjamin, Textbook of Basic Mechanical Engineering, Publisher: Kollam : Pentex
2. Roy Chaudhary, Basic Engineering Thermodynamic. Tata McGraw Hill, Delhi.
3. Dudley Brian Spalding, Edward Harry Cole, Engineering Thermodynamics McGraw-Hill series in mechanical engineering.. Edition, 2, Publisher, Edward Arnold

COURSE OUTCOMES:

The student will be able to:

CO1	Identify tools used in various mechanical workshops
CO2	Understand functions and operations of machine tools including milling, shaping, grinding and lathe machines and mode of power transmission in machines
CO3	Explain laws of thermodynamics and its practical application of thermodynamics
CO4	Illustrate various parts of internal combustion engine
CO5	Understand basics of pump, compressor and refrigeration and air-conditioning systems

Course Code:	:	ECES204
Course Title	:	Fundamentals of Electronics Engineering
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	Semiconductor Physics
Course Category	:	ES

COURSE OBJECTIVES:

- To know the applications of electronics engineering in different fields of life.
- To get knowledge of p-n junction diode and its application in rectifiers.
- To gain knowledge about the removal of unwanted ripple component from the rectified output by using filters.
- To understand how a Zener diode can be used in voltage regulator to maintain a constant output voltage despite variations in the input voltage or load current.
- To develop knowledge of bipolar junction transistor and its application in amplifier circuit.

COURSE CONTENT:

UNIT-I: PN JUNCTION DIODE

PN Junction diode, Depletion layer, Potential barrier, Behavior of P-N junction diode under forward and reverse bias, Cut-in voltage, Reverse saturation current, V-I characteristics, Breakdown phenomenon, Static and dynamic resistance and their calculations from diode characteristics, Dynamic resistance of the diode in terms of diode current, Diode ratings and specifications.

UNIT-II: RECTIFIERS AND FILTERS

Rectifier circuits, Principle of operation and output waveforms of half wave rectifier, centre tapped and bridge type rectifier, Average value and RMS value of output voltage and load current, Performance analysis of rectifier circuits: ripple factor and rectification efficiency, Filter circuits, Shunt capacitor filter, Series inductor filter, L-type and pie type filter, Physical explanation of working of the shunt capacitor and series inductor filter and their suitability.

UNIT-III: SPECIAL PURPOSE DIODES

Zener diode: construction and operation, zener and avalanche breakdown mechanism, V-I characteristics, Zener ratings: zener voltage, minimum zener current, maximum zener current, maximum zener power dissipation and zener resistance, Application of Zener diode in voltage regulator circuit, Brief description with V-I characteristics and applications of varactor diode and light emitting diode.

UNIT-IV: BIPOLAR JUNCTION TRANSISTOR

Concept of bipolar junction transistor as a two junction three terminal device, NPN and PNP transistor, Principle of operation of transistor, Transistor current relation, Different configurations: CB, CE, and CC, concept of leakage current and effect of temperature on it, input and output characteristics, Determination of input, output dynamic resistances and current amplification factor from the characteristics, Comparison of the three configurations.

UNIT-V: AMPLIFIER AND BIASING CIRCUITS

Transistor as an amplifier in CE configuration, DC equivalent circuit, DC load line and operating point, Factors affecting operating point, Thermal runway condition of transistor, Effect of fixing operating point in cut off and saturation region, Different biasing circuits: Fixed biasing, collector to base biasing, potential divider biasing and emitter biasing circuit, Calculation of operating point for these biasing circuits, Merits and demerits.

REFERENCE BOOKS:

1. N. N. Bhargava, D. C. Kulshrestha, S. C. Gupta, Basic Electronics and Linear Circuits, Tata McGraw-Hill Publishing Company Limited, New Delhi.

2. V. K. Mehta, Rohit Mehta, Principles of Electronics, S. Chand and Company, New Delhi.

3. Albert Malvino, David Paul, Electronics Principles, McGraw Hill Education, New Delhi.

4. R. S. Sedha, A Text Book of Applied Electronics, S. Chand and Company, New Delhi.

5. David Bell, Fundamental of Electronic Devices and Circuits, Oxford University Press.

COURSE OUTCOMES:

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

CO1	Know about various applications of electronics engineering in different fields of life.
CO2	Learn about the uses of semiconductor diodes in electronic switching and in various rectifiers.
CO3	Gain knowledge about the filters for converting pulsating dc signal into smooth dc signal.
CO4	Explore the use of Zener diode in voltage stabilizing circuit.
CO5	Gain knowledge about the uses of bipolar junction transistor in electronic switching and in amplifier circuits.

Course Code	:	MEBS205
Course Title	:	Applied Mathematics-II
Number of Credits	:	3 (L:2, T: 1, P: 0)
Prerequisites	:	NIL
Course Category	:	BS

COURSE OBJECTIVES:

- Develop Mathematical Foundations: Equip students with a strong understanding of fundamental calculus concepts, including limits, continuity, differentiation, and integration, to analyze and solve mathematical and engineering problems.
- Explore Advanced Problem-Solving Techniques: Enable students to apply differentiation and integration methods, including the chain rule, trigonometric functions, substitution, and partial fractions, to solve complex problems in mathematics and related disciplines.
- Understand and Apply Geometrical and Analytical Concepts: Introduce the principles of coordinate geometry, including the study of conic sections, straight lines, and loci, and their applications in solving geometrical and real-world problems.
- Enhance Analytical and Computational Skills in Differential Equations and Vectors: Develop the ability to solve first- and second-order differential equations and use

vector operations such as addition, scalar multiplication, and vector products in practical applications across physics and engineering.

COURSE CONTENTS:

UNIT-I: DIFFERENTIAL CALCULUS

Concept of limits and continuity (without problems), Four standard limits: $\lim_{n \to a} \frac{x^n - a^n}{x - a}$, $\lim_{x \to 0} \frac{\sin x}{x}$, $\lim_{x \to 0} \frac{a^x - 1}{x}$, and $\lim_{x \to 0} (1 + x)^{\frac{1}{x}}$. Differentiation of functions by first principle, Differentiation of sum, difference, product and quotient of two functions, Differentiation of function of a function (Chain rule), Differentiation of trigonometric and inverse trigonometric functions, Logarithmic differentiation, Higher order derivatives (or successive differentiation).

UNIT-II: INTEGRAL CALCULUS

Integration as inverse operation of differentiation, Simple integration by substitution**,** by parts and by partial fractions, Use of $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x \, dx$ for solving problems, where *m* and *n* are positive integers, Evaluation of definite integral, Properties of definite integral, area bounded by a curve between two ordinates and *x*-axis

UNIT-III: CO-ORDINATE GEOMETRY OF TWO DIMENSIONS

Definition of locus with problems, Equations of straight lines in various forms, Angle between two lines, Perpendicular distance formula, Study of properties of Circle, Parabola, Ellipse and Hyperbola

UNIT-IV: ORDINARY DIFFERENTIAL EQUATIONS

Ordinary differential equation, Order and degree of differential equations, Solution of differential equations of first order and first degree, Variable separable, Homogeneous and Linear differential equations, Complementary function and Perticular integral of linear differential equations of 2nd order with constant coefficient.

UNIT-V: VECTORS

Scalars and vectors, addition and subtraction of vectors and their simple applications, multiplication of a vector by a scalar, Scalar and vector product of two vectors and their simple applications, Scalar product of three vectors and its geometrical interpretation

REFERENCE BOOKS:

1. H.K. Dass, Rama Verma & Rajnish Verma, Mathematics for Polytechnics, CBS Publishers.
2. R.D. Sharma, Applied Mathematics, DhanPat Rai Publications.

3. Deepak Singh, Mathematics-I, Khanna Book Publishing Co. (P) Ltd.
4. Garima Singh, Mathematics-II, Khanna Book Publishing Co. (P) Ltd.

COURSE OUTCOMES:

The students will be able to:

CO1	Use the concept of limits and differentiation to find derivatives of functions, including applications of sum, difference, product, quotient, chain rule, and differentiation of trigonometric, inverse trigonometric, and logarithmic functions.
CO2	Apply integration techniques such as substitution, integration by parts, and partial fractions to evaluate integrals, and understand the properties of definite integrals for finding areas and solving related problems.
CO3	Analyze and solve problems related to the equations of straight lines, conic sections, and loci, and apply the properties of geometric shapes like circles, parabolas, ellipses, and hyperbolas.
CO4	Formulate and solve ordinary differential equations of first and second order, including separable, homogeneous, and linear equations, and find complementary functions and particular integrals.
CO5	Understand and perform operations on vectors, including addition, subtraction, scalar multiplication, scalar and vector products, and apply these operations in geometric contexts and real-world applications.

Course Code	:	CEES 211
Course Title	:	Engineering Mechanics Lab.
Number of Credits	:	1 (L:0,T:0,P:2)
Prerequisites	:	NIL
Course Category	:	ES

COURSE OBJECTIVES:

Following are the objectives of this course:

- To obtain resultant of various forces
- To calculate support reactions through conditions of equilibrium for various structures
- To understand role of friction in equilibrium problems
- To know fundamental laws of machines and their applications to various engineering problems

COURSE CONTENT:

S. No. Topics for practice

1. To find the M.A., V.R., Efficiency and law of machine for Differential Axle and Wheel.
2. To find the M.A., V.R., Efficiency and law of machine for Simple Screw Jack.
3. Derive Law of machine using Worm and worm wheel.

4. Derive Law of machine using Single purchase crab.
5. Derive Law of machine using double purchase crab.
6. Derive Law of machine using Weston's differential or wormed geared pulley block.
7. Determine resultant of concurrent forces by Y-stem applying Law of Polygon of forces using force table.
8. Determine resultant of concurrent forces by Y-stem graphically.
9. Determine resultant of parallel forces by Y-stem graphically.
10. Verify Lami's theorem.
11. Study forces in various members of Jib crane
12. Determine support reactions for simply supported beam
13. Obtain support reactions of beam using graphical method
14. Determine coefficient of friction for motion on horizontal and inclined plane
15. Determine centroid of geometrical plane figures

REFERENCE BOOKS:

1. Bedi D.S., Engineering Mechanics, Khanna Publishing House
2. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
3. Bansal RK, A text book of Engineering Mechanics, Laxmi Publications.
4. Ramamrutham, Engineering Mechanics, S., S Chand & Co. New Delhi.
5. Ram, H.D.; Chauhan, A.K. Foundations and Applications of Applied Mechanics, Cambridge University Press.

COURSE OUTCOMES:

The students will be able to:

CO1	Identify the forces for given conditions by applying the basics of mechanics
CO2	Determine unknown force(s) of different engineering systems
CO3	Apply the principles of friction in various conditions for useful purposes
CO4	Find the centroid and centre of gravity of various components in engineering systems
CO5	Select the relevant simple lifting machine(s) for given purposes

Course Code	:	MEBS212
Course Title	:	Applied Chemistry Lab
Number of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	High School Chemistry Course
Course Category	:	BS

COURSE OBJECTIVES:

The objective of this lab course is to equip students with practical skills in performing chemical analyses and determining the purity, hardness, and chemical composition of various substances, such as oxalic acid, NaOH, KOH, and water samples. Students will learn to apply laboratory techniques like titration, EDTA method, and viscosity testing to evaluate water quality, the presence of dissolved oxygen, chlorine, and other key parameters. Through hands-on experience, students will develop critical thinking and analytical skills to interpret experimental data and understand the real-world applications of these methods.

COURSE CONTENT:

S. No. Topics for practice

1. To determine the purity percentage of oxalic acid in a given impure mixture
2. To analyse a mixture of NaOH and KOH (given a solution contacting 2.5g mixture of NaOH and KOH per litre)
3. To estimate the calcium and magnesium hardness in the given water sample
4. To estimate the Chloride ion (Cl^-) in the given water sample
5. To estimate the free Chlorine (Cl_2) in the given water sample
6. To estimate the dissolved Oxygen (D.O) in the given water sample
7. To estimate the Alkalinity in the given water sample
8. To estimate the temporary, permanent and total hardness in the given water sample by EDTA method
9. To determine the viscosity of a lubricating oil by Redwood Viscometer
10. To determine the moisture percentage in a coal sample

REFERENCE BOOKS:

1. A. Rawlley & D.V. Saraf, Applied Chemistry (with lab manual), Khanna Book Publishing Co. (P) Ltd. Delhi.
2. G. H. Hugar & A. N. Pathak, Applied Chemistry Laboratory Practices (Vol. I and Vol. II), NITTTR Publications, Chandigarh.

Open-source software and website address:

3. www.chemguide.co.uk/atommenu.html (Atomic structure and chemical bonding)
4. www.visionlearning.com (Atomic structure and chemical bonding)
5. www.chem1.com (Atomic structure and chemical bonding)
6. https://www.wastewaterelearning.com/elearning/ (Water Treatment)
7. www.capital-refractories.com (Metals, Alloys, Cement, and Refractory Materials)

8. www.em-ea.org/guide%20books/book-2/2.1%20fuels%20and%20combustion.pdf (Fuel and Combustion)
9. www.chemcollective.org (Metals, Alloys)
10. www.wqa.org (Water Treatment)

COURSE OUTCOMES:

The students will be able to:

CO1	Recall the key laboratory techniques and procedures used in the estimation of purity, hardness, and chemical composition of various substances in water and other samples.
CO2	Explain the principles behind titration, EDTA method, and viscosity measurement, and their significance in determining the quality of substances such as water and lubricating oils.
CO3	Apply appropriate laboratory techniques to determine the concentration of chemicals like NaOH, KOH, chloride ions, and dissolved oxygen in water samples.
CO4	Analyze experimental data from laboratory tests (e.g., chloride ion concentration, hardness, viscosity) to draw conclusions about the properties of the samples being tested.
CO5	Assess the accuracy and reliability of the results obtained from chemical analyses, and propose improvements or alternative methods where necessary.
CO6	Design an experimental setup for determining the moisture content in coal or estimating the hardness of water using complexometric titration.
CO7	Perform titrations to determine the free chlorine content in water samples, demonstrating proper technique and ensuring precision in measurements.
CO8	Interpret the impact of various water quality parameters (e.g., hardness, alkalinity, D.O) on environmental and industrial applications.
CO9	Compare results from different methods for determining chemical properties (e.g., chlorine, dissolved oxygen) to evaluate their efficiency and accuracy.
CO10	Justify the choice of a specific laboratory method (such as EDTA titration or Redwood viscometer) for a given analysis, based on the characteristics of the sample and the desired outcome.

Course Code:	:	ECES214
Course Title	:	Fundamentals of Electronics Engineering Lab
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Fundamentals of Electronics Engineering
Course Category	:	ES

COURSE CONTENT:

S. No. Topics for practice

1. To draw V-I characteristics of p-n junction diode and to calculate its static and dynamic resistances in forward and reverse bias conditions.
2. To draw V-I characteristics of zener diode and to calculate its static and dynamic resistances in forward and reverse bias conditions.
3. To draw V-I characteristics of light emitting diode and to calculate its static and dynamic resistances in forward and reverse bias conditions.
4. To calculate ripple factor for half wave rectifier without filter and with filters.
5. To calculate ripple factor for centre-tap full wave rectifier without filter and with filters
6. To calculate ripple factor for bridge type full wave rectifier without filter and with filters.
7. To draw input characteristics for common base transistor and to calculate its static and dynamic resistances.
8. To draw output characteristics for common base transistor and to calculate its static and dynamic resistances
9. To draw input characteristics for common emitter transistor and to calculate its static and dynamic resistances.
10. To draw output characteristics for common emitter transistor and to calculate its static and dynamic resistances.

Course Code	:	MEES216
Course Title	:	Engineering Workshop Practice
Number of Credits	:	2 (L: 0 T: 0 P: 4)
Prerequisites	:	NIL
Course Category	:	ES

COURSE OBJECTIVES:

- To understand the safety precaution in the workshops.
- To understand different tool &equipment for work shop practice.
- To understand, identify, select and use various marking, measuring, and holding, striking and cutting tools and equipment's
- To understand and interpret job drawings, produce jobs, and inspect the job for specified dimensions
- To acquire skills and understand, operate, control different shops.

COURSE CONTENT:

Sr. No. Details of Practical Content

1 Carpentry Shop:

- Safety Precautions to be served in the shop
- Demonstration of different wood working tools/machines and different wood working processes, like plaining, marking, chiseling, grooving, turning of wood etc.
- One simple job involving any one joint like mortise and tenon dovetail, bridle, half lap etc.

2 Fitting Shop:

- Safety Precautions to be served in the shop
- Demonstration of different fitting tools different operations like chipping, filing, drilling, tapping, sawing, cutting etc.
- One simple fitting job involving practice of above operations

3 Welding Shop:

- Safety Precautions to be served in the shop
- Demonstration of different welding tools / machines, and arc Welding, Gas Welding, MIG, MAG welding, gas cutting and rebuilding of broken parts with welding
- One simple job involving butt and lap joint

4 Sheet Metal shop:

- Safety Precautions to be served in the shop
- Demonstration of different sheet metal tools / machines
- Demonstration of different sheet metal operations like sheet cutting, bending, edging, end curling, lancing, soldering, brazing, and riveting
- One simple job involving sheet metal operations and soldering and riveting.

5 Smithy Shop:

- Safety Precautions to be served in the shop
- Demonstration and detailed explanation of tools, equipment used
- One simple job involving operation of forging a square headed bolt.

6 Machine Shop:

- Safety Precautions to be served in the shop
- Study and sketch of lathe machine, bench grinder, milling machine, drilling machine.
- Study of various operations on lathe machine such as turning, step turning, taper turning, facing, and knurling.

REFERENCE BOOKS:

1. B. S. Raghuwanshi, Workshop Technology, Dhanpat Rai and sons, New Delhi 2014
2. K. Venkat Reddy, Workshop Practice Manual, BS Publications, Hyderabad 2014
3. Kents Mechanical Engineering Hand book, John Wiley and Sons, New York
4. S. K. Hajara Chaudhary, Workshop Technology, Media Promoters and Publishers, New Delhi, 2015
5. H S Bawa, Mechanical Workshop Practice, McGraw Hill Education

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1	Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools & equipment's and machines
CO2	Understand job drawing and complete jobs as per specifications in allotted time
CO3	To provides the knowledge of job materials in various shops.
CO 4	To provides the knowledge of core technical subjects for making and working of any type of project.
CO5	Operate, control different machines and equipment's adopting safety practices

Course Code	:	MEHS217
Course Title	:	Sports and Yoga
Number of Credits	:	1 (L: 0 T: 0 P: 2)
Prerequisites	:	NIL
Course Category	:	HS

COURSE OBJECTIVES:

- To make the students understand the importance of sound health and fitness principles as they relate to better health.
- To expose the students to a variety of physical and yogic activities aimed at stimulating their continued inquiry about Yoga, physical education, health and fitness.
- To create a safe, progressive, methodical and efficient activity-based plan to enhance improvement and minimize risk of injury.
- To develop among students an appreciation of physical activity as a lifetime pursuit and a means to better health.

COURSE CONTENT:

• Introduction to Physical Education

Meaning & definition of Physical Education, Aims & Objectives of Physical Education, Changing trends in Physical Education

Olympic Movement

Ancient & Modern Olympics (Summer & Winter), Olympic Symbols, Ideals, Objectives & Values, Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)

• Physical Fitness, Wellness & Lifestyle

Meaning & Importance of Physical Fitness & Wellness, Components of Physical fitness, Components of Health-related fitness, Components of wellness, Preventing Health Threats through Lifestyle Change, Concept of Positive Lifestyle

• Fundamentals of Anatomy & Physiology in Physical Education, Sports and Yoga

Define Anatomy, Physiology & Its Importance, Effect of exercise on the functioning of Various Body Systems. (Circulator System, Respiratory System, Neuro-Muscular System etc.)

• **Kinesiology, Biomechanics & Sports**

Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports, Newton's Law of Motion & its application in sports, Friction and its effects in Sports.

• **Postures**

Meaning and Concept of Postures, Causes of Bad Posture., Advantages & disadvantages of weight training, Concept & advantages of Correct Posture, Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis, Corrective Measures for Postural Deformities

• **Yoga**

Meaning & Importance of Yoga, Elements of Yoga, Introduction - Asanas, Pranayama, Meditation & Yogic Kriyas, Yoga for concentration & related Asanas (Sukhasana; Tadasana; Padmasana & Sha-shankasana), Relaxation Techniques for improving concentration -Yog-nidra.

• **Yoga & Lifestyle**

Asanas as preventive measures,

Hypertension: Tadasana, Vajrasana, Pavan Muktasana, Ardha Chakrasana, Bhujangasana, Sharasana,

Obesity: Procedure, Benefits & contraindications for Vajrasana, Hastasana, Trikonasana, Ardh Matsyendrasana.

Back Pain: Tadasana, Ardh Matsyendrasana, Vakrasana, Shalabhasana, Bhujangasana.

Diabetes: Procedure, Benefits & contraindications for Bhujangasana, Paschimottasana, Pavan Muktasana, Ardh Matsyendrasana.

Asthema: Procedure, Benefits & contraindications for Sukhasana, Chakrasana, Gomukhasana, Parvatasana, Bhujangasana, Paschimottasana, Matsyasana.

• **Training and Planning in Sports**

Meaning of Training, Warming up and limbering down, Skill, Technique & Style, Meaning and Objectives of Planning, Tournament – Knock-Out, League/Round Robin & Combination

• **Psychology & Sports**

Definition & Importance of Psychology in Physical Edu & Sports, Define & Differentiate Between Growth & Development, Adolescent Problems & Their Management, Emotion: Concept, Type & Controlling of emotions, Meaning, Concept & Types of Aggressions in Sports, Psychological benefits of exercise, Anxiety & Fear and its effects on Sports Performance, Motivation, its type & techniques.

• **Doping**

Meaning and Concept of Doping, Prohibited Substances & Methods, Side Effects of Prohibited Substances

• **Sports Medicine**

First Aid – Definition, Aims & Objectives, Sports injuries: Classification, Causes & Prevention; Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries

• **Sports / Games**

Following sub topics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc.; History of the Game/Sport, Latest General Rules of the Game/Sport, Specifications of Play Fields and Related Sports Equipment, Important Tournaments and Venues, Sports Personalities, Proper Sports Gear and its Importance.

REFERENCE BOOKS:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light on Yoga by B.K.S. Iyengar.
3. Health and Physical Education – NCERT (11th and 12th Classes)

COURSE OUTCOMES:

On successful completion of the course the students will be able to:

CO1	Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, and relaxation.
CO2	Learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
CO3	Understand basic skills associated with yoga and physical activities and perform yoga movements in various combination and forms.
CO4	Develop understanding of health-related fitness components: cardiorespiratory endurance, flexibility and body composition etc.
CO5	Improve personal fitness and develop understanding of psychological problems associated with the age and lifestyle.

Course Code	:	MEAU200
Course Title	:	Environmental Science
Number of Credits	:	0 (non-credit) (L: 2, T: 0, P: 0)
Prerequisites	:	High School Science
Course Category	:	AU

COURSE OBJECTIVES:

Technicians working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce most efficient, economical and eco-friendly finished products.

- Solve various engineering problems applying ecosystem to produce eco – friendly products.
- Use relevant air and noise control method to solve domestic and industrial problems.
- Use relevant water and soil control method to solve domestic and industrial problems.
- To recognize relevant energy sources required for domestic and industrial applications.
- Solve local solid and e-waste problems.

COURSE CONTENT:

UNIT-I: ECOSYSTEM

Structure of ecosystem, Biotic & Abiotic components Food chain and food web Aquatic (Lentic and Lotic) and terrestrial ecosystem Carbon, Nitrogen, Sulphur, Phosphorus cycle Global warming: Causes, effects, process, Green House Effect, Ozone depletion

UNIT-II: AIR AND, NOISE POLLUTION

Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler); Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator); Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler

Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000

UNIT-III: WATER AND SOIL POLLUTION

Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, Total suspended solids, total solids BOD and COD: Definition, calculation; Waste Water Treatment; Primary methods: sedimentation, froth floatation; Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis); Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.

UNIT-IV: RENEWABLE SOURCES OF ENERGY

Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air); Theory of flat plate collector, Importance of coating; Advanced collector, Solar pond, Solar water heater, solar dryer. Solar stills

Biomass: Overview of biomass as energy source; Thermal characteristics of biomass as fuel; Anaerobic digestion; Biogas production mechanism; Utilization and storage of biogas;

Wind energy: Current status and future prospects of wind energy; Wind energy in India, Environmental benefits and problem of wind energy; New Energy Sources: Need of new sources, Different types new energy sources, Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion) Concept, origin and power plants of geothermal energy

UNIT-V: SOLID WASTE MANAGEMENT, ISO 14000 & ENVIRONMENTAL MANAGEMENT

Solid waste generation- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste.

Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries.

Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste

Air quality act 2004, air pollution control act 1981 and water pollution and control act1996.

Structure and role of Central and state pollution control board.

Concept of Carbon Credit, Carbon Footprint, Environmental management in fabrication industry, ISO14000: Implementation in industries, Benefits.

TEXT BOOKS:

1. Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication, 2007, ISBN: 81-224-1835-X.
2. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi

REFERENCE BOOKS:

1. S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House,NewDelh
2. C. N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011
3. Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control and Reuse, Mc-Graw illiam, Cohen, Lisa, Environmental Engineering Science, Willy, New York, 2000, ISBN 10: 0471144940.
4. Rao, M. N. Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New delhi, 1988, ISBN: 0-07-451871-8.
5. Frank Kreith, Jan F Kreider, Principles of Solar Engineering, McGraw-Hill, New York; 1978, ISBN: 9780070354760.
6. Aldo Vieira, Da Rosa, Fundamentals of renewable energy processes, Academic Press Oxford, UK; 2013. ISBN: 9780123978257.
7. Patvardhan, A.D, Industrial Solid Waste, Teri Press, New Delhi, 2013, ISBN:978-81-7993-502-6
8. Metcalf & Eddy, Waste Water Engineering, Mc-Graw Hill, New York, 2013, ISBN: 077441206.
9. Keshav Kant, Air Pollution & Control, Khanna Publishing House, New Delhi (Edition 2018)

Open -source software and website address:

- www.eco-prayer.org
- www.teriin.org
- www.cpcp.nic.in
- www.cpcp.gov.in
- www.indiaenvironmentportal.org.in
- www.whatis.techtarget.com
- www.sustainabledevelopment.un.org
- www.conserve-energy-future.com

COURSE OUTCOMES:

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

CO1	Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco – friendly products.
CO2	Explain the suitable air, extent of noise pollution, and control measures and acts
CO3	Observe the water and soil pollution, and control measures and acts
CO4	Distiguish different renewable energy resources and efficient process of harvesting.
CO5	Understand solid Waste Management, ISO 14000 & Environmental Management.

Course Code	:	MEPC301
Course Title	:	Applied Thermodynamics
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Fundamentals of Mechanical Engineering
Course Category	:	PC

COURSE OBJECTIVES:

- To understand the applications of SFEE and its application in engineering.
- To explain the perfect gas laws and different processes.
- To discuss the properties of steam and working of modern steam boilers.
- To understand the Working of Steam Nozzles and Steam turbines.
- To describe the mechanism of heat transfer.

COURSE CONTENT:

UNIT I: BASIC CONCEPTS AND LAWS OF THERMODYNAMICS:

Introduction, Definition of volume, pressure, temperature, internal energy, enthalpy, laws of thermodynamics, derivation of steady flow energy equation (SFEE), its application for turbine, pump, boiler, compressor, nozzles, Introduction to third law of thermodynamics, concept of entropy, simple numerical problems on above topics

UNIT II PERFECT GASES:

Laws of perfect gases (Boyle's law, Charles's law, Avogadro's law, Renault's law), Universal gas constant, characteristic gas constant, specific heat at constant pressure, specific heat at constant volume, relation between specific heats Polytropic law, polytropic index, relation between pressure, temperature and volume for polytropic process, Derivation of work done, heat transfer, change in internal energy, change in entropy, for isochoric, isobaric, isothermal, adiabatic and polytropic processes, simple numerical problems on above topics

UNIT-III: PROPERTIES OF STEAM:

Formation of steam; uses of steam; Basic definitions: saturated liquid line, saturated vapour line, liquid region, vapour region, wet region, superheat region, critical point, saturated liquid, saturated vapour, saturation temperature, sensible heat, latent heat, wet steam, dryness fraction, wetness fraction, saturated steam, superheated steam, degree of superheat; Determination of properties of wet, dry and superheated steam using steam tables and Mollier chart for the different processes, Simple numerical problems on the above using tables and charts; Description with line sketches and working of modern high pressure boilers Lamont and Benson boilers, Performance of boiler.

UNIT-IV: STEAM NOZZLES AND STEAM TURBINE:

Flow of steam through nozzle, Velocity of steam at the exit of nozzle in terms of heat drop using analytical method and Mollier chart; Discharge of steam through nozzles, Critical pressure ratio, Methods of calculation of cross-sectional areas at throat and exit for maximum discharge; Effect of friction in nozzles, Simple numerical problems.

Steam Turbines: Principle of working of a simple De-lavel turbine Velocity diagrams; combined velocity triangle for single stage impulse turbine, Methods of reducing rotor speed; compounding for velocity, for pressure or both pressure and velocity; Working principle of a Parson's Reaction turbine–velocity diagrams; Governing of steam turbines.

UNIT-V: HEAT TRANSFER:

Introduction to heat transfer. Different modes of heat transfer. Conduction: Mechanism, basic law and equation of conduction heat transfer, Conduction heat transfer through a plane wall, composite wall, thick walled hollow cylinder and hollow spherical shell. Fins: rectangular and pin fins. Fin effectiveness and efficiency, Convection: Mechanism, basic law and equation of convection heat transfer, Types of heat convection, Laminar and Turbulent flow in convective heat transfer. Heat exchangers, types of heat exchangers, over all heat transfer coefficient. Radiation: Mechanism of radiation heat transfer. Radiation properties (emissivity, absorptivity, reflectivity, transmissivity, irradiation, radiosity) and emissive power of a surface, Concept of black and real bodies, Laws of thermal radiation Numerical problems

TEXT BOOKS:

1. P K Nag , Basic and Applied Thermodynamics, Tata McGraw-Hill, New Delhi
2. R K Rajput , Engineering Thermodynamics, Laxmi Publications Pvt Limited

REFERENCE BOOKS:

1. S. Domkundwar & C.P. Kothandaraman, A Course in Thermal Engineering, Dhanpat Rai & Publication, New Delhi
2. P.L. Ballaney, Thermal Engineering, Khanna Publishers
3. V.P. Vasandani & D.S. Kumar, Treatise on Heat Engineering in MKS and SI Units, Metropolitan Book Co. Pvt. Ltd, New Delhi.
4. Yunus A Cengel, Thermodynamics, McGraw Hill Education India
5. R.E. Sonntag, C. Borgnakke & G.J. Van Wylen, Fundamentals of Thermodynamics, Publication: John Wiley

COURSE OUTCOMES:

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

CO1	Apply the laws of thermodynamics to analysis the steady flow devices such as nozzle, compressor, turbine etc.
CO2	Calculate the work done, heat transfer, change in internal energy, and change in entropy using perfect gas laws for various precesses.
CO3	Use steam tables and Mollier chart to compute the various properties of steam and performance of boilers.
CO4	Calculate velocity of steam at the exit of nozzle in terms of heat drop analytically and by using Mollier chart.
CO5	Understand the velocity diagram, necessity of governing and compounding of a turbine.
CO6	Understand the heat transfer mechanism and compute the rate of heat transfer in composite wall, hollow cylinder, hollow spherical shell and fins.

Course Code	:	MEPC302
Course Title	:	Fluid Mechanics & Fluid Machines
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	NIL
Course Category	:	PC

COURSE OBJECTIVES:

- To Select and use appropriate flow measuring device
- To Select and use appropriate pressure measuring device
- To understand and analyze the performance of pumps and turbines
- To understand the concept of Pneumatic System

COURSE CONTENT:

UNIT-I: PROPERTIES OF FLUID

Properties of fluid: Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapour Pressure, Compressibility. Fluid Pressure & Pressure Measurement: Fluid pressure, Pressure head, Pressure intensity, Con cept of vacuum and gauge pressures, atmospheric pressure, absolute pressure, Simple and differen tial manometers, Bourdan pressure gauge, Concept of Total pressure on immersed bodies, center of pressure, Simple problems on Manometers.

UNIT-II: FLOW THROUGH PIPE

Fluid Flow: Types of fluid flows, Path line and Stream line, Continuity equation, Bernoulli's theorem, Principle of operation of Venturimeter, Orifice meter and Pitot tube, Derivations for discharge, coefficient of discharge, Numerical problems

Flow Through Pipes: Laminar and turbulent flows; Darcy's equation and Chezy's equation for frictional losses, Minor losses in pipes, Hydraulic gradient and total gradient line, Compound pipe, equivalent size of compound pipe, pipes in parallel connection, flow through Syphon, Numerical problems

UNIT-III: IMPACT OF JET

Impact of jets: Introduction, Impulse momentum principle, Impact of jet on fixed vertical, moving vertical flat plates, Impact of jet on fixed inclined and moving inclined plates, Impact of jet on fixed curved and moving curved vanes with special reference to turbines & pumps, Simple Numericals on work done and efficiency.

UNIT-IV: HYDRAULIC MACHINES

Hydraulic Turbines: Introduction, Classification and Selection of turbine, Construction and working principle of Pelton wheel, Francis and Kaplan turbines, Draft tubes, Concept of cavitation in turbines, Calculation of Work done, Power, efficiency of turbines, Unit quantities, simple numerical

Hydraulic Pumps: Principle of working, construction and applications of centrifugal pump, Priming, Cavitation, Manometric head, Work done, Manometric efficiency, Overall efficiency. Power required to drive pumps, Principle of working, construction and applications of Reciprocating Pumps Concept of Slip, Negative slip, Cavitation and separation.

UNIT-V: FLUID MACHINES

Fluid System: Working Principle and applications of Hydraulic press, Hydraulic ram, Intensifier, and Hydraulic jack.

Pneumatic System: Basic elements of pneumatic system and their functions, Application of Pneumatics, Characteristic / features of pneumatic system. Pneumatic valves, pneumatic actuators, pneumatic system safety, cleanliness and preventive maintenance.

TEXT BOOKS:

1. A.R. Basu , Fluid Mechanics and Hydraulic Machines, Publisher: Dhanpat Rai & Co

2. R. K. Bansal, Fluid Mechanics and Hydraulic Machins, Laxmi Publications, New Delhi

REFERENCE BOOKS:

1. S. S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Publishing House, New Delhi
2. Modi P. N. and Seth S. M, Hydraulics and fluid mechanics including Hydraulic machines, Standard Book House. New Delhi
3. Yunus A. Çengel, John M. Cimbala, Fluid mechanics: Fundamentals and applications- McGraw Hill.
4. S. Ramamrutham, Hydraulic, fluid mechanics & fluid machines, Dhanpat Rai & Sons, New Delhi

COURSE OUTCOMES:

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

CO1	Measure various properties such as pressure, velocity, rate of flow using various instruments.
CO2	Calculate different parameters such as coefficient of friction, power and efficiency of various Systems.
CO3	Describe the impulse momentum principle and impact of jet on fixed and moving plates.
CO4	Study the performance of hydraulic turbines and pumps
CO5	Providing principle and applications of Fluid and Pneumatic systems

Course Code	:	MEPC303
Course Title	:	MATERIAL SCIENCE & ENGINEERING
Number of Credits	:	2 (L: 2 T: 0 P: 0)
Prerequisites	:	NIL
Course Category	:	PC

COURSE OBJECTIVES:

- To understand crystal structures and atomic bonds.
- To understand the properties of different types of ferrous metals and alloys.
- To understand the properties of different types of non-ferrous metals and alloys.
- To understand various metallic failures and acquire the knowledge of testing of materials.
- To understand the concept of corrosion and its prevention.

COURSE CONTENT:

UNIT I: CRYSTAL STRUCTURES AND BONDS:

Unit cell and space lattice: Crystal system: The seven basic crystal systems; Crystal defect, Crystal structure for metallic elements: BCC, FCC and HCP; Coordination number for Simple Cubic, BCC and FCC; Atomic radius: definition, atomic radius for Simple Cubic, BCC and FCC; Atomic Packing Factor for Simple Cubic, BCC, FCC and HCP; Simple problems on finding number of atoms for a unit cell. Bonds in solids: Classification - primary or chemical bond, secondary or molecular bond; Types of Primary bonds: Ionic, Covalent and Metallic Bonds; Types of secondary bonds: Dispersion bond, Dipole bond and Hydrogen bond.

UNIT-II: PHASE DIAGRAMS, FERROUS METALS AND ITS ALLOYS:

Isomorphs, eutectic and eutectoid systems; Iron carbon binary diagram; Iron and Carbon Steels; flow sheet for production of iron and steel; Iron ores– Pig iron: classification, composition and effects of impurities on iron; Cast Iron: classification, composition, properties and uses; Wrought Iron: properties, uses/applications of wrought Iron; comparison of cast iron, wrought iron and mild steel and high carbon steel; standard commercial grades of steel as per BIS and AISI; Alloy Steels – purpose of alloying; effects of alloying elements – Important alloy steels: Silicon steel, High Speed Steel (HSS), heat resisting steel, spring steel, Stainless Steel (SS): types of SS, applications of SS – magnet steel – composition, properties and uses.

UNIT-III: NON-FERROUS METALS AND ITS ALLOYS:

Properties and uses of aluminium, copper, copper alloys: Brasses, bronzes–composition, properties and uses; cast & wrought Aluminium alloys, Nickel alloys: Inconel, monel, Nichrome alloys, properties and uses. Anti-friction/Bearing alloys: Various types of bearing bronzes-Standard commercial grades as per BIS/ASME.

Introduction to Polymers: Types, Classifications, Properties and uses.

UNIT-IV: FAILURE ANALYSIS & TESTING OF MATERIALS:

Introduction to failure analysis; Fracture: ductile fracture, brittle fracture; cleavage; notch sensitivity; fatigue; endurance limit; characteristics of fatigue fracture; variables affecting fatigue life; creep; creep curve; creep fracture; Destructive testing: Tensile testing; compression testing; Hardness testing: Brinell, Rockwell; bend test; torsion test; fatigue test; creep test. Heat treatment processes and its objectives.

UNIT-V: CORROSION & SURFACE ENGINEERING:

Nature of corrosion and its causes; Types of corrosion, Galvanic corrosion Factors affecting corrosion: Environment, Material properties and physical conditions; Types of corrosion; Corrosion control: Material selection, environment control and design; Surface engineering

processes: Coatings and surface treatments; Cleaning and mechanical finishing of surfaces; Organic coatings; Electroplating and Special metallic plating; Electro polishing and photo-etching.

TEXT BOOKS:

1. O. P. Khanna , A Text Book of Material Science & Metallurgy, Dhanpath Rai and Sons, New Delhi.
2. A Marikani, Material Science, PHI Learning Pvt. Ltd.

REFERENCE BOOKS:

1. Material Science & Engineering –R. K. Rajput, S. K. Kataria & Sons, New Delhi, 2004.
2. Material Science –R. S. Khurmi, S. Chand & Co. Ltd., New Delhi, 2005.

COURSE OUTCOMES:

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

CO1	Explain about crystal structures and atomic bonds.
CO2	Describe about classification of ferrous metals and their properties.
CO3	Explain about non-ferrous metals, cutting tool materials and composites along With their properties.
CO4	Describe about the various metallic failures and knowledge in testing of materials.
CO5	Explain the principle of corrosion, their types and its prevention methods along With the various surface engineering processes.

Course Code	:	MEPC304
Course Title	:	MANUFACTURING ENGINEERING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Fundamental of Mechanical Engineering (MEES 203)
Course Category	:	PC

COURSE OBJECTIVES:

- To understand the importance of cutting fluids & lubricants in machining.
- To study various types of basic production processes.
- To select, operate and control the appropriate processes for specific applications.
- To understand the concept of gear making and list various gear materials.
- To understand the importance of press tools and understand various die operations.
- To understand Grinding and finishing processes.

COURSE CONTENT:

UNIT-I: INTRODUCTION TO MACHINING PROCESSES

Introduction to manufacturing: Definition, process, types and applications; Lathe Operations: Types of lathes – light duty, medium duty and heavy duty geared lathe, CNC lathe; Specifications; Basic parts and their functions; Operations and tools – Turning,

parting off, Knurling, facing, Boring, drilling, threading, step turning, taper turning, safety guidelines for working on a lathe; Introduction to cutting fluids: Types of cutting fluids, Fluids and coolants required in turning, drilling, shaping, sawing & broaching; Selection of cutting fluids, methods of application of cutting fluid; Classification of lubricants (solid, liquid, gaseous), Properties and applications of lubricants.

UNIT-II: DRILLING & MILLING

Drilling: Classification; Basic parts and their functions; Radial drilling machine; Types of operations; Specifications of drilling machine; Types of drills and reamers; Milling: Introduction; Types of milling machines: plain, Universal, vertical; constructional details– specifications; Milling operations: simple, compound and differential indexing; Milling cutters– types; Nomenclature of teeth; Teeth materials; Tool signature of milling cutter; Tool & work holding devices.

UNIT-III: CASTING & WELDING

Moulding and Casting: Introduction, Types of moulding sand and their properties, Synthetic sand mould. Core material core making, position of the core, Types of core prints, Types of mould, Gating Systems, Moulding Process (bench moulding, floor moulding, pit moulding and machine moulding) melting furnaces (pit furnace, cupola furnace, electrical furnace). Fatling of casting, defects in casting and remedies.

Welding: Classification; Gas welding techniques; Types of welding flames; Arc Welding Principle, Equipment, Applications; Shielded metal arc welding; Submerged arc welding; TIG / MIG welding; Resistance welding - Spot welding, Seam welding, Projection welding; Welding defects; Brazing and soldering: Types, Principles, Applications,

UNIT-IV: PRESS WORKING & SHAPING

Press working: Types of presses and Specifications, Press working operations: Cutting, bending, drawing, punching, blanking, notching, lancing; Die set components: punch and die shoe, guide pin, bolster plate, stripper, stock guide, feedstock, pilot; Punch and die clearances for blanking and piercing, effect of clearance.

Shaping: Introduction to shaping, Principal parts features and use of shaper, Specification of a shaper, Quick return motion mechanism, Shaper tools types, operation performed on a shaper, Description of slotter, its tool and uses, Drive mechanism of slotter, cutting fluid used in shaping and slotting. Main parts and features of a planer, its working and use, Specification of a planer, Types of the planer, Quick return motion mechanism of table, Planner tools, and Job holding devices.

UNIT-V: GRINDING & FINISHING

Grinding Processes: Introduction and Principles of metal removal by Grinding; Abrasives– Natural & Artificial; Bonds and binding processes: Vitrified, silicate, shellac, rubber, Bakelite; Factors affecting the selection of grind wheels: size and shape of wheel, kind of abrasive, grain size, grade and strength of bond, structure of grain, spacing, kinds of bind material;

Standard marking systems: Meaning of letters & numbers sequence of marking, Grades of letters; Grinding machines classification: Cylindrical, Surface, Tool & Cutter grinding machines; Construction details; Principle of center less grinding; Advantages & limitations of center less grinding;

Finishing by grinding: Honing, Lapping, Superfinishing; Electroplating: Basic principles, Plating metals, applications; Hot dipping: Galvanizing, Tin coating, Parkerizing, anodizing; Metal spraying: wire process, powder process and applications;

Organic coatings: Oil base Paint, Lacquer base, Enamels, Bituminous paints, rubber base coating; Finishing Specifications.

TEXT BOOKS:

1. H N Gupta R C Gupta, A Mittal, Manufacuring Process, New Age Int. Publication
2. Amitabha ghosh, Ashok kumar mallik, Manufacturing Science, East-West Press

REFERENCE BOOKS:

1. P N Rao , Manufacturing technology, Tata McGraw-Hill Publications
2. S. K. Hajra Chaudary, Bose & Roy , Elements of workshop Technology (Volume I & II), Media Promoters and Publishers Limited
3. O. P. Khanna & Lal , Production Technology (Volume I & II), Dhanpat Rai Publications
4. B. L. Juneja , Fundamental of metal cutting and machine tools, New age Int. Ltd.
5. P. N. Rao , Manufacturing Technology, Metal Cutting & Machine tools, Tata McGraw-Hill Publications
6. S.A Rizvi and Wajahat Ali, Manufacturing Science-I & II, Katariya Pub., New Delhi.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1	Know and identify basic manufacturing processes for manufacturing different components.
CO2	Operate & control different machines and equipment.
CO3	Produce jobs as per specified dimensions and inspect the job for specified dimensions.
CO4	Select the specific manufacturing process for getting the desired type of output.
CO5	Adopt safety practices while working on various machines.

Course Code	:	MEPC305
Course Title	:	Mechanics of Solid
Number of Credits	:	3 (L: 2, T: 1, P: 0)
Prerequisites	:	Engineering Mechanics (CEES 201)
Course Category	:	PC

COURSE OBJECTIVES:

- To understand the concept of Simple Stresses and Strains.
- To understand the concept of Strain Energy.
- To understand the concept of Shear Force and Bending Moment Diagrams.
- To understand the concept of Theory of Simple Bending and Deflection of Beams.
- To understand the concept of Torsion in Shafts and springs.
- To understand the concept of Thin Cylindrical Shells.

COURSE CONTENT:

UNIT-I: SIMPLE STRESSES AND STRAINS:

Types of forces; Stress, Strain and their nature; Mechanical properties of common engineering materials; Significance of various points on stress–strain diagram for M.S. and C.I. specimens; Significance of factor of safety; Relation between elastic constants; Stress and strain values in bodies of uniform section and of composite section under the influence of normal forces; Thermal stresses in bodies of uniform section and composite sections; Related numerical problems on the above topics.

Strain Energy: Strain energy or resilience, proof resilience and modulus of resilience; Derivation of strain energy for the following cases: i) Gradually applied load, ii) Suddenly applied load, iii) Impact/ shock load; Related numerical problems.

UNIT-II: SHEAR FORCE & BENDING MOMENT DIAGRAMS:

Types of beams with examples: a) Cantilever beam, b) Simply supported beam, c) Over hanging beam, d) Continuous beam, e) Fixed beam; Types of Loads Point load, UDL and UVL; Definition and explanation of shear force and bending moment; Calculation of shear force and bending moment and drawing the S.F and B.M. diagrams by the analytical method only for the following cases: a) Cantilever with point loads, b) Cantilever with uniformly distributed load, c) Simply supported beam with point loads, d) Simply supported beam with UDL, e) Overhanging beam with point loads, at the center and at free ends, f) Overhanging beam with UDL throughout, g) Combination of point and UDL for the above; Related numerical problems.

UNIT-III: THEORY OF SIMPLE BENDING AND DEFLECTION OF BEAMS:

Explanation of terms: Neutral layer, Neutral Axis, Modulus of Section, Moment of Resistance, Bending stress, Radius of curvature; Assumptions in theory of simple bending; Bending Equation $M/I=\sigma/Y=E/R$ with derivation; Problems involving calculations of bending stress, modulus of section and moment of resistance; Calculation of safe loads and safe span and dimensions of cross-section; Definition and explanation of deflection as applied to beams; Deflection formulae without proof for cantilever and simply supported beams with point load and UDL only (Standard cases only); Related numerical problems.

UNIT-IV: TORSION IN SHAFTS AND SPRINGS:

Definition and function of shaft; Calculation of polar M.I. for solid and hollow shafts; Assumptions in simple torsion; Derivation of the equation $T/J=\tau/R=G\theta/l$; Problems on design of shaft based on strength and rigidity; Numerical Problems related to comparison of strength and weight of solid and hollow shafts; Classification of springs; Nomenclature of closed coil helical spring; Deflection formula for closed coil helical spring (without derivation); stiffness of spring; Numerical problems on closed coil helical spring to find safe load, deflection, size of coil and number of coils.

UNIT-V: THIN CYLINDRICAL SHELLS:

Explanation of longitudinal and hoop stresses in the light of circumferential and longitudinal failure of shell; Derivation of expressions for the longitudinal and hoop stress for seamless and seam shells; Related numerical Problems for safe thickness and safe working pressure.

TEXT BOOKS:

1. Strength of Materials–D.S. Bedi, Khanna Book Publishing Co. (P) Ltd., Delhi
2. Strength of Materials– R.S. Khurmi, S. Chand Company Ltd. Delhi

REFERENCE BOOKS:

1. Strength of Materials– B.C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications, New Delhi
2. Strength of Materials– S. Ramamrutham, Dhanpat Rai & Publication New Delhi
3. A Text Book strength of Material– R.K. Bansal, Laxmi Publication New Delhi

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1	Compute stress and strain values and find the changes in axial, lateral and volumetric dimensions of bodies of uniform section and of composite section under the influence of normal forces.
CO2	Calculate thermal stresses, in bodies of uniform section and composite sections.
CO3	Define resilience, proof–resilience and modulus of resilience and obtain expressions for Instantaneous stress developed in bodies subjected to different loads.
CO4	Compute shear force and bending moment at any section of beam and draw the S.F. & B.M diagrams of for UDL and Point loads.
CO5	Calculate the safe load, safe span and dimensions of cross-section.
CO6	Compare strength and weight of solid and hollow shafts of the same length and material and compute the stress and deflection of the closed coil helical spring.

Course Code	:	MEPC311
Course Title	:	Applied Thermodynamics Lab
Number of Credits	:	1 (L:0; T:0; P:2)
Prerequisites	:	Applied Thermodynamics (MEPC 301)
Course Category	:	PC

COURSE OBJECTIVES:

- To understand the importance of fuel properties and learn the methods of determination of various properties of fuels.
- To understand the working principles of various methods used in determination of properties of fuels.
- To observe different parts of I.C. engine and understand their working.
- To identify the physical differences between S.I. and C.I. engines and 2-Stroke and 4-Stroke engines.

COURSE CONTENT:

S. No.	Topics for practice
1.	To determine the convective heat transfer coefficient in case of natural convection
2.	To determine the convective heat transfer coefficient in case of forced convection
3.	To determine the thermal conductivity of brass rod
4.	To determine the convective heat transfer coefficient and efficiency of pin fin in free convection
5.	To determine the convective heat transfer coefficient and efficiency of pin fin in forced convection
6.	To measure the emissivity of test plate
7.	To determine the Stefan Boltzmann's constant
8.	To determine the heat transfer through composite wall

REFERENCE BOOKS:

https://www.academia.edu/41877010/Heat_Transfer_Lab_Manual_Dr_Shah_Alam

1. P. L. Ballaney, Thermal Engineering, Khanna Publishers
2. S. Domkundwar & C.P. Kothandaraman, A Course in Thermal Engineering, Dhanpat Rai & Publication New Delhi
3. R. S. Khurmi and J.K. Gupta, Thermal Engineering, S. Chand & Co, New Delhi

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1	Understand the different modes of heat transfer
CO2	Evaluate the convection heat transfer coefficient
CO3	Evaluate the thermal conductivity of material
CO4	Evaluate the Stefan Bolzmann's constant
CO5	Understand the heat transfer through composite wall

Course Code	:	MEPC312
Course Title	:	FLUID MECHANICS & HYDRAULIC MACHINERY LAB
Number of Credits	:	1 (L: 0, T: 0, P: 2)
Prerequisites	:	Fluid Mechanics & Hydraulic Machinery (MEPC 302)
Course Category	:	PC

COURSE OBJECTIVES:

- To calibrate the given flow measuring device.
- To apply the knowledge acquired in theory subject.
- To analyze the performance of turbines and pumps.

COURSE CONTENT:

S. No.	Topics for practice
1.	Verification of Bernoulli's theorem.
2.	Determination of Coefficient of Discharge of Venturi meter.
3.	Determination of Coefficient of Discharge, coefficient of contraction and coefficient of velocity of Orifice meter.
5.	Determination of coefficient of friction of flow through pipes.
5.	Determination of force exerted by the jet of water on the given vane.
6.	Determination of loss of head due to sudden enlargement in a flow through pipes.
7.	Determination of loss of head due to sudden contraction in a flow through pipes.
8.	Determination of loss of head due to bend of a flow through pipes.
9.	Determination of loss of head due to elbow of a flow through pipes.
10.	Trial on centrifugal pump to determine overall efficiency.
11.	Trial on Pelton wheel to determine overall efficiency.

REFERENCE BOOKS:

1. https://www.academia.edu/36745307/Fluid_Mechanics_Lab_Manual_Modified_version pdf

2. N. Kumara Swamy, Fluid Mechanics and Machinery Laboratory Manual, Charotar Publishing House Pvt. Ltd., Ed.2008

COURSE OUT COMES:

At the end of the course, the student will be able to

CO1	Measure various properties such as pressure, velocity, flow rate using various instruments.
CO2	Calculate parameter of major loss in a pipe flow
CO3	Calculate parameters of minor losses in a pipe flow
CO4	Describe the construction, working and efficiency of Pelton wheel turbine.
CO5	Describe the construction working and efficiency of centrifugal pump.

Course Code	:	MEPC313
Course Title	:	Material Testing Lab
Number of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	Material Science and Engineering (MEPC 303) Mechanics of Solid (MEPC 305)
Course Category	:	PC

COURSE OBJECTIVES:

- To identify the type of material based on its grain structure
- To learn the procedure for identifying the cracks in the material
- To understand various material testing methods to determine mechanical properties such as yield stress, Ultimate stress, percentage elongation, Young's Modulus etc.
- To understand the Moment of Inertia and Modulus of Rigidity

COURSE CONTENT:

S. No.	Topics for practice
1.	Prepare a specimen and examine the micro structure of the Ferrous and Non-ferrous metals using the Metallurgical Microscope.
2.	Detect the cracks in the specimen using (i) Visual inspection and ring test (ii) Die penetration test (iii) Magnetic particle test.
3.	Determination of Rockwell's Hardness Number for various materials like mild steel, high carbon steel, brass, copper and aluminium.
6.	Finding the resistance of materials to impact loads by Izod test and Charpy test.
5.	To determine the Brinell Hardness number of several materials.
6.	To determine the moment of Inertia of a Flywheel by using Flywheel apparatus
7.	To determine the Modulus of Rigidity of a given material by using Helical Spring Apparatus.

8. To determine the Modulus of Elasticity of a given wire by Searl's Apparatus and plot a graph between stress and strain up to the Elastic Limit.
9. Determination of modulus of rigidity, strain energy, shear stress and stiffness by load deflection method (Open & Closed coil spring)
10. Finding Young's Modulus of Elasticity, yield points, percentage elongation and percentage reduction in area, stress strain diagram plotting, tests on mild steel.
11. Single or double Shear test on M.S. bar to finding the resistance of material to shear load.

REFERENCE BOOKS:

1. Ernest O Doebelin, Measurement system (Application and Design), Tata McGraw-Hill
2. R.S. Khurmi, Strength of Materials, S. Chand Company Ltd. Delhi
3. R.K. Bansal, A Text Book strength of Material, Laxmi Publication New Delhi

COURSE OUTCOMES

At the end of the course, the student will be able to

CO1	Identify the given specimen by viewing the micro structure using metallurgical microscope
CO2	Indicate the cracks in the specimen using different techniques
CO3	Illustrate the moment of Inertia of a Flywheel.
CO4	Observe the Modulus of Rigidity.
CO5	Determine the modulus of rigidity, strain energy, shear stress and stiffness of coil spring

Course Code	:	MEPC314
Course Title	:	Manufacturing Process – I Lab
Number of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	Fundamental of Mechanical Engineering (MEES 203) Manufacturing Process (MEPC 304)
Course Category	:	PC

COURSE OBJECTIVES:

- To Practice the casting principles and operations in foundry.
- To Practice the operation of Lathe.
- To Practice the joining of metals using different Welding techniques.

COURSE CONTENT:

S. No.	Topics for practice
1.	Moulding & casting of (i) Connecting rod (ii) Solid bearing (iii) V-Pulley/Gear Pulley
2.	Arc welding (i) Lap Joint (ii) Butt Joint (iii) T- Join
3.	Gas welding (i) Lap Joint (ii) Butt Joint
4.	Exercise Facing, Step Turning, Taper Turning & Chamfering
5.	Exercise Groove Cutting, Knurling, Thread Cutting and Drilling
6.	Grinding the Lathe Cutting tools to the required angles
7.	Study of Lathe, drilling machine, shaping machine and slotting machine
8.	The dismantling some of the components of lathe and then assemble the same
9.	List the faults associated with lathe and its remedies
10.	The routine and preventive maintenance procedure for lathe

REFERENCE BOOKS:

1. Hajra Chowdry & Bhattacharaya,, Elements of Workshop Technology (Volume I & II), Media Promoters
2. Rajender singh, Introduction of Basic Manufacturing Processes and Workshop Technology, NewAge International (P) Ltd. New Delhi, 2006
3. Raghuwanshi,, Workshop Technology, Khanna Publishers. Jain & Gupta, New Delhi
4. Jain & Gupta, Production Technology, Khanna Publishers, New Delhi
5. Myro N Begman,, Manufacturing process, 5th edition, Tata McGraw Hill, New Delhi

COURSE OUT COMES:

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

CO1	Centre the job and select the proper tool to perform the job on lathe machine.
CO2	Calculate the taper angle and practice different taper turning methods on lathe.
CO3	Prepare the edges for welding and select the suitable electrode, voltage and current
CO4	Identification faults and remedies with lathe operations.
CO5	Operate the welding transformer and generator to perform various weld joint operations

Course Code	:	MEPC316
Course Title	:	Summer Internship I
Number of Credits	:	2 (L: 0, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	SI

The Course includes at least four week summer internship mandatory for students. The students are supposed to have practical understanding and training in a suitable industry or organization. The students are required to apply their classroom learning for identification of problem. They are required prepare reports and present the output. Summer Internship I should be undertaken in an industry/Govt. or Pvt. Certified Agencies which are in social sector/ Govt. Skill Centres/Institutes/Schemes.

COURSE OBJECTIVE:

- To provide industrial exposure to student that will help students to gain real life experience
- To engage students with experienced professionals that can help them further in their careers
- To provide industrial exposure to student to the real time
- To enable the students to work on short industry projects and gain the skill of preparing report, describing its results and findings
- To identify the gap between existing knowledge and industry expectations

Course Code	:	MEPC401
Course Title	:	ADVANCED MANUFACTURING PROCESSES
Number of Credits	:	3 (L: 3, T:0, P:0)
Prerequisites	:	Basic Mechanical Engineering (MEES203) Manufacturing Engineering (MEPC304)
Course Category	:	PC

COURSE OBJECTIVES:

- To know the functions of Jigs and Fixtures.
- To know the applications of jig-boring machines.
- To identify different fabrication methods of plastic processing viz., sheet forming, blow moulding, laminating and reinforcing of plastics.
- To distinguish between non-conventional machining and traditional machining processes.
- To know about the advancements in the area of manufacturing and production processes.
- To impart knowledge & skills necessary for working in modern manufacturing environment.
- To get familiarized with working principles and operations performed on non-traditional machines, machining center, SPM, automated machines and maintenance of machine tools.

COURSE CONTENT:

UNIT-I: INTRODUCTION TO MODERN MACHINING

Introduction; comparison with traditional machining; Ultrasonic Machining: principle, Description of equipment, applications; Electric Discharge Machining: Principle, Description of equipment, Dielectric fluid, tools (electrodes), Process parameters, Output characteristics, applications; Wire cut EDM: Principle, Description of equipment, Controlling parameters; applications; Abrasive Jet Machining: principle, description of equipment, application; Laser Beam Machining: principle, description of equipment, application; Electrochemical Machining: description of equipment, application.

UNIT-II: JIGS & FIXTURES

Jigs: Introduction, Types, Leaf jig, Box and Handle jig, Template jig, Plate jig, Indexing jig, Universal jig, Vice jigs- constructional details of the above jigs; General consideration in the design of drill jigs; Drill bush;

Fixtures: Types of fixtures: Vice fixtures, Milling fixtures, Boring fixtures, Grinding fixtures-constructional details of the above fixtures; Basic principles of location; Locating methods and devices; Basic principles of the clamping; Types of clamps: Strap clamps, Cam clamps, Screw clamps, Toggle clamps, Hydraulic and Pneumatic clamps.

UNIT-III: METAL FORMING PROCESSES

Metal Forming Processes: Introduction; Rolling: Principles of rolling, types of Rolling mills and products, applications, limitations, defects in rolled products; Forging processes: Principles, types and applications of forging, forging; Extrusion processes: Basic extrusion process and its characteristics. Mechanics of hot and cold extrusion - Forward extrusion and backward extrusion – Impact extrusion Hydrostatic extrusion, defects in extruded parts; Wire Drawing: Process, its characteristics and defects in products.

UNIT-IV: CNC MACHINING & MACHINE TOOL AUTOMATION

NC Machines: Introduction and basic components; CNC programming: Preparatory functions (G Code), miscellaneous functions (M Code), Part programming including subroutines and canned cycles. Principles of computer aided part programming; Vertical and horizontal machining center: Constructional features, Axis identification, electronic control system. Automatic tool changer and tool magazine; Machine Tool Automation**:** Introduction and need; (A) Single spindle automates, transfer lines. (B) Elements of control system, Limit switches, Proximity switches, Block diagram for feedback and Servo control system, Introduction to PLC, Block diagram of PLC.

UNIT-V: SPECIAL PURPOSE MACHINES (SPM)

Concept, General elements of SPM, Productivity improvement by SPM, Principles of SPM design, Maintenance of Machine Tools: Types of maintenance, Repair cycle analysis, Repair complexity, Maintenance manual, Maintenance records, Housekeeping.
Introduction to Total Productive Maintenance (TPM)

TEXT BOOKS:

1. David L. Goetsch , Advanced manufacturing technology
2. P. K. Mistra, Non-conventional Machining, Narvasa Publishining House

REFERENCE BOOKS:

1. Production Technology – HMT, Banglore, Tata Mc-Graw Hill
2. Pabla B. S. & M. Adithan, CNC machines, New Age international limited.
3. Begman & Amsted, Manufacturing Processes, John Willey and Sons.
4. Stephen F. Krar & Arthur Gil, Exploring Advanced Manufacturing Technologies, Industrial Press

COURSE OUTCOMES:

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

CO1	Know the Operation and control of different advanced machine tools and equipment.
CO2	Produce jobs as per specified requirements by selecting the specific machining process.
CO3	Develop the mind set for modern trends in manufacturing and automation
CO4	Identify the different fabrication methods viz., sheet forming, blow moulding, laminating and reinforcing of plastics.
CO5	Know different non-traditional machining processes, CNC milling machines, special purpose machines
CO6	Work as maintenance engineer.

Course Code	:	MEPC402
Course Title	:	THEORY OF MACHINES & MECHANISMS
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	Engineering Mechanics (CEES201)
Course Category	:	PC

COURSE OBJECTIVES:

- To understand different types of cams and their motions and also to draw cam profiles for various motions.
- To understand the mechanism of various types of drives available for transmission of power.
- To understand the design of Brakes, Dynamometers, Bearings and Clutches and their function and working.
- To understand the need for balancing of masses in the same plane
- To know different types of governors.

COURSE CONTENT:

UNIT I: INTRODUCTION TO KINEMATICS PAIRS

Kinematics of Chain and Mechanism: Introduction; Definition of kinematic pairs and their types, Kinematic chains and their types, Mechanism, Inversions, Grashop's criteria to indentify the inversions of four bar mechanism, Inversions of slider-crank mechanism, Inversions double slider mechanism and their applications, Degree of freedom of kinematic chains and mechanisms

UNIT II: POWER TRANSMISSION

Transmission of Power: Types of Drives – Belt, Chain, Rope, Gear drives & their comparison; Belt Drives - flat belt, V– belt & its applications; Material for flat and V-belt; Angle of lap, Belt length. Slip and creep; Determination of Velocity Ratio, Ratio of tight side and slack side tension; Centrifugal tension and Initial tension; Condition for maximum power transmission (Simple numericals); Chain Drives – Advantages & Disadvantages; Methods of lubrication; Gear Drives – Spur gear terminology; Types of gears and gear trains, their selection for different applications; Train value & Velocity ratio for compound, reverted and simple epicyclic gear train; Methods of lubrication; Law of gearing; Rope Drives – Types, applications, advantages & limitations of Steel ropes.

UNIT III: FLY WHEEL & GOVERNORS

Flywheel: Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (no Numerical); Coefficient of fluctuation of energy, Coefficient of fluctuation of speed and its significance;
Governors: Types and explanation with neat sketches (Centrifugal, Watt and Porter); Concept, function and applications & Terminology of Governors; Comparison between Flywheel and Governor.

UNIT IV: BRAKES, DYNAMOMETERS, CLUTCHES & BEARINGS

Brakes and Dynamometers: Function of brakes and dynamometers; Types of brakes and Dynamometers; Comparison between brakes and dynamometers; Construction and

working of i) shoe brake, ii) Band Brake, iii) Internal expanding shoe brake iv) Disc Brake; Concept of Self Locking & Self energizing brakes; Numerical problems to find braking force and braking torque for shoe & band brakes; Construction and working of i) Rope Brake Dynamometer, ii) Hydraulic Dynamometer, iii) Eddy current Dynamometers; Clutches: Uniform pressure and Uniform Wear theories; Function of Clutch and its application; Construction and working of i) Single plate clutch, ii) Multiplate clutch, iii) Centrifugal Clutch iv) Cone clutch . (Simple numerical on single and Multiplate clutch); Bearings: Introduction, types i) Simple Pivot, ii) Collar Bearing, iii) Conical pivot. Torque & power lost in friction (no derivation), Simple numerical.

UNIT V: BALANCING OF MASS & CAMS FOLLOWERS

Balancing: Concept of balancing; Balancing of single rotating mass; Graphical method for balancing of several masses revolving in same plane; Concept and terminology used in vibrations, Causes of vibrations in machines; their harmful effects and remedies.

Cam and Followers: Definition and application of Cams and Followers; Classification of Cams and Followers; Different follower motions and their displacement diagrams like uniform velocity, SHM, uniform acceleration and Retardation; Drawing of profile of radial cam with knife-edge and roller follower with and without offset with reciprocating motion (graphical method)

TEXT BOOKS:

1. R.S. Khurmi & J.K. Gupta, Theory of machines, S. Chand publications.
2. D.R. Malhotra, Theory of Machines, SatyaPrakashan, New Delhi.

REFERENCE BOOKS:

1. S.S. Rattan, Theory of machines, Tata McGraw- Hill publications.
2. R.K. Bansal, Theory of machines, Laxmi publications
3. Jagdishlal, Theory of machines: Bombay Metro– Politan book Ltd.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1	Understand Kinematics and Dynamics of different machines and mechanisms
CO2	Select Suitable Drives and Mechanisms for a particular application
CO3	Know the functions of various components such as brake, dynamometer, flywheel and clutches.
CO4	Appreciate concept of balancing and Vibration
CO5	Understand different types of cams and their motions and also draw cam profiles for various motions

Course Code	:	MEPC403
Course Title	:	THERMAL ENGINEERING
Number of Credits	:	3 (L: 3, T: 0, P: 0)
Prerequisites	:	Fundamental of Mechanical Engineering (MEES 203), Applied Thermodynamics (MEPC 301)
Course Category	:	PC

COURSE OBJECTIVES:

- To understanding of gas turbine cycle and its working principles.
- To understand the principles & working of jet propulsion
- To study, analyze and evaluate the operation and the performance of I.C. engines
- To understand the system of IC engine and evaluate its performances
- To understand the working principle of air compressor

COURSE CONTENT:

UNIT-I: GAS POWER CYCLE

Heat Engines: Introduction, Assumptions made in air standard cycle analysis; Carnot, Otto and Diesel cycles with P-V and T-S diagrams; Define: Bore, Stroke, Dead Centre, Swept volume, Cubic capacity, clearance volume, compression ratio, Derivation of thermal efficiency of Otto cycle and Diesel cycle, simple numerical problems on above topics, Comparison of the Otto and Diesel cycles for following operating conditions: same compression ratio and heat input, same compression ratio and heat rejection, same peak pressure peak temperature and heat rejection, same maximum pressure and heat input, Valve timing and port timing diagrams for four stroke and two stroke engines.

UNIT-II: IC ENGINE SYSTEMS

IC Engine Systems: Introduction, Fuel system of Petrol engines; Principle of operation of simple carburetors; Fuel system of Diesel engines; Types of injectors and fuel pumps;
Cooling system: air cooling and water-cooling system with thermo siphon method of circulation and water-cooling system with radiator and forced circulation (description with line diagram). Comparison of air cooling and water-cooling system
Ignition systems: Battery coil ignition and magneto ignition (description and working),
Lubrication Systems: Introduction, Types of lubricating systems used in I. C. engines with line diagram
Governing Systems: Types of governing of I. C. engines – hit and miss method, quantitative method, qualitative method and combination methods of governing; their applications, Objective of supercharging

UNIT-III: COMBUSTION & ALTERNATIVE FUELS

Combustion in S I engines: Stages of combustion, flame front propagation, factors influencing the flame speed, phenomenon of knock,
Combustion in the C I engines: Stages of combustion, ignition delay , factors affecting delay period, phenomenon of knock
Alternate fuels: Alcohol, vegetable oil, bio diesel, Engine emissions & their control
Performance parameters- Brake power; Indicated power; Frictional power; Brake and Indicated mean effective pressures; Brake and Indicated thermal efficiencies; Mechanical

efficiency; Relative efficiency; Performance test; Morse test; Heat balance sheet; Simple numerical problem

UNIT-IV: AIR COMPRESSOR

Air Compressor: Introduction, Functions of air compressor; Uses of compressed air; classification of air compressors; Two stage compressor: construction and working (with line diagram) using P-V diagram; Work done for two stage compressor; Multi stage compressors; Work done for multi stage compressor, condition for maximum efficiency, effect of clearance volume, Rotary compressors: Centrifugal compressor, axial flow type compressor, screw compressor, scroll compressor,

UNIT V: GAS TURBINE & JET PROPULSION ENGINES

Gas turbine: Classification and applications of Gas turbines, comparison of gas turbine with reciprocating I.C. engines and steam turbines. Air-standard Brayton cycle; Description with P-V and T-S diagrams; Efficiency of Brayton cycle, General layout and working principle of Open cycle and closed cycle gas turbine;

Jet Propulsion: Principle of jet propulsion; Fuels used for jet propulsion; Applications of jet propulsion; Working of a turbojet engine; Principle of Ram effect; Working of a Ram jet engine; Principle of Rocket propulsion; Working principle of a rocket engine; Applications of rocket propulsion; Comparison of jet and rocket propulsions.

TEXT BOOKS:

1. V Ganesan, Internal Combustion Engine, Tata McGraw-Hill Publishing Ltd.
2. M. L. Mathur, R. P. Sharma. Internal combustion engines, Dhanpat Rai Pub.,

REFERENCE BOOKS:

3. P. L. Ballaney, Thermal Engineering, Khanna Publishers
4. S. Domkundwar & C. P. Kothandaraman, A Course in Thermal Engineering, Dhanpat Rai Pub.
5. R. S. Khurmi and J. K. Gupta, Thermal Engineering, 18th Edition, S. Chand & Co, New Delhi.
6. R. K. Rajput, Thermal Engineering, 8th Edition, Laxmi publications Pvt Ltd, New Delhi.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1	Classify I.C. engines and understand their working and constructional features
CO2	Understand the various systems such as fuel system, ignition system, cooling systems etc. of IC engines
CO3	Explain the process of combustion and evaluate the performance of I.C. engine
CO4	Describe the constructional features of air compressor and working of different air compressors.
CO5	Describe the construction and working of gas turbine and the concept of working of jet propulsion engines

Course Code	:	MEPE404
Course Title	:	MATERIAL HANDLING SYSTEM
Number of Credits	:	2 (L:2, T:0, P:0)
Prerequisites	:	NIL
Course Category	:	PE

COURSE OBJECTIVES:

- To know the operational features of the material handling equipment & its practical applications.
- To understand, select, operate and maintain the material handling equipment.
- To understand different material handling processes used in industries.
- To understand & appreciate safety instrumentation for equipment.

COURSE CONTENT:

UNIT-I: INTRODUCTION TO MATERIAL HANDLING SYSTEM:
Main types of Material handling equipment & their applications; Types of loads to be handled; Types of Movements; Methods of stacking, loading & unloading systems; Principles of Material Handling Systems; Modern trends in Materials handling.

UNIT-II: HOISTING MACHINERY & EQUIPMENTS
Construction, Working & Maintenance of different types of hoists such as Lever operated hoist, Portable hand chain hoist, Differential hoists, Worm geared and Spur geared hoists, Electric & Pneumatic hoists, Jumper; Construction, Working & Maintenance of different types of cranes such as Rotary cranes, Trackless cranes, Mobile cranes, Bridge cranes, Cable cranes, Floating cranes & Cranes traveling on guide rails; Construction, Working & Maintenance of Elevating equipment such as Stackers, Industrial lifts, Freight elevators, Passenger lifts, and Mast type's elevators, Vertical skip hoist elevators.

UNIT-III: CONVEYING MACHINERY:
Construction, Working & Maintenance of Traction type conveyors such as Belt conveyors, Chain conveyors, Bucket elevators, Escalators; Construction, Working & Maintenance of Traction less type conveyors such as Gravity type conveyors, Vibrating & Oscillating conveyors, Screw conveyors, Pneumatic & Hydraulic conveyors, Hoppers gates & Feeders.
Surface Transportation Equipment: Construction, Function, Working of Trackless equipment such as Hand operated trucks, Powered trucks, Tractors, Automatic Guided vehicle, Industrial Trailers; Construction, Function, Working of Cross handling equipment such as Winches, Capstans, Turntables, Transfer tables, Monorail conveyors.

UNIT-IV: COMPONENTS OF MATERIAL HANDLING SYSTEMS:
Flexible hoisting appliances such as Welded load chains, Roller chains, Hemp ropes, Steel wire ropes, fastening methods of wire & chains, Eye bolts, lifting tackles, Lifting & Rigging practices; Load handling attachments: a) Various types of hooks-Forged, Triangular eye hooks, Appliances for suspending hooks b) Crane grab for unit & piece loads c) Electric lifting magnet, vacuum lifter. d) Grabbing attachment for loose materials e) Crane attachment for handling

liquids/molten metals; Construction & Working of Arresting gear & Brakes; Construction & use of electromagnetic shoe brakes, Thruster operated shoe brakes, Control brakes.

UNIT-V: MECHANISM USED IN MATERIAL HANDLING EQUIPMENT:
Steady state motion; Starting & stopping of motion in following mechanisms: Hoisting mechanism, Lifting Mechanism, Traveling Mechanism, Slewing Mechanism, Rope & chain operated Cross- Traverse Mechanism.
Selection of Material Handling Equipment: Factors affecting choice of material handling equipment such as Type of loads, Hourly capacity of the unit, Direction & length of travel, Methods of stocking at initial, final & intermediate points, Nature of production process involved, Specific load conditions & Economics of material handling system.

TEXT BOOKS:

1. Allegri T. H., Material handling (Principles & Practice), CBS Publisher, New Delhi.
2. Apple J. M., Plant Layout & Materials Handling, John Wiley Publishers

REFERENCE BOOKS:

3. N. Rundenko, Material Handling Equipment, Peace Publisher, Moscow.
4. M. P. Alexandrov, Material Handling Equipment, MIR Publisher, Moscow.
5. Y. I. Oberman, Material Handling Equipment, MIR Publisher, Moscow.

COURSE OUTCOMES

At the end of the course, the student will be able to

CO1	Understand constructional & operational features of various materials handling systems.
CO2	Identify, compare & select proper material handling equipment for specified applications.
CO3	Know the controls & safety measures incorporated on material handling equipment
CO4	Appreciate the role of material handling devices in mechanization & automation of industrial process.
CO5	Understand & appreciate safety instrumentation for equipment

Course Code	:	MEPE405
Course Title	:	HYBRID VEHICLES
Number of Credits	:	3 (L:3, T:0, P:0)
Prerequisites	:	NIL
Course Category	:	PE

COURSE OBJECTIVES:

1. To understand the basics of electric vehicle history and components.
2. To understand properties of batteries.
3. To understand the electrical machine properties and classifications.
4. To understand the properties of electric vehicle, drive systems.
5. To understand the concepts of hybrid electric vehicles.

COURSE CONTENT:

UNIT-I: ELECTRIC VEHICLES:
Introduction; History of Hybrid and Electric Vehicles; Social and Environmental importance of Hybrid and Electric Vehicles; Components, Vehicle mechanics: Roadway fundamentals, Vehicle kinetics, Dynamics of vehicle motion; Propulsion System Design.

UNIT-II: BATTERY:
Basics; Types; Parameters: Capacity, Discharge rate, State of charge, State of Discharge, Depth of Discharge; Technical characteristics, Battery pack Design, Properties of Batteries.

UNIT-III: DC & AC ELECTRICAL MACHINES:
Motor and Engine rating; Requirements; DC machines; Three phase A/c machines; Induction machines; Permanent magnet machines; Switched reluctance machines.

UNIT-IV: ELECTRIC VEHICLE DRIVE TRAIN:
Transmission configuration; Components: Gears, Differential, Clutch, Brakes; Regenerative braking, Motor sizing; Fuel efficiency analysis.

UNIT-V: HYBRID ELECTRIC VEHICLES:
Types: Parallel, Series, Parallel and Series configurations; Drive train; Sizing of components; Basics of Micro, Mild, Mini, Plug-in and Fully hybrid

TEXT BOOKS:

1. A.K. Babu, Electric & Hybrid Vehicles, Khanna Publishing House, N. Delhi
2. Iqbal Hussain, Electric & Hybrid Vehicles – Design Fundamentals, Second Edition, CRC Press

REFERENCE BOOKS:

1. James Larminie, Electric Vehicle Technology Explained, John Wiley & Sons
2. Mehrdad Ehsani, Yimin Gao, Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, CRC Press, 2010.

COURSE OUTCOMES:

CO1	Understand the basics of electrical vehicle history and components.
CO2	Understand the properties of batteries.
CO3	Understand the electrical machine properties and classifications
CO4	Understand the properties of electrical vehicle drive systems
CO5	Understand the concepts of hybrid electric vehicles

Course Code	:	MEPC411
Course Title	:	MANUFACTURING ENGINEERING -II LAB
Number of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	Manufacturing Process (MEPC304), Advance Manufacturing Process (MEPC401)
Course Category	:	PC

COURSE OBJECTIVES:

- To know the working of Drilling machine, shaper, slotter, planer, milling and grinding machines and be in a position to operate the same.
- To make use of various measuring instruments for taking dimensions.
- To Practice different operations on drilling shaper, slotter, planer, milling and grinding machines.

COURSE CONTENT:

S. No.	Topics for practice
1.	Drilling Exercise (Three different sized holes for different materials maintaining uniform distance between them)
2.	Milling-square-hexagon from round bars with indexing and without indexing
3.	Generation of spur gear teeth on a round bar
7.	Simple planning exercise cutting 'T' slots (one model)
5.	Shaping a Hexagon on a round bar, key ways, grooves splines
6.	Shaping step block cut dovetail to angles 60, 90, 120 degrees
7.	Cylindrical grinding of external surface and internal surface using universal grinding machines
8.	Grinding flat surface on a surface grinder using magnetic chuck and clamping devices
9.	Dismantling some of the components of drilling machine and service, assemble the same
10.	Dismantling some of the components of shaper head and then assemble the same
11.	Dismantling some of the components of Milling machines and service, assemble the same

REFERENCE BOOKS:

1. Hajra Chowdry & Bhattacharaya, Elements of Workshop Technology (Volume I & II), Media Promoters, 11th Edition, 2007
2. Rajender singh, Introduction of Basic Manufacturing Processes and Workshop Technology, New age International (P) Ltd. New Delhi, 2006
3. Production Technology – HMT, 18th edition, Tata McGraw Hill, New Delhi
4. Myro N Begman, Manufacturing process, 5th edition, Tata McGraw Hill, New Delhi

COURSE OUTCOMES:

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

CO1	Dismantle and assemble the components on drilling, shaping, milling and grinding machines.
CO2	Perform operations on drilling, shaping, milling and grinding machines.
CO3	Produce articles of industrial application such as Spur gear, square headed bolt, V-block
CO4	Make use of various measuring instruments for taking dimensions

Course Code	:	MEPC412
Course Title	:	MACHINE & MECHANISM LAB
Number of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	Theory of machine & Mechanism MEPC 402
Course Category	:	PC

COURSE OBJECTIVES:

- To identify and enumerate different link-based mechanisms with basic understanding of motion
- To interpret and analyze various velocity and acceleration diagrams for various mechanisms
- To understand and illustrate various power transmission mechanisms using suitable method
- To design and evaluate the performance of different cams and followers.

COURSE CONTENTS:

S. No.	Topics for practice
1.	Study of different types of links, pairs, kinematic chains, degree of freedom and motion constraints.
2.	Study of inversions of four bar linkage and experimental verification of Grashof's Law
3.	Study of Oldham's coupling and hooks joint.

8.	Study of inversions of single slider crank chain.
5.	Plotting of the displacement diagram for the piston of a crank and connecting rod assembly.
6.	Drawing the velocity and acceleration diagrams of quick return mechanism.
7.	Study of Ackerman's Steering Gear Mechanism.
8.	Study of types of gears, tooth profile, and nomenclature.
9.	To draw displacement diagram, velocity diagram & acceleration diagram of cam follower.

REFERENCE BOOKS:

1. Theory of Machines & Mechanisms, J.J. Uicker, G.R. Pennock, J.E. Shigley, OXFORD 3rd Ed. 2009.
2. Theory of Machines by Thomas Bevan, CBS Publication 1984.
3. Design of Machinery by Robert L. Norton, McGraw Hill, 2001.
4. Mechanisms and Dynamics of Machinery by J. Srinivas, Scitech Publications, Chennai, 2002.
5. Dynamics of machinery by J. B. K. Das & P. L. S. Murthy.
6. Theory of machines– S.S. Rattan, Tata McGraw- Hill publications.
7. Theory of machines– R.K. Bansal, Laxmi publications
8. Theory of machines– R.S. Khurmi & J.K. Gupta, S. Chand publications.

COURSE OUTCOMES:

The student shall be able to:

CO1	Identify and enumerate different link-based mechanisms with basic understanding of motion
CO2	Illustrate various power transmission mechanisms using suitable methods
CO3	Understand various power transmission mechanisms using suitable methods
CO4	To design and evaluate the performance of different cams and followers.

Course Code	:	MEPC413
Course Title	:	THERMAL ENGINEERING LAB
Number of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	Thermal Engineering (MEPC 403)
Course Category	:	PC

COURSE OBJECTIVES:

- To understand the working of boilers, compressors and IC engines.
- To observe various parts of engines and understand their functions.
- To perform various tests on IC engines and calculate performance parameters.
- To understand economical and optimum running conditions of the engines.

COURSE CONTENT:

S. No.	Topics for practice
1.	To study the construction and working the two-stage reciprocating air compressor
2.	To conduct a performance test on the two-stage reciprocating air compressor and to determine the volumetric efficiency and plot the graph between delivery pressure and volumetric efficiency.
3.	To conduct a performance test on the two-stage reciprocating air compressor and to determine the isothermal efficiency and plot the graph between delivery pressure and isothermal efficiency
4.	To study the performance of a single cylinder four stroke vertical water-cooled diesel engine and compute the brake power, fuel consumption, specific fuel consumption, heat input, thermal efficiency, volumetric efficiency and air fuel ratio under various loads.
5.	To study the heat balance on a single cylinder four stroke vertical water-cooled diesel Engine
6.	To conduct performance test on two stroke air cooled Petrol engine and plot the following curves: Fuel consumption vs BP, Brake thermal efficiency vs BP, Specific Fuel consumption (SFC) vs Brake Power (BP), A/F vs BP
7.	To study the heat balance on a single cylinder two stroke air cooled petrol engine
8.	To conduct load test on the four cylinders, four stroke Petrol engine and compute its efficiency.
9.	To study the heat balance on a multi cylinder four stroke Petrol engine
10.	To conduct Morse test on the four cylinders, four stroke Petrol engine and determine indicated power.

REFERENCE BOOKS:

https://www.academia.edu/41519174/Heat_Engine_Lab_Manual

1. Thermal Engineering– P.L. Ballaney, Khanna Publishers ,2002
2. A Course in Thermal Engineering S. Domkundwar & C.P. Kothandaraman, Dhanpat Rai & Publication New Delhi
3. Thermal Engineering– R.S. Khurmi and J.K. Gupta, 18th Edition, S. Chand & Co, New Delhi

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1	Observe the performance characteristics Multi stage air compressor
CO2	Identify the components of diesel/petrol engines.
CO2	Evaluate the performance characteristics of single cylinder diesel/petrol engine at different loads and draw the heat balance sheet
CO3	Find the indicated power of individual cylinders of an engine by using morse test

Course Code	:	MEPC414
Course Title	:	ADVANCE ENGINEERING GRAPHICS
Number of Credits	:	2 (L:0 T:0 P:4)
Prerequisites	:	NIL
Course Category	:	PC

COURSE OBJECTIVES:

- It is expected that a student should learn this subject in a very systematic way to develop the skill to express effectively his idea about an object to others through drawings.
- To learn the basic principles involved in the projection of lamina and solids.
- Draw orthographic views of objects.
- Identification of surfaces of drawn orthographic views from isometric object
- Interpenetration of solids, development of surfaces and isometric drawings

COURSE CONTENT

PROJECTIONS (PLANES AND SOLIDS)

Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in First angle only. Projection of solids, such a Prism, Cube, Cylinder and Cones with axis perpendicular to horizontal plane or parallel to horizontal plane/vertical plane or both. Drawing 3 orthographic views of given objects (at least five objections). Identification of surfaces of drawn orthographic views from isometric object, Sketching practice of pictorial views from isometric objects

SECTIONAL VIEWS:

Need for sectional views – cutting planes methods of representing sections, conventional sections of various materials, classification of sections, conventions in sectioning. Drawing of full section, half section, partial broken out sections offset sections, revolved section and removed sections. Exercises on sectional views of different objects, Drawing of different conventions for materials in section conventional breaks for shafts pipes rectangular, square, angle, channel, rolled sections, Freehand Sketch of Nut and Bolt

ORTHOGRAPHIC PROJECTIONS:

Introduction of projections-orthographic, perspective, isometric and oblique: concept and applications. Introduction to orthographic projection, First angle and Third angle method,

Three views of orthographic projection of different objects, Conversion of pictorial view into Orthographic Views – object containing plain surfaces, slanting surfaces, slots, ribs, cylindrical surfaces, (use First Angle Projection method only), sectional views of objects

ISOMETRIC VIEWS:

Fundamentals of isometric projections (theoretical instructions) and isometric scale, Free hand sketching of Isometric views from 2or 3 given orthographic views. Isometric views of combination of regular solids like cylinder, cone, cube and prism.

COURSE CONTENT:

S. No.	Practical Exercises
1.	Draw some problems on projections of planes
2.	Draw some problems on projection of solids: cone, cylinders
3.	Draw some problems on projection of solids: pyramid and prism
4.	Types of sections. Sectioning and conventional representation of different sections
5.	Draw free hand sketch of nut and bolt
6.	Draw various problems on orthographic projections (2 sheets)
7.	Draw various problems on isometric projections (2 sheets)
8.	Draw some problems related to missing lines and missing views with isometric projection

REFERENCE BOOKS:

1. Bureau of Indian Standards. Engineering Drawing Practice for Schools and Colleges IS: Sp-46. BIS. Government of India, Third Reprint, October 1998; ISBN: 81-7061-091-2.
2. Bhatt, N. D. Engineering Drawing. Charotar Publishing House, Anand, Gujrat 2010; ISBN: 978-93-80358-17-8.
3. Jain & Gautam, Engineering Graphics & Design, Khanna Publishing House, New Delhi (ISBN: 978-93-86173-478)
4. Jolhe, D. A. Engineering Drawing. Tata McGraw Hill Edu. New Delhi, 2010; ISBN: 978-0-07-064837-1
5. Dhawan, R. K. Engineering Drawing. S. Chand and Company, New Delhi; ISBN: 81-219-1431-0.
6. Shah, P. J. Engineering Drawing. S. Chand and Company, New Delhi, 2008, ISBN:81-219-2964-4.
7. Kulkarni, D. M.; Rastogi, A. P.; Sarkar, A. K. Engineering Graphics with AutoCAD. PHI Learning Private Limited-New Delhi (2010); ISBN: 978-8120337831.
8. Jeyapoovan, T. Essentials of Engineering Drawing and Graphics using AutoCAD. Vikas Publishing House Pvt. Ltd, Noida, 2011; ISBN: 978-8125953005.

COURSE OUTCOMES

After going through this course, the students will be able to

CO 1	Practice the projection of plane and solids
CO 2	Practice of pictorial views from isometric objects
CO 3	Drawing of sectional views of objects
CO 4	Draw the views of orthographic projection of different objects
CO 5	Practice free hand sketching of Isometric views

Course Code	:	MEPR416
Course Title	:	Minor Project
Number of Credits	:	2 (L: 0 T: 0 P:4)
Prerequisites	:	NIL
Course Category	:	PR

COURSE OBJECTIVES:

- Understand the method of applying engineering knowledge to solve specific problems.
- Apply engineering and management principles while executing the project.
- Demonstrate good verbal presentation and technical report writing skills.
- Identify and solve complex engineering problems using professionally prescribed standards.

GUIDELINES:

1. Project will have to be done by a group in their area of interest.
2. Each group has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The student will be assigned a faculty guide who would be the supervisor of the student.
5. The number of projects that a faculty can guide would be limited to two groups.
6. The project can be carried out on-campus or in an industry or an organization with prior approval from the principal through head of section.
7. The project shall be completed and submitted at least one month before the last teaching day.
8. The project should be presented by students using power point once before submission of project.

COURSE OUTCOMES:

After going through this course, the students will be able to

CO 1	Conceptualize, design and implement solutions for specific problems.
CO 2	Communicate the solutions through presentations and technical reports
CO 3	Apply project and resource managements skills, professional ethics, societal concerns
CO 4	Synthesize self-learning, sustainable solutions and demonstrate lifelong learning

Course Code	:	MEAU400
Course Title	:	INDIAN KNOWLEDGE & TRADITION
Number of Credits	:	0 (L: 2, T: 0; P: 0)
Prerequisites	:	NIL
Course Category	:	AU

COURSE CONTENT:

- Basic Structure of Indian Knowledge System:

(i) वेद, (ii) उन्नवेद (आयुवेद, धनुवेद, गन्धवेद , स्थान्नत्य आदद) (iii) वेदथाथांग (शिक्था, कलन्न, ननरुत , व् थाकरण , ज्योनतष छथांद), (iv) उन्नथाइग (धर्म शथास्न , र्ीर्थांसथा, नुरथाण, तकशरथास्न)

- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case Studies.

REFERENCE BOOKS:

1. Sivaramakrishna, Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. Fritzof Capra, The wave of Life
4. Fritzof Capra, Tao of Physics
5. V N Jha, arkasangraha of Annam Bhatta, Inernational, Chinmay Foundation, Velliarnad, Amaku,am, RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016

Course Code	:	MEPC 501
Course Title	:	Design of Machine Elements
Number of Credits	:	3 (L: 2, T:1, P:0)
Prerequisites	:	Engineering Mechanics (CEES 201) Mechanics of Solid (MEPC 305) Theory of Machines & Mechanisms (MEPC 402)
Course Category	:	PC

COURSE OBJECTIVES:

- To enable the student to design and draw simple machine components used in small and medium scale industries.
- To understand the basic philosophy and fundamentals of Machine Design.
- To understand the modes of failures of m/c components and decide the design criteria and equations.
- To analyze and evaluate the loads, forces, stresses involved in components and subassemblies and decide the dimensions.
- To develop analytical abilities to give solutions to engineering design problems.

COURSE CONTENT:

UNIT-I: INTRODUCTION TO DESIGN:
Machine Design philosophy and Procedures; General Considerations in Machine Design; Fundamentals: Principal Stresses; Simple Numerical; Creep strain and Creep Curve; Fatigue; S-N curve; Endurance Limit; Factor of Safety and Factors governing selection of factor of Safety; Stress Concentration: Causes & Remedies; Converting actual load or torque into design load or torque using design factors like velocity factor, factor of safety & service factor; Properties of Engineering materials; Designation of materials as per IS and introduction to International standards & advantages of standardization; Use of design data book; Use of standards in design and preferred numbers series; Theories of Elastic Failures; Principal normal stress theory; Maximum shear stress theory & Maximum distortion energy theory.

UNIT-II: DESIGN OF SIMPLE MACHINE PARTS:
Cotter Joint; Knuckle Joint; Turnbuckle; Design of bell crank lever; Overhang Crank; Antifriction Bearings: Classification of Bearings; sliding contact & rolling contact; Terminology of Ball bearings: Life Load relationship, Basic static load rating and Basic dynamic load rating, limiting speed; Selection of ball bearings using manufacturer's catalogue

UNIT-III: DESIGN OF SHAFTS, KEYS & COUPLINGS:
Types of Shafts; Shaft materials; Standard Sizes; Design of Shafts (Hollow and Solid) using strength and rigidity criteria; ASME code of design for line shafts supported between bearings with one or two pulleys in between or one overhung pulley;
Design of Sunk Keys; Effect of Keyways on strength of shaft; Design of Couplings – Muff Coupling, Protected type Flange Coupling, Bush-pin type flexible coupling;
.

UNIT-IV: DESIGN OF SPRINGS:
Design of springs: Classification and Applications of Springs; Spring terminology; Materials and Specifications; Stresses in springs; Wahl's correction factor; Deflection of springs; Energy stored in springs; Design of Helical, Tension and Compression springs subjected to uniform applied loads like I.C. engine valves, Weighing balance, Railway buffers and Governor springs; Leaf springs: Construction and Application.

UNIT-V: DESIGN OF FASTENERS:
Stresses in Screwed fasteners; Bolts of Uniform Strength; Design of Bolted Joints subjected to eccentric loading; Design of Parallel and Transverse fillet welds; Axially loaded symmetrical section; Merits and demerits of screwed and welded joints. Thread Profiles used for power Screws - Relative merits and demerits of each; Torque required to overcome thread friction; Self-locking and overhauling property; Efficiency of power screws; Types of stresses induced; Design of Screw Jack.

TEXT BOOKS:

1. Sharma and Agrawal, Machine Design, S.K. Katara & Sons
2. V.B. Bhandari, Design of Machine Elements, Tata McGraw Hill, New Delhi

REFERENCE BOOKS:

1. Sadhu Singh, Khanna Book Publishing Co., Delhi (ISBN: 978-9382609-575)
2. Sadhu Singh, Machine Design, Machine Design Data Book, Revised Edition, Khanna Book

Publishing Co., Delhi (ISBN: 978-9382609-513)
3. Joseph Edward Shigley, Mechanical Engineering Design, Tata Mc- Graw Hill, New Delhi.
4. Pandya & Shah, Machine design, Dhanpat Rai & Son, New Delhi.
5. R. K .Jain, Machine design, Khanna Publication, New Delhi.
6. Abdulla Shariff, Hand Book of Properties of Engineering Materials & Design Data for Machine Elements –Dhanpat Rai & Sons, New Delhi.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1	Analyze the various modes of failure of machine components under different load patterns.
CO2	Design and prepare part and assembly drawings
CO3	Use design data books and different codes of design.
CO4	Design shaft, keys, keyway, coupling and leaf spring for specific applications
CO5	Illustrate the design the fasteners, Bolts, fillet welds and screw jack for specific applications

Course Code	:	MEPC502
Course Title	:	MEASUREMENTS & METROLOGY
Number of Credits	:	3 (L:2, T:1, P:0)
Prerequisites	:	NIL
Course Category	:	PC

COURSE OBJECTIVES:

- To study advances in technology, measurement techniques, types of instrumentation devices, innovations, refinements.
- To study the principles of instrumentation, transducers & measurement of non-electrical parameters like temperature, pressure, flow, speed, force and stress.

COURSE CONTENT:

UNIT-I: MEASURING INSTRUMENTS

Definition and significance of measurement; Methods of measurements: Direct & Indirect; Generalized measuring system; Standards of measurements: Primary & Secondary; Factors influencing selection of measuring instruments; Terms applicable to measuring instruments: Precision and Accuracy, Sensitivity and Repeatability, Range, Threshold, Hysteresis, calibration; Errors in Measurements: Classification of errors, Systematic and Random error.

Measuring instruments: Introduction; Gauges: plain plug gauge, ring Gauge, snap gauge, limit gauge; Comparators: Characteristics of comparators, Types of comparators; Surface finish: Definition, Terminology of surface finish, Talysurf surface roughness tester; Coordinating measuring machine.

UNIT-II: TRANSDUCERS AND STRAIN GAUGES:

Introduction; Transducers: Characteristics, classification of transducers, two-coil self-inductance transducer, Piezoelectric transducer; Strain Measurements: Strain gauge, Classification, mounting of strain gauges, Strain gauge rosettes-two and three elements. Measurement of force, torque, and pressure: Introduction; Force measurement: Spring Balance, Proving ring, Load cell; Torque measurement: Prony brake, Eddy current, Hydraulic dynamometer; Pressure measurement: Mcloed gauge.

UNIT-III: APPLIED MECHANICAL MEASUREMENTS

Speed measurement: Classification of tachometers, Revolution counters, Eddy current tachometers; Displacement measurement: Linear variable Differential transformers (LVDT); Flow measurement: Rotometers, Turbine meter; Temperature measurement: Resistance thermometers, Optical Pyrometer. Liquid level measurement: sight glass, Float gauge; Biomedical measurement: Sphygmo monometer.

UNIT-IV: LIMITS, FITS & TOLERANCES:

Concept of Limits, Fits, and Tolerances; Selective Assembly; Interchangeability; Hole and Shaft Basis System; Taylor's Principle; Design of Plug; Ring Gauges; IS 919-1993 (Limits, Fits & Tolerances, Gauges} IS 3477-1973; concept of multi gauging and inspection.

Angular Measurement: Concept; instruments for angular measurements; working and use of universal bevel protractor, sine bar, spirit level; principle of working of clinometers; angle gauges (with numerical on setting of angle gauges).

Screw thread Measurements: ISO grade and fits of thread; Errors in threads; Pitch errors; Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch; Two wire method; Thread gauge micrometer; Working principle of floating carriage dial micrometer.

UNIT-V: GEAR MEASUREMENT AND TESTING:

Analytical and functional inspection; rolling test; measurement of tooth thickness (constant chord method); gear tooth vernier; errors in gears such as backlash, run out, composite. Machine tool testing: parallelism; straightness; squareness; coaxiallity; roundness; run out; alignment testing of machine tools as per is standard procedure.

TEXT BOOKS:

1. Kumar D.S., "Mechanical Measurements and Control", Metropolitan, N. Delhi.
2. Gupta, I.C., "Engineering Metrology", Dhanpat Rai& Sons, New Delhi, 1994
3. Jain, R.K., "Mechanical Measurement" Khanna Publishers

REFERENCE BOOKS:

1. K. J. Hume, Engineering Metrology, Kalyani publishers

2. Beckwith Marangoni and Lienhard, Mechanical measurements, Pearson Education, 6th Ed., 2006.

3. Anand K Bewoor, Vinay kulakarni, Metrology & Measurement, Tata McGraw Hill, New Delhi, 2009

4. N V Raghvendra, L. Krishnamurthy, Engineering Metrology and Measurements, OXFORD University Press, 2013

5. Channakesava. R. Alavala, Principles of Industrial instrumentation and control systems, DELMAR cenage learning, 2009.

6. Rega Rajendra, Principles of Engineering Metrology, Jaico publishers,2008

7. Connie Dotson, Dimensional Metrology, Delmar, Cenage learning,2007

COURSE OUTCOMES

At the end of the course, the student will be able to

CO1	Define accuracy, precision, calibration, sensitivity, repeatability and such relevant terms in metrology.
CO2	Distinguish between various types of errors.
CO3	Understand the principle of operation of an instrument and select suitable measuring device for a particular application.
CO4	Appreciate the concept of calibration of an instrument.
CO5	Analyze and interpret the data obtained from the different measurements processes and present it in the graphical form, statistical form.

Course Code	:	MEPC503
Course Title	:	AUTOMOBILEENGINEERING
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	PE

COURSE OBJECTIVES:

- To understand the basic structure and components of an automobile.
- To understand the concepts of gear boxes and differential.
- To understand the concepts of transmission and steering systems.
- To understand the necessity of suspension system.
- To understand braking and steering system.

COURSE CONTENT:

UNIT-I: INTRODUCTION TO BASIC STRUCTURE OF AN AUTOMOBILE:
Basic engine components; Cylinder block; Cylinder head; Gaskets; cylinder liners, Piston and piston pin; piston rings, types of piston rings; Connecting rod; Crank shaft; Cam shaft; Crankcase; Engine valves; Flywheel and Governor. classification of vehicles on the basis of load drive, fuel used, position of engine, axles, steering, transmission, suspension, Layout of an automobile chassis, Function of major Components of a vehicle and introduction to their different systems such as frame, Clutch, gear box, braking system, axles, steering and suspension system and final drive; Multi-cylinder Engine: Engine balancing & firing order, power balance charts for 4-cylinder engine.

UNIT-II: TRANSMISSION SYSTEM:
Resistances affecting the movement of a vehicle, wind, gradient, rolling resistance and tractive resistance, tractive effort, Tractive effort V.S. speed and performance curve, Power calculation for vehicle, Single plate and multi plate clutches, clutch pedal free play adjustment, Gear box and its types, sliding mesh & constant mesh gear boxes,

synchronizing unit, gear shifting mechanism, brief introduction to automatic transmission. Overdrive and torque converter, Final Drive: Function and working of universal joints, propeller shaft and differential, types of rear axles.

UNIT-III: ELECTRICAL SYSTEM:

Complete line diagram of electrical system of a car, function and working principle of a self-starter or cranking motor drives.

Braking system: Function and principle of braking system, classification of brakes: mechanical brakes, hydraulic brakes, internal expanding brake shoes, brake drum, disc brakes, braking materials, wheel cylinder, master cylinder, Brief introduction to vacuum, air & power brakes. Bleeding and adjustment of hydraulic brake

UNIT-IV: STEERING SYSTEM:

Introduction, layout of steering system, steering gear box and linkages, fundamental equation for correct steering, Ackermann's steering mechanism, factors affecting steering, Introduction to power steering. Wheel alignment & steering geometry: Castor, Camber, king pin inclination, included angle, toe-in & toe-out, Centrifugal & cornering force, slip angle and its effect on steering, Under steering & over-steering.

UNIT-V: FRAME &SUSPENSION:

Frame and frame-less construction, purpose of suspension System, types of suspension system, Rigid axle suspension system, independent suspension system Basic parts, Types of independent suspension system, Advantages and disadvantages, leaf springs, coil springs and torsion bar, function and working of shock Absorber (telescopic), Front axle-Live and dead front axle, stub axle

TEXT BOOKS:

1. Kirpal Singh, Automobile Engineering Vol I, II, Standard Publishers Distributors, Delhi. 2012.
2. A.K. Babu, S.C. Sharma, Automobile Mechanics, Khanna Publications, New Delhi

REFERENCE BOOKS:

1. Joseph Heitner, Automotive Mechanics: Principles and Practices, East West Press
2. S. Srinivasan, Automotive Mechanics, 2nd Edition, Tata McGraw Hill
3. K. M. Gupta, Automobile Engineering Vol I and Vol II, Umesh Publications.
4. Jain and Asthana, Automotive Engineering, Tata McGraw Hill.

COURSE OUTCOMES:

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

CO1	Identify the components of an automobile with their working
CO2	Explain the concepts of transmission and braking systems.
CO3	Explain the concepts of gear box and differential and steering systems.
CO4	To understand the concept of steering geometry and wheel alignment.
CO5	Identify different suspension systems and their applications.

Course Code	:	MEPE504
Course Title	:	POWER PLANT ENGINEERING
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	Thermal Engineering (MEPC403)
Course Category	:	PE

COURSE OBJECTIVES:

- To understand the present scenario of power in India.
- To recognize various load terminologies used in power plants.
- To understand hydro working principles
- To understand working of Diesel, Gas and Nuclear power plants.
- To understand the issues and safety precautions in power plants.

COURSE CONTENT:

UNIT-I: INTRODUCTION TO POWER PLANT AND CYCLE:
Introduction to power plant; Indian Energy scenario in India; Location of power plant; Choice of Power plant; Classification of power plants, Power plant cycles: Rankine cycle, Reheat cycle, Regenerative cycle, Binary vapour cycle, Reheat-regenerative cycle, simple numerical.

UNIT-II: ECONOMICS OF POWER PLANT:
Terminology used in power plant: Peak load, Base load, Load factor, Load curve; Various factor affecting the operation of power plant; Methods of meeting the fluctuating load in power plant; Load sharing- cost of power-tariff methods; Performance and operating characteristics of power plant.

UNIT-III: STEAM AND DIESEL POWER PLANT:
Steam power plant: General layout of a steam power plant, Coal handling system: belt conveyor, screw conveyor, Pulverizing mills: Principle of ball mill, roller mill, Pulverized coal firing system, Ash handling system: Pneumatic conveyor system, Dust collection system: Principle of electrostatic precipitator (ESP), requirement and working of surface steam condenser, Safety methods
The layout of diesel power plant; Components and the working of diesel power plant; Advantages and disadvantages of diesel power plant;

UNIT-IV: HYDRO AND NUCLEAR PLANT:
Hydroelectric power plant; Introduction, Rainfall, Runoff and its measurement, Hydrograph, flow duration curve; Selection of sites for hydroelectric power plant; General layout of Hydroelectric power plant and its working; Classification of the Plant-Run off river plant, storage river plant, pumped storage plant; Advantages and disadvantages of hydroelectric power plant.
Nuclear power plant: Introduction; Nuclear Power-Radio Activity-Radioactive charge-types of reactions; nuclear fission, nuclear fusion, nuclear chain reaction Working of a nuclear power plant; Thermal fission Reactors PWR, BWR and gas cooled reactors; Advantages and Disadvantages of Nuclear power plant.

UNIT-V: ENVIRONMENTAL IMPACT OF POWER PLANT:

Social & Economical issues of power plant; Greenhouse effect; Acid precipitation Acid rain, Acid snow, Dry deposition, Acid fog; Air, water, Thermal pollution from power plants; Radiations from nuclear power plant effluents.

Power plant safety: Plant safety concept; Safety policy to be observed in power plants; Safety practices to be observed in boiler operation; Safety in oil handling system; Safety in Chemical handling system; Statutory provision related to boiler operation.

TEXT BOOKS:

1. P.K. Nag, Power Plant Engineering,Tata McGraw Hill.
2. El-Wakil, Power Plant Technology, McGraw Hill.

REFERENCE BOOKS:

1. Frederick T. Morse, Power plant Engineering, Litton Educational Publishing Inc. 1953.
2. S. C. Arora, S. Domakundwar, A Course in Power Plant Engineering, Dhanpat Rai, 1984.
3. P.C. Sharma, Power Plant Engineering, S.K.Kataria & sons, 2009.
4. G. D. Rai, An Introduction to Power Plant Technology, Khanna Publishers Pvt. Ltd.
5. R.K. Rajput, Power System Engineering, Firewell Media,2006

COURSE OUTCOMES

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

CO1	Familiarized with the present and future power scenario of India
CO2	Enlist various load terminologies in power plants
CO3	Working and classifications in steam and diesel power plant
CO4	Working principles of hydro and nuclear power plants.
CO5	Understand the issues and necessity of safety concepts of power plants.

Course Code	:	MEOE505
Course Title	:	RENEWABLE ENERGY TECHNOLOGIES
Number of Credits	:	3 (L: 3, T:0, P:0)
Prerequisites	:	NIL
Course Category	:	OE

COURSE OBJECTIVES:

- To understand present and future scenario of world energy use.
- To understand fundamentals of solar energy systems.
- To understand basics of wind energy.
- To understand bio energy and its usage in different ways.
- To identify different available non-conventional energy sources.

COURSE CONTENT:

UNIT-I: INTRODUCTION:

World Energy Use; Reserves of Energy Resources; Environmental Aspects of Energy Utilization; Renewable Energy Scenario in India and around the World; Potentials; Achievements / Applications; Economics of renewable energy systems

UNIT-II: SOLAR ENERGY:

Solar Radiation; Measurements of Solar Radiation; Flat Plate and Concentrating Collectors; Solar direct Thermal Applications; Solar thermal Power Generation Fundamentals of Solar Photo Voltaic Conversion; Solar Cells; Solar PV Power Generation; Solar PV Applications.

UNIT-III: WIND ENERGY:

Wind Data and Energy Estimation; Types of Wind Energy Systems; Performance; Site Selection; Details of Wind Turbine Generator; Safety and Environmental Aspects

UNIT-IV: BIO-ENERGY:

Biomass direct combustion; Biomass gasifiers; Biogas plants; Digesters; Ethanol production; Bio diesel; Cogeneration; Biomass Applications.

UNIT-V: OTHER RENEWABLE ENERGY SOURCES:

Tidal energy; Wave Energy; Open and Closed OTEC Cycles; Small Hydro-Geothermal Energy; Hydrogen and Storage; Fuel Cell Systems; Hybrid Systems

TEXT BOOKS

1. S. Rao, B. B. Parulekar, “Energy Technology” Khanna Publishers New Delhi
2. Bansal Keemann, Meliss," Renewable energy sources and conversion technology", Tata Mc Graw Hill.

REFERENCE BOOKS:

1. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018)
2. Twidell, J.W. & Weir, A., Renewable Energy Sources, EFN Spon Ltd., UK, 2006.
3. Sukhatme. S.P., Solar Energy, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 1997.
4. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K., 1996.

5. G. N. Tiwari and M. K. Ghoshal, Fundamental of Renewable Energy Sources, Narosa, New Delhi, 2007.
6. NH Ravindranath, UK Rao, B Natarajan, P Monga, Renewable Energy and Environment-A Policy Analysis for India, Tata McGraw Hill.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO 1	Understand present and future energy scenario of the world
CO 2	Understand various methods of solar energy harvesting.
CO 3	Identify various wind energy systems.
CO 4	Evaluate appropriate methods for Bio energy generations from various Bio wastes.
CO 5	Identify suitable energy sources for a location.

Course Code	:	MEPC511
Course Title	:	MACHINE DRAWING
Number of Credits	:	2 (L: 0 T: 0 P: 4)
Prerequisites	:	Engineering Graphics (MEES 116), Advance Engineering Graphics (MEPC 511)
Course Category	:	PC

COURSE OBJECTIVES:

- Provide the fundamental concepts of machine drawing and elaborate the idea of new structures of machine element.
- Study the conventions and rules to be followed by engineers for making accurate drawings.
- Understand and draw different types of threads used in manufacturing.
- Help the student in the visualization of assembly and sub assembly of various machine elements.
- Train the students in the preparation of assembly drawings

COURSE CONTENTS:

- Threads (one sheet), Screw thread nomenclature, different forms right hand and left hand. Nut and Bolts (one sheet), Hexagonal and square hade d nut and bold. Locking Devices & Screws (one sheet). Different types of locking devices and screws.
- Limits and fits (One Sheet). Limit system tolerance, limits, deviation, allowance, basic size. Tolerances fundamental tolerances, fundamental deviation, Method of placing limit dimensions.
- Fits: Clearance fit transition fit. Interference fit hole basis system shaft basis system Calculating values of clearance/interference, hole tolerance and shaft tolerance with given basic size for common assemblies like H7/g6, H7/m6 H8u7.

- Surface roughness
- Sketch of the following: Introduction, actual profile, surface roughness number, indication of machining symbols and allowances. Indication of surface roughness symbols on drawing.
- Details of Assembling Drawing: practical exercises on drawing from details to assemble of the following:

  I.C. engine Parts & Steam Engine: Stuffing Box, Connecting rod, Engine piston, Fuel injector, carburetor, Boiler Mountings, Non-Return Valves, Stop Valve, Blow of Cock.

  Machine tool Parts (02 Sheets): Screw Jack, Flanged coupling, Flexible type, Tail stock, Tool post, Tool holder, Machine vice

Course Content:

S. No.	Practical Exercises
1.	Draw the different types of threads used in manufacturing with nomenclature and Draw nut and bolt assembly (hexagonal headed or square headed)
2.	Study of Limits, fits and tolerances and Draw the symbols of surface roughness with details of manufacturing processes
3.	Draw the assembly drawing of Stuffing box/ engine piston
4.	Draw the assembly drawing of fuel injector/ connecting rod
5.	Draw the assembly drawing of non-return valve
6.	Draw the assembly drawing of steam stop valve/ blow off cock
7.	Draw the assembly drawing of Plummer block
8.	Draw the assembly drawing of screw jack
9.	Draw the assembly drawing of flanged coupling/ knuckle joint/ universal coupling
10.	Draw the assembly drawing of tail stock/ tool holder/ machine vice.

REFERENCES BOOKS:

1. Machine Drawing by R.K. Dhawan (S. Chand publishers)
2. Machine Drawing by Narayana Kanaiha (Willey Publications)
3. Machine Drawing by K. C. John (PHI Learning Pvt. Ltd.)

COURSE OUTCOMES:

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

CO1	Interpret Conventional symbols as per IS code SP46
CO2	Understand the Conventional representation of Riveted joints
CO3	Categorize attributes of Production Drawing and Limits, fits, tolerances
CO4	Preparation of the part or assembly drawings as per the convention
CO5	Visualize the assembly of a given set of details of machine components

Course Code	:	MEPC512
Course Title	:	MEASUREMENTS & METROLOGY LAB
Number of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	Measurements & Metrology (MEPC502)
Course Category	:	PC

COURSE OBJECTIVES:

- To understand techniques for precise measurement of the dimensions of various objects and shapes.

COURSE CONTENT:

S. NO.	TOPICS FOR PRACTICE
1.	Measure the diameter of a wire using micrometre and compare the result with digital micrometre
2.	Measurement of the effective diameter of a thread by: (a) Screw thread micrometer. (b) Three wire method
3.	Measure the angle of the machined surface using sine bar with slip gauges
4.	Measure the angle of a v-block / taper shank of drill / dovetail using universal bevel protractor.
5.	Measure the dimensions of ground ms flat/cylindrical bush using vernier caliper compare with digital/dial vernier caliper.
6.	Measure the geometrical dimensions of v-thread using thread vernier gauge
7.	Measure the thickness of ground ms plates using slip gauges
8.	Study of flatness of slip gauges and micrometer anvil faces using optical flat.
9.	Study of mechanical comparator and determine that the given pieces are within specified limits of tolerances.
10.	Study of tool marker's microscope and to measure the following: (a) pitch of a thread (b) angle of thread

REFERENCE BOOKS:

1. Engineering Metrology – R. K. Jain
2. Engineering precision metrology – R. C. Gupta
3. A Hand book of Industrial Metrology – ASME
4. Engineering Metrology: By K.J. Hume.

COURSE OUT COMES:

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

CO1	Measure various component of linear measurement using Vernier calipers and Micrometre
CO2	Measure various component of angle measurement using sine bar and bevel Protractor
CO3	Measure the geometrical dimensions of V-thread and spur gear

Course Code	:	MEPC513
Course Title	:	Automobile Engineering Lab
Number of Credits	:	1 (L:0, T:0, P:2)
Prerequisites	:	Automobile Engineering (MEPC503)
Course Category	:	PC

COURSE OBJECTIVES:

- To understand the parts of four stroke and two stroke petrol engines.
- To understand the parts of four stroke and two stroke diesel engines.
- To understand the mechanism of transmission and steering systems.
- To understand the mechanism of gear box.
- To understand the mechanism of differential.

COURSE CONTENT:

S. No.	Topics for Practice
1.	Identify various parts & study the functions four stroke Petrol Engine.
2.	Identify various parts & study the functions four stroke Diesel Engine.
3.	Identify various parts & study the functions two stroke Petrol Engine.
4.	Identify various parts & study the functions two stroke Diesel Engine.
5.	Study of construction & working of Clutch
6.	Study of transmission and steering mechanism
7.	Study of Synchromesh and sliding mesh 4 speed Gear Box and determine the speed ratios in 1st, 2nd, 3rd gears
8.	Study of construction & working of Differential
9.	Study of different type of Brakes: Mechanical and Hydraulic

REFERENCE BOOKS:

1. Automotive Mechanics, S. Srinivasan, 2nd Edition, Tata McGraw Hill
2. Automobile Engineering Vol I and Vol II, K. M. Gupta, Umesh Publications.
3. Automotive Engineering, Jain and Asthana, Tata McGraw Hill.

COURSE OUTCOMES:

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

CO1	Understand the components of two stroke and four stroke petrol and diesel engine
CO2	Understand the function of clutches and gear box
CO3	Understand the function of steering and differential

Course Code	:	MEPC516
Course Title	:	Summer Internship II
Number of Credits	:	2 (L: 0, T: 0, P: 0)
Prerequisites	:	NIL
Course Category	:	SI

Four week summer internships is mandatory for students. The students are supposed to have practical understanding and training in a suitable industry or organization.

Summer Internship II should be undertaken in an industry only. It should be based on real/ live problems of the Industry/Govt./NGO/ MSME/Rural Sector or an innovative idea having the potential of a Startup

COURSE OBJECTIVE:

- To provide industrial exposure to student that will help students to gain real life experience
- To engage students with experienced professionals that can help them further in their careers
- To provide industrial exposure to student to the real time
- To enable the students to work on short industry projects and gain the skill of preparing report, describing its results and findings
- To identify the gap between existing knowledge and industry expectations

Course Code	:	MEPR517
Course Title	:	Major Project-I
Number of Credits	:	1 (L:0 T:0 P:2)
Prerequisites	:	NIL
Course Category	:	PR

COURSE OBJECTIVES:

- Understand the method of applying engineering knowledge to solve specific problems.
- Apply engineering and management principles while executing the project.
- Demonstrate good verbal presentation and technical report writing skills.
- Identify and solve complex engineering problems using professionally prescribed standards.

GUIDELINES:

1. Project will have to be done by a group in their area of interest.
2. Each group has to select a contemporary topic that will use the technical knowledge of their program of specialization.

3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The student will be assigned a faculty guide who would be the supervisor of the student.
5. The major project-1 required:
   - To specify project topics
   - To complete introduction, literature review
   - To specify methodology completely
   - The line diagram and requirements of parts and materials should be specified in case of fabrication project

COURSE OUTCOMES:

After going through this course, the students will be able to

CO 1	Conceptualize, design and implement solutions for specific problems.
CO 2	Communicate the solutions through presentations and technical reports
CO 3	Apply project and resource managements skills, professional ethics, societal concerns
CO 4	Synthesize self-learning, sustainable solutions and demonstrate lifelong learning

Course Code	:	MEHS601
Course Title	:	Entrepreneurship and Start-ups
Number of Credits	:	3 (L: 3, T:0, P:0)
Prerequisites	:	None
Course Category	:	HS

Course Learning Objectives:

1. Acquiring Entrepreneurial spirit, Acquiring entrepreneurial quality, Competency and motivation.
2. Understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation.
3. To eliminate unproductive activities under the control of the Management, Supervisor, worker and the Design of Products and Processes.
4. To use the Charts to record the Activities of the people, materials and Equipment to find alternative methods which minimize waste and to implement the best method.

COURSE CONTENT:

UNIT-I: INTRODUCTION TO ENTREPRENEURSHIP AND START UPS:
Definitions, Traits of an entrepreneur, Intrapreneurship, Qualities to becomes entrepreneur, Motivation, Types of Business Structures, Similarities/differences between entrepreneurs and managers, Small Scale of industries, Business Ideas and their implementation, Business Plan.

UNIT-II: IDEA TO START-UP:

Market Survey, Project report, Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Marketing and accounting, Risk analysis, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses, exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy.

UNIT-III: PRINCIPLES OF MANAGEMENT:

Definition of Management, Administration Organization, F.W. Taylor's and Henry Fayol's Principles of Management, Functions of Manager, Types of Organization: Line, Staff, and committee type, Directing, Leadership; Styles of Leadership; Qualities of a good leader; Motivation, Positive and Negative Motivation, Modern Management Techniques, Management Information Systems, Objectives and Importance.

UNIT-IV: PRODUCTION PLANNING AND CONTROL:

Introduction, Major functions of Production Planning and Control, Methods of forecasting, Concept of Critical Path Method (CPM), Types of Production: Mass Production, Batch Production and Job Order Production, Principles of Product and Process Planning, Quality Control: Definition, Objectives, Sampling Inspection, Benefits of ISO to the organization, Concept of ISO 9001:2008, Quality Management System, Registration/Certification.

UNIT-V: FINANCIAL MANAGEMENT:

Financial Institutions, Financing methods available for start-ups in India, Fixed and Working Capital; Resources of Capital; Shares Preference and Equity Shares; Debentures; Public Deposits; Factory Costing: Direct Cost; Indirect Cost; Factory Overhead; Selling Price of a product; Profit.

TEXT BOOKS

1. S.C. Sharma, Industrial Engineering & Management, Khanna Book Publishing Co. (P) Ltd., Delhi
2. O.P. Khanna, Industrial Engineering and Management, Revised Edition, Dhanpat Rai Publications (P) Ltd., New Delhi – 110002.

REFERENCE BOOKS:

3. Steve Blank and Bob Dorf, K & S Ranch, The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company, ISBN – 978-0984999392
4. Eric Ries, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Penguin UK ISBN – 978-0670921607
5. Heinz Weihrich, Harold Koontz, Management, A global perspective, 10th Edition, McGraw Hill International Edition 1994.
6. M. Mahajan, Industrial Engineering and Production Management, Dhanpat Rai & Co.

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO 1	Understanding the concept and process of entrepreneurship
CO 2	Understand the ideas of start-up, finance and protection
CO 3	Explain the production planning and quality control, and its functions
CO 4	Understand the basic principles, approaches and functions of management and identify concepts to specific situations
CO 5	List and explain the different financial sources and methods of inventory management

Course Code	:	MEPC602
Course Title	:	COMPUTER AIDED DESIGN AND MANUFACTURING
Number of Credits	:	3 (L: 3, T:0, P:0)
Prerequisites	:	AutoCAD (MEPC)
Course Category	:	PC

COURSE OBJECTIVES:

- To provide an overview of how computers are being used in design, development of manufacturing plans and manufacture.
- To understand concepts of drafting and modelling using CAD.
- To understand the need for integration of CAD and CAM.
- To understand the concepts of flexible manufacturing system.

COURSE CONTENT:

UNIT-I: FUNDAMENTALS OF CAD/CAM:

Automation; Design process; Application of computers for design; Benefits of CAD; Computer configuration for CAD applications; Design workstation; Graphic terminal; CAD Software: Definition of system software and application software; CAD database and structure. Geometric Modeling: 3D-Wire frame modeling; Wire frame entities and their definitions; Interpolation and Approximation of curves; Concept of Parametric and Non-parametric representation of curves; Curve fitting techniques.

UNIT-II: FINITE ELEMENT METHODS

Introduction, Principles of Finite elements modelling, Stiffness matrix/displacement matrix, Stiffness matrix for spring system, bar & beam elements, bar elements in 2D space (truss element); CAD of Machine Elements: Basics of programming in MATLAB, writing a program in MATLAB for machine elements like shaft, keys, couplings, knuckle joint, welded joints etc.

UNIT-III: NC CONTROL PRODUCTION SYSTEMS:
Numerical control; Elements of NC system; NC part programming; Methods of NC part programming; Manual part programming, Computer assisted part programming; Post processor; Computerized part program

UNIT-IV: GROUP TECHNOLOGY:
Part families; Parts classification and coding; Production analysis; Machine cell design; Computer aided process planning: Retrieval type and Generative type; Machinability data systems; MRP and its Benefits.

UNIT-V: FLEXIBLE MANUFACTURING SYSTEM:
F.M.S equipment; Layouts; Analysis methods and benefits; Computer aided quality control; Automated inspection: Off-line, On-line, Contact, Non-contact; Coordinate measuring machines; Machine vision; CIM system and Benefits.

TEXT BOOKS:

1. Kundra and Rao, Computer Aided Manufacturing, McGraw Hill Education
2. RK Srivastava, Computer Aided Design, Umesh Publications.

REFERENCE BOOKS:

1. P.N. Rao, CAD/CAM Principles and Applications, Tata McGraw-Hill
2. Groover M.P. & Zimmers Jr, Computer Aided Design and Manufacturing, Prentice hall of India
3. Radha Krishna P. & Subramanyam, CAD/CAM/CIM, Wiley Eastern Ltd

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1	Develop mathematical models to represent curves and surfaces and Model engineering components using solid modeling techniques.
CO2	Understand geometric transformation techniques in CAD.
CO3	Develop programs for CNC to manufacture industrial components.
CO4	Understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system
CO5	Utilize Flexible manufacturing system tools.

Course Code	:	MEPE 603
Course Title	:	REFRIGERATION AND AIR-CONDITIONING
Number of Credits	:	3 (L:3, T:0, P:0)
Prerequisites	:	
Course Category	:	PE

COURSE OBJECTIVES:

- To understand the basics of Refrigeration cycles
- To understand basics of vapour compression and vapour absorption systems
- To identify components and refrigerants and lubricants of a refrigeration system
- To understand control strategies for refrigeration system
- To understand the basics about air conditioning systems

COURSE CONTENT:

UNIT-I: INTRODUCTION TO REFRIGERATION:

Definition of Refrigeration; Refrigerating effect-unit of refrigeration- Coefficient of performance; Types of Refrigeration-Ice, dry ice, Steam jet, Throttling, Liquid nitrogen refrigeration; Carnot refrigeration Cycle; Air refrigeration- Bell - Coleman cycle, PV& TS diagram; Advantage and disadvantages in air refrigeration; Simple problems

UNIT-II: REFRIGERATION SYSTEMS:

Basic Components, Flow diagram of working of Vapour compression cycle; Representation of the vapour compression cycle on P-H, T-S & P-V Diagram; Expression for Refrigerating effect, work done and power required; Types of Vapour Compression cycle; Effects of super heating and under cooling, its advantages and disadvantages; Simple Vapour absorptions cycle and its flow diagram; Simple Electrolux system for domestic units; Comparison of Vapour absorption and vapour compression system; Simple problems on vapour compression cycle

UNIT-III: REFRIGERATION EQUIPMENTS:

Compressor - types of compressors; Hermetically sealed and semi hermetically sealed compressor; Condensers - Air Cooled, water cooled, natural and forced draught cooling system; Advantages and disadvantages of air cooled and water-cooled condensers; Evaporators -natural, convection, forced convection types. Refrigerants and lubricants: Introduction to refrigerants; Properties of good refrigerants; Classification of refrigerants by group number and commonly used refrigerants in practice; Detection of refrigerants leakage; Charging the system with refrigerant; Lubricants used in refrigeration and their properties.

UNIT-IV: REFRIGERANT FLOW CONTROLS:

Capillary tube; Automatic Expansion valve; Thermo static expansion valve; High side and low side float valve; Solenoid valve; Evaporator pressure regulator. Application of refrigeration: Slow and quick freezing; Cold storage and Frozen storage; Dairy refrigeration; Ice making industry; Water coolers.

UNIT-V: AIR-CONDITIONING:

Introduction to Air conditioning; Factors affecting Air conditioning; Psychometric chart and its use; Psychometric process-sensible heating and cooling, Humidifying and dehumidifying; Adiabatic saturation process; Equipment used in air conditioning cycle; Air conditioning units and plants. Refrigeration and Air-conditioning tools: Tools used in refrigeration and Air conditioner installation; Installation procedure; Faults in refrigeration and air conditioning system; Servicing procedure

TEXT BOOKS:

1. Sadhu Singh, Refrigeration and Air Conditioning, Khanna Book Publishing Co
2. S. Domakundawar, Refrigeration and Air Conditioning, Dhanpat Rai publications

REFERENCE BOOKS:

1. A.S. Sarao & G.S. Gabi, Refrigeration and Air Conditioning, 6th edition, Satya Prakashan publications, New Delhi, 2004
2. Roy J. Dossat, Principles of Refrigeration, 5th edition, Pearson Publications, 2001
3. M. Zakria Baig, Refrigeration and Air Conditioning, Premier/ Radiant Publishing House
4. C.P Arora, Refrigeration and Air Conditioning, Tata McGraw Hill Education, 2000

COURSE OUTCOMES

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

CO1	Define refrigeration and types of Refrigeration cycles
CO2	Explain Vapour Compression and Vapour Absorption System working principles
CO3	Identify the components required for refrigeration system.
CO4	Identify the controlling components for a refrigeration system
CO5	Explain the working principles of Air-conditioning.

Course Code	:	MEOE604
Course Title	:	MECHATRONICS
Number of Credits	:	3 (L:3, T:0, P:0)
Prerequisites	:	NIL
Course Category	:	OE

Course Objectives:

- To understand the basic concepts and characteristics of measurement systems.
- To learn various types of sensors and transducers various mechanical, electrical and pneumatic actuation systems.
- To learn various mechanical, electrical and pneumatic actuation systems.
- To learn the concepts of digital communications and develop PLC programs.
- To evaluate the performance of mechatronic systems.

COURSE CONTENT:

UNIT-I: INTRODUCTION TO MECHATRONICS:

Mechatronics; Importance of Mechatronics; Systems: Measurement systems; Control systems and their types; Closed-loop control System; Automatic water level controller; Sequential controllers-washing machine

Measurement System terminology: Displacement, Position & Proximity Sensors; Velocity and Motion Sensors; Force Sensors; Fluid Pressure Sensors; Flow Sensors; Liquid Level Sensors; Temperature Sensors; Light Sensors; Selection of Sensors.

UNIT-II: MECHANICAL & ELECTRICAL ACTUATION SYSTEMS:

Mechanical: Types of motion; Freedom and constraints; Loading; Gear Trains; Pawl & Ratchet; Belt & Chain drives; Bearings: Selection, Ball & Roller bearings; Mechanical aspects of motor selection.

Electrical Actuation Systems: Switches & Relays; Solenoids; D.C Motors; A. C. Motors; Stepper Motors: Specifications and Control of stepper motors; Servomotors: D.C Servomotor and A.C Servomotor. Pneumatic & Hydraulic Systems: Power supplies; DCV; PCV; Cylinders; Rotary actuators.

UNIT-III: MATHEMATICAL MODEL:

Introduction to Mathematical model; Mechanical System building blocks; Electrical System building blocks; Fluid System building blocks; Thermal System building blocks. System Model: Engineering Systems, Rotational, Translational Systems; Electro-Mechanical System; Hydro-Mechanical System. Input/Output Systems: Interfacing; Input/output ports; Interface requirements: Buffers, Handshaking, Polling and interrupts, Serial interfacing; Introduction to PIA; Serial communications interface; Example of interfacing of a seven-segment display with a decoder.

UNIT-IV: PROGRAMMABLE LOGIC CONTROLLER (PLC):

Definition; Basic block diagram and structure of PLC; Input/Output processing; PLC Programming: Ladder diagram, its logic functions, Latching and Sequencing; PLC mnemonics; Timers; Internal relays and Counters; Shift registers; Master and Jump

Controls; Data handling; Analog input/output; Selection of PLC

UNIT-V: DESIGN EXAMPLES & APPLICATIONS IN MECHATRONICS:
Design process stages; Traditional Vs Mechatronics designs; Possible design solutions: Timed switch, Wind-screen wiper motion, Bath room scale; Case studies of Mechatronics systems: A pick-and-place robot, Car park barrier, Car engine management system, Automatic Camera and Automatic Washing Machine only.
Sensors for Condition Monitoring Systems of Production Systems: Examples of Monitoring methods: Vibration monitoring, Temperature monitoring, Wear behavior monitoring; Mechatronics control in automated manufacturing: Monitoring of Manufacturing processes, On-line quality monitoring, Model based systems, Hardware in-the-loop simulation, Supervisory control in manufacturing inspection, Integration of heterogeneous systems.

TEXT BOOKS:

1. R.K. Rajput, A Text Book on Mechatronics, S. Chand & Co, New Delhi.
2. M.D. Singh & Joshi, Mechatronics, Prentice Hall of India.

REFERENCE BOOKS:

1. W. Bolton, Mechatronics, Pearson Education India
2. HMT, Mechatronics, Tata McGraw Hill, New Delhi.
3. Devadas Shetty, Mechatronics System, PWS Publishing
4. Pradeep Kumar Srivastava, Exploring Programmable Logic Controllers with applications, BPB Publications.

COURSE OUTCOMES
At the end of the course, the student will be able to:

CO 1	Describe about various types of sensors and transducers.
CO 2	Explain the various mechanical, electrical and pneumatic actuation systems.
CO 3	Explain the basic mathematical building blocks for mechanical, electrical, thermal and fluid actuation system and its interfacing of input/output requirements.
CO 4	Explain the basic PLC architecture and PLC programming concepts.
CO 5	Describe the design examples of mechatronics system. Explain the condition monitoring of production systems using sensors.

Course Code	:	MEPC612
Course Title	:	AUTOCAD PRACTICE
Number of Credits	:	2 (L:0, T:0, P:4)
Prerequisites	:	Machine Drawing (MEPC 511)
Course Category	:	PC

COURSE OBJECTIVES:

a. Introduction to CAD software and to develop basic skills related to computer aided drafting,
b. To understand the basic commands of how to draw, modify, and edit basic shapes (2D), using AUTOCAD.
c. To prepare geometrical model of various machine elements
d. To draw the different views of machine elements
e. To interpret the drawing in engineering field and illustrate three dimensional objects

COURSE CONTENT:

S. No. Topics for practice

1. System requirements and understanding the interface:
Components of AutoCAD software window: Title bar, standard tool bar, menu bar, 0bject properties tool bar, draw tool bar, modify tool bar, cursor cross hair. Command window, status bar, drawing area, UCS icon, File features, setting up new drawing: Units, Limits, Grid, Snap, Undoing and redoing action.

2. Draw basic 2D entities like: Line, Rectangle, Rhombus, Polygon using AutoCAD

3. Draw basic 2D entities like: Circles, Arcs, circular using AutoCAD

4. Basic dimensioning, hatching, blocks and views.

5. Draw basic 2D entities like: Circular and rectangular array using AutoCAD

6. Draw complex branch specific components in 2D using AutoCAD

7. Isometric drawing, printing and plotting

8. Machine Drawing practice using Auto CAD: Detailed drawings of any TWO machine parts are to be given to the students to assemble and draw the sectional using cad software.

1.	Sleeve & Cotter Joint	5	Screw Jack	9	Simple eccentric
2	Knuckle Joint	6	Foot Step Bearing	10	Machine Vice
3	Spigot & Cotter Joint	7	Universal Coupling	11	Connecting Rod
4	Nut & Bolt	8	Plummer Block	12	Flanged coupling

REFERENCE BOOKS:

1. Autodesk. AutoCAD User Guide. Autodesk Press, USA, 2015.
2. Sham, Tickoo. AutoCAD 2016 for Engineers and Designers. Dreamtech Press; Galgotia Publication, New Delhi, 2015; ISBN 978-9351199113
3. Bhatt, N.D., Machine Drawing,Charotar Publishing House, 2003.
4. Sidheswar, N., Kannaiah, P. and Sastry, V.V.S., Machine Drawing, Tata McGraw Hill Book Company, New Delhi, 2000.
5. Kannaih, P., Production Drawing, New AgeInternational,2009

COURSE OUTCOMES:

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

CO1	Apply computer aided drafting tools to create 2D engineering drawings
CO2	Draw basic and complex mechanical components in 2D using AutoCAD
CO3	Draw the isometric view of machine elements
CO4	Draw the sectional or plain elevations, plans and side views with dimensioning
CO5	Construct an assembly drawing using part drawings of machine components

Course Code	:	MEPC613
Course Title	:	Refrigeration & Air-conditioning Lab
Number of Credits	:	2 (L:0, T:0, P:4)
Prerequisites	:	Refrigeration & Air-conditioning (MEPE603)
Course Category	:	PE

COURSE OBJECTIVES:

- To understand the working principle of refrigeration and air-conditioning systems
- To understand the function of domestic refrigerator
- Determination of COP of machines
- To understand the gas charging mechanism
- To study the properties of psychometer

COURSE CONTENT:

S. No.	Topics for practice
1.	Study of a vapour compression refrigeration system with the help of given machine
2.	Study of Water dispenser with the help of given model/machine
3.	To study the storage type water cooler
4.	To study the domestic refrigerator
5.	To determine theoretical, actual, relative and Carnot COP of the machine with the help of window A.C trainer
6.	To determine the EPR of a given heat pump trainer
7.	To study the gas charging in the Refrigeration and AC machines
8.	To determine psychometric properties of moist air with the help of sling psychometer
9.	To study different psychometric processes using window A/C trainer
10.	To study Refrigeration controls with the help of cut sections- thermo-stat, HP/LP cutout, Solenoid valve, Expansion valve and Relay

REFERENCE BOOKS:

1. Refrigeration and Air Conditioning– Sadhu Singh, Khanna Book Publishing Co
2. Refrigeration and Air Conditioning – A.S. Sarao & G.S. Gabi, 6 th edition, Satya Prakashan publications, New Delhi, 2004.
3. Refrigeration and Air Conditioning – C.P Arora, Tata McGraw Hill Education, 2000

COURSE OUTCOMES:

At the end of the course, the student will be able to

CO1	Identify the components of refrigeration and air-conditioning system
CO2	Use psychometer to measure properties of moist air
CO3	Understand the gas charging procedure in machines

Course Code	:	MESE616
Course Title	:	Seminar
Number of Credits	:	1 (L: 0, T: 0; P: 0)
Prerequisites	:	NIL
Course Category	:	SE

Course Code	:	MEPR 617
Course Title	:	Major Project II
Number of Credits	:	3 (L: 0 T: 0 P: 6)
Prerequisites	:	NIL
Course Category	:	PR

COURSE OBJECTIVES:

- Understand the method of applying engineering knowledge to solve specific problems.
- Apply engineering and management principles while executing the project.
- Demonstrate good verbal presentation and technical report writing skills.
- Identify and solve complex engineering problems using professionally prescribed standards.

GUIDELINES:

1. Project will have to be done by a group in their area of interest.
2. Each group has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The student will be assigned a faculty guide who would be the supervisor of the student.
5. The number of projects that a faculty can guide would be limited to two groups.
6. The project can be carried out on-campus or in an industry or an organization with prior approval from the principal through head of section.
7. The project shall be completed and submitted at least one month before the last teaching day.
8. The project should be presented by students using power point once before submission of project.

COURSE OUTCOMES:

After going through this course, the students will be able to

CO 1	Conceptualize, design and implement solutions for specific problems.
CO 2	Communicate the solutions through presentations and technical reports
CO 3	Apply project and resource managements skills, professional ethics, societal concerns
CO 4	Synthesize self-learning, sustainable solutions and demonstrate lifelong learning

Course Code	:	MEAU600
Course Title	:	Indian Constitution
Number of Credits	:	0 (L: 2, T:0; P:0)
Prerequisites	:	NIL
Course Category	:	AU

COURSE CONTENT

UNIT-I: THE CONSTITUTION - INTRODUCTION
The History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its interpretation, Fundamental Rights and Duties and their interpretation, State Policy Principles

UNIT-II: UNION GOVERNMENT
Structure of the Indian Union, President – Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha

UNIT-III: STATE GOVERNMENT
Governor – Role and Power, Chief Minister and Council of Ministers, State Secretariat

UNIT-IV: LOCAL ADMINISTRATION
District Administration, Municipal Corporation, Zila Panchayat

UNIT-V: ELECTION COMMISSION
Role and Functioning, Chief Election Commissioner, State Election Commission

References:

1. Rajeev Bhargava, Ethics and Politics of the Indian Constitution, Oxford University Press, New Delhi, 2008
2. B.L. Fadia, The Constitution of India, Sahitya Bhawan; New edition (2017)
3. DD Basu, Introduction to the Constitution of India, Lexis Nexis; Twenty-Third 2018 edition

Suggested Software/Learning Websites:

a. https://www.constitution.org/cons/india/const.htm
b. http://www.legislative.gov.in/constitution-of-india
c. https://www.sci.gov.in/constitution
d. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india

ANEXURE-I

LIST OF OPEN ELECTIVE COURSES (OE)

Sr. No.	Course Title	Course Code
1.	Energy Conservation & Audit	MEOE###
2.	Product Design	MEOE###
3.	Engineering Economics & Accountancy	MEOE###
4.	Energy Efficiency and Audit	MEOE###
5.	Artificial Intelligence	COOE###
6.	Cyber Security	COOE###
7.	3-D Printing	ECOE###
8.	Disaster Management	CEOE###
9.	Renewable Energy Technologies	MEOE###
10.	Robotics	MEOE###

Note: ### Three-digit numeric code

ANNEXTURE – II

List of Program Elective Courses (PE)

S. No	Code No.	Course Title
1	MEPE###	Tool Engineering
2	MEPE###	Computer Integrated Manufacturing
3	MEPE###	Computer Aided Design and Manufacturing
4	MEPE###	Industrial Robotics & Automation
5	MEPE###	Heat Transfer
6	MEPE###	Refrigeration & Air-conditioning
7	MEPE###	Automobile Engineering
8	MEPE###	Power Plant Engineering
9	MEPE###	Farm Equipment & Farm Machinery
10	MEPE###	Material Handling Systems
11	MEPE###	Hybrid Vehicles
12	MEPE###	Mechatronics

ANNEXTURE-III

EXIT POLICY

After the implementation of the guideline **NEP-2020**, if any student fails to continue with the Diploma Engineering course of 3-year duration, after completing 2nd year of the enrolled discipline of the course due to any reason/s, he/she may be awarded with a certificate in the respective discipline of engineering.
The result of the same will be prepared according to the following table:

S. No.	Year	Weightage	Maximum Marks
1.	First	25 %	500
2.	Second	75 %	1500
		GRAND TOTAL	**2000**

ANNEXTURE-IV

FINAL RESULT PREPARATION

S. No.	Year	Weightage	Maximum Marks
1	First	25 %	500
2	Second	75 %	1500
3	Third	100 %	2000
		GRAND TOTAL	**4000**