Bapatla Engineering College

(*Autonomous*)

BAPATLA

B.Tech

Mechanical Engineering

Curriculum Effective from A.Y. 2024-25 (R24 Regulations)

Bapatla Engineering College:: Bapatla

(Autonomous under Acharya Nagarjuna University)

(Sponsored by Bapatla Education Society)

BAPATLA - 522102 Guntur District, A.P., India

www.becbapatla.ac.in

Bapatla Engineering College :: Bapatla

Estd.1981 (Autonomous)

SCHEME OF INSTRUCTION & EXAMINATION

For

Mechanical Engineering

Effective from the Academic Year 2024-2025 (R24 Regulations)

First Year B.Tech (Semester – I)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total Marks	
24ME101	BS	Linear Algebra and Ordinary Differential Equations	2	1	0	3	40	60	100	3
24ME102	BS	Engineering Chemistry	3	0	0	3	40	60	100	3
24ME103	ES	Basic Electrical & Electronics Engineering	3	0	0	3	40	60	100	3
24ME104	ES	Python Programming	3	0	0	3	40	60	100	3
24ME105	ES	Engineering Mechanics - Statics	2	1	0	3	40	60	100	3
24MEL101	BS	Engineering Chemistry Lab	0	0	2	2	40	60	100	1
24MEL102	ES	Basic Electrical & Electronics Engineering Lab	0	0	3	3	40	60	100	1.5
24MEL103	ES	Python Programming Lab	0	0	3	3	40	60	100	1.5
24MEL104	ES	IT Workshop	0	0	2	2	40	60	100	1
Induction Program		First Three Weeks (Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Familiarization to Dept. / Branch & Innovations)								
TOTAL			**13**	**2**	**10**	**25**	**360**	**540**	**900**	**20**

L: Lecture T: Tutorial P: Practical

CIE: Continuous Internal Evaluation SEE: Semester End Examination

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SCHEME OF INSTRUCTION & EXAMINATION

For

Mechanical Engineering

Effective from the Academic Year 2024-2025 (R24 Regulations)

First Year B.Tech (Semester – II)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total Marks	
24ME201	BS	Numerical Methods & Advanced Calculus	2	1	0	3	40	60	100	3
24ME202	BS	Advanced Optics and Materials Testing	3	0	0	3	40	60	100	3
24ME203	HM	Communicative English	2	0	0	2	40	60	100	2
24ME204	ES	Engineering Mechanics - Dynamics	2	1	0	3	40	60	100	3
24MEL201	ES	Engineering Graphics	1	0	4	5	40	60	100	3
24MEL202	BS	Engineering Physics Lab	0	0	2	2	40	60	100	1
24MEL203	HM	English Communication Skills Lab	0	0	2	2	40	60	100	1
24MEL204	ES	Engineering Mechanics & Surveying Lab	0	0	3	3	40	60	100	1.5
24MEL205	ES	Workshop Practice	0	0	3	3	40	60	100	1.5
TOTAL			**10**	**2**	**14**	**26**	**360**	**540**	**900**	**19**

L: Lecture T: Tutorial P: Practical

CIE: Continuous Internal Evaluation SEE: Semester End Examination

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SCHEME OF INSTRUCTION & EXAMINATION

For

Mechanical Engineering

Effective from the Academic Year 2024-2025 (R24 Regulations)

Second Year B.Tech (Semester – III)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total Marks	
24ME301	BS	Probability and Statistics	2	1	0	3	40	60	100	3
24ME302	PC	Basic manufacturing processes	3	0	0	3	40	60	100	3
24ME303	PC	Strength of Materials	3	0	0	3	40	60	100	3
24ME304	PC	Fluid Mechanics & Hydraulic Machines	3	0	0	3	40	60	100	3
24MEL301/ SEC1	SEC	Pneumatic & Hydraulic drives Lab	1	0	2	3	40	60	100	2
24MEL302	ES	Design Thinking & Innovation	1	0	2	3	40	60	100	2
24MEL303	PC	Strength of Materials & Fluid Mechanics Lab	0	0	3	3	40	60	100	1.5
24MEL304	PC	Basic Manufacturing Processes lab	0	0	3	3	40	60	100	1.5
24MEL305	HM	NSS/ NCC/Scouts & Guides/Community Service	0	0	1	1	0	100	100	0.5
24ME305/ MC01	MC	Environmental Science	2	0	0	2	40	0	40	0
TOTAL			**15**	**1**	**11**	**27**	**360**	**580**	**940**	**19.5**

L: Lecture T: Tutorial P: Practical

CIE: Continuous Internal Evaluation SEE: Semester End Examination

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SCHEME OF INSTRUCTION & EXAMINATION

For

Mechanical Engineering

Effective from the Academic Year 2024-2025 (R24 Regulations)

Second Year B.Tech (Semester – IV)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total Marks	
24ME401	BS	Material Engineering	3	0	0	3	40	60	100	3
24ME402	PC	Metal Cutting & Machine Tools	3	0	0	3	40	60	100	3
24ME403	PC	Kinematics of Machines	3	0	0	3	40	60	100	3
24ME404	PC	Thermal Engineering	3	0	0	3	40	60	100	3
24ME405	PC	Industrial Engineering & Management	3	0	0	3	40	60	100	3
24MEL401/ SEC2	SEC	Sensorics & PLC Lab	1	0	2	3	40	60	100	2
24MEL402	PC	Machine shop Practice	0	0	3	3	40	60	100	1.5
24MEL403	PC	Modeling lab	1	0	2	3	40	60	100	2
24MEL404	PC	Computer aided machine drawing	1	0	2	3	40	60	100	2
24MEL405	HM	Health and Wellness, Yoga and Sports	0	0	1	1	0	100	100	0.5
24ME406/ MC02	MC	Constitution of India	2	0	0	2	40	0	40	0
TOTAL			**20**	**0**	**10**	**30**	**400**	**640**	**1040**	**23**
24MEH4/ 24MEM4		Honors/Minors course	3	0	2	5	40	60	100	4

L: Lecture T: Tutorial P: Practical

CIE: Continuous Internal Evaluation SEE: Semester End Examination

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SCHEME OF INSTRUCTION & EXAMINATION
For
Mechanical Engineering
Effective from the Academic Year 2024-2025 (R24 Regulations)
Third Year B.Tech (Semester – V)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total Marks	
24ME501	PC	Dynamics of Machines	2	1	0	3	40	60	100	3
24ME502	PC	Design of Machine Elements	2	1	0	3	40	60	100	3
24ME503	PC	Manufacturing Technology	3	0	0	3	40	60	100	3
24ME504/ PE1	PE	Professional Elective - 1	3	0	0	3	40	60	100	3
24ME505/ JO1	JOE	Job Oriented Elective - 1	2	0	2	4	40	60	100	3
24MEL501/ SEC3	SEC	Soft Skills Lab	1	0	2	3	40	60	100	2
24MEL502	PC	Design and Metrology Lab	0	0	3	3	40	60	100	1.5
24MEL503	PC	Fuels and IC Engines lab	0	0	3	3	40	60	100	1.5
24ME506/ MC03	MC	Technical paper writing and IPR	2	0	0	2	40	0	40	0
24MEL504/ INT01	PR	Summer Internship - I	0	0	0	0	0	100	100	2
TOTAL			**15**	**2**	**10**	**27**	**360**	**580**	**940**	**22**
24MEH5/ 24MEM5		Honors/Minors course	3	0	2	5	40	60	100	4

Professional Elective-I	**Job Elective – I**
1A. Advanced Strength of Materials 1B. I.C. Engines and Gas Turbines 1C. Nano Technology	1A. Artificial Intelligent and Machine Learning 1B. Drone Technology

L: Lecture T: Tutorial P: Practical
CIE: Continuous Internal Evaluation SEE: Semester End Examination

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SCHEME OF INSTRUCTION & EXAMINATION

For

Mechanical Engineering

Effective from the Academic Year 2024-2025 (R24 Regulations)

Third Year B.Tech (Semester – VI)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total Marks	
24ME601	PC	CAD/CAM	3	0	0	3	40	60	100	3
24ME602	PC	Design of Transmission Elements	2	1	0	3	40	60	100	3
24ME603	PC	Heat Transfer	2	1	0	3	40	60	100	3
24ME604 / PE2	PE	Professional Elective – 2	3	0	0	3	40	60	100	3
24MEL601/ JO2	JOE	Job Oriented Elective - 2	2	0	2	4	40	60	100	3
24MEL602/ SEC4	SEC	Internet of Things Lab	1	0	2	3	40	60	100	2
24MEL603	PC	Heat Transfer lab	0	0	3	3	40	60	100	1.5
24MEL604	PC	CAE lab	1	0	2	3	40	60	100	2
24ME605/ MC04	MC	Campus Recruitment Training (CRT)	2	0	0	2	40	0	40	0
TOTAL			**16**	**2**	**9**	**27**	**360**	**480**	**840**	**20.5**
24MEH6/ 24MEM6		Honors/Minors course	3	0	2	5	40	60	100	4

Professional Elective-II	**Job Elective - II**
2A. Finite Element Analysis 2B. Non-Conventional Energy Sources 2C. Advanced Manufacturing Processes 2D. Operations Research	2A. Data Base Management systems 2B. Introduction to Data Analytics

L: Lecture T: Tutorial P: Practical

CIE: Continuous Internal Evaluation SEE: Semester End Examination

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SCHEME OF INSTRUCTION & EXAMINATION

For

Mechanical Engineering

Effective from the Academic Year 2024-2025 (R24 Regulations)

Fourth Year B.Tech (Semester – VII)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total Marks	
24ME701	HM	Operations Management	3	0	0	3	40	60	100	3
24ME702 / PE3	PE	Professional Elective - 3	3	0	0	3	40	60	100	3
24ME703/ JO3	JOE	Job Oriented Elective - 3	3	0	0	3	40	60	100	3
24ME704/ OE	OE	Open Elective (To be placed at Sr. No. 4 only)	3	0	0	3	40	60	100	3
24MEL701/ SEC5	SEC	Robotics & 3D Printing Lab	1	0	2	3	40	60	100	2
24MEL702	PC	CAM Lab	1	0	2	3	40	60	100	2
24MEL703	PR	TERM PAPER			6	6	40	60	100	3
24MEL704/ INT02	PR	Summer Internship -II	-	-	-	0	0	100	100	2
TOTAL			**14**	**0**	**10**	**24**	**280**	**520**	**800**	**21**
24MEH7/ 24MEM7	Honors/Minors course		3	0	2	5	40	60	100	4

L: Lecture T: Tutorial P: Practical

CIE: Continuous Internal Evaluation SEE: Semester End Examination

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SCHEME OF INSTRUCTION & EXAMINATION
For
Mechanical Engineering
Effective from the Academic Year 2024-2025 (R24 Regulations)
Fourth Year B.Tech (Semester – VIII)

Course Code	Category	Course Title	Scheme of Instruction (Hours per week)				Scheme of Examination (Maximum marks)			No. of Credits
			L	T	P	Total	CIE	SEE	Total Marks	
24ME801/ PE4	PE		**3**			3	40	60	100	3
24ME802/ PE5	PE		3			3	40	60	100	3
24ME803	PR	Project Work	0	0	18	18	40	60	100	9
TOTAL			**6**	**0**	**18**	**24**	**120**	**180**	**300**	**15**

L: Lecture T: Tutorial P: Practical
CIE: Continuous Internal Evaluation SEE: Semester End Examination

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Structure of the Undergraduate Program (B.Tech)

S.No.	Category	AICTE Recommended credits (%)	Breakup of Credits (Total 160)*
1	Humanities and social science including Management (HM)	5 – 8 %	7 (4.4%)
2	Basic Science Courses (BS)	12 – 16 %	20 (12.5%)
3	Engineering Science courses (ES)	10 – 18 %	24 (15%)
4	Professional core Courses (PC)	30 – 36 %	56 (35%)
5	Electives – Professional Electives (PE); Job Oriented Electives (JOE); Open Electives (OE); Skill Enhancement Courses (SEC) (15 + 9 + 3 + 8)	19 – 25 %	37 (23.1%)
6	Internships & Project Work (PR) (2 + 2 + 12)	8 – 11 %	16 (10%)
7	Mandatory Courses (MC)	-	Non-credit

ME R24 SYLLABUS CREDITS DISTRIBUTION

	HM	BS	ES	PC	PE	JOE	OE	SEC	PR	MC	Total
SEM-1		7	13								20.0
SEM-2	3	7	9								19.0
SEM-3	0.5	3	2	12				2		0	19.5
SEM-4	0.5	3		17.5				2		0	23.0
SEM-5				12	3	3		2	2	0	22.0
SEM-6				12.5	3	3		2			20.5
SEM-7	3			2	3	3	3	2	5		21.0
SEM-8					6				9		15.0
	7.0	**20.0**	**24.0**	**56.0**	**15.0**	**9.0**	**3.0**	**10.0**	**16.0**	**0.0**	**160**
					37.0						
											160
% of credits	4.4	12.5	15.0	35.0			23.1		10.0		**100.0**

DYNAMICS OF MACHINES

24ME501

III B. Tech. Vth Semester

Lectures	:	2 Hours/Week	Tutorial	:	1	Practical	:	0
CIE Marks	:	40	SEE Marks	:	60	Credits	:	3

Pre-Requisite: Engineering Mechanics – Statics, Engineering Mechanics – Dynamics and Kinematics of Machines.

Course Objectives: Students will learn how to

➢	To equip the student with fundamental knowledge of dynamics of machines, so that students can identify and analyse the external and inertia forces associated with moving parts of a machine.
➢	Develop understanding of vibrations and their significance in engineering design and analyse the same.

Course Outcomes: After studying this course, the students will be able to

CO1	Develop expressions for parameters of motion and find the dynamic forces in a slider-crank mechanism & relate the working parameters of the governors.
CO2	Find the gyroscopic effect on naval ships and airplanes & balance rotating and reciprocating masses.
CO3	Find the parameters of free vibration of undamped and viscously damped systems with single DOF.
CO4	Find the parameters of forced vibration of a single DOF subjected to harmonic excitation.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												PSO's		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2										1	3	2	
CO2	3	2										1	2	3	
CO3	3	2										1	3	3	
CO4	3	2										1	3	3	

UNIT-I	(11 Hours)

DYNAMIC FORCE ANALYSIS:
Introduction, D'Alembert's principle, Equivalent offset inertia force, Dynamic analysis of slider - crank mechanism (using analytical method): Velocity and Acceleration of piston, Angular velocity and Angular acceleration of connecting rod, Piston effort (Effective driving force), Crank effort, Turning moment on crankshaft. (5)

GOVERNORS:
Introduction, Types of governors, Watt governor, Porter governor, Hartnell governor, Sensitiveness of a governor, Hunting, Isochronism, Stability. (6)

UNIT-II	(11 Hours)

GYROSCOPES:
Angular velocity, Angular acceleration, Gyroscopic torque, Gyroscopic effect on aeroplanes and naval ships. (5)

BALANCING:
Introduction, Static balancing, Dynamic balancing, Transferring of a force from one plane to another, Balancing of several rotating masses in different planes, Balancing of reciprocating mass (Single cylinder engine). (6)

UNIT-III	(12 Hours)

FUNDAMENTALS OF VIBRATION:
Introduction, Definitions, Vector method of representing harmonic motions, Addition of two simple harmonic motions of the same frequency. (4)

UNDAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS:
Introduction, Derivations of differential equations, Solution of differential equation, Torsional vibrations, Equivalent stiffness of spring combinations. (4)

DAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS:
Introduction, Free vibrations with viscous damping, Logarithmic Decrement. (4)

UNIT-IV	(11 Hours)

FORCED VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS:
Introduction, Forced vibrations with constant harmonic excitation, Forced vibration with rotating and reciprocating unbalance, Forced vibrations due to excitation of the support. (11)

Text Books :	1. Theory of Machines by S.S. Rattan, Tata McGraw Hill Education India Pvt. Ltd., New Delhi, 5th Edition. 2. Mechanical Vibrations by G. K. Groover, Nem Chand & Bros., Roorkee, 8th Edition.
References :	1. Theory of Machines by T. Bevan, Pearson, 3rd Edition. 2. Mechanical Vibration by S. S. Rao, Pearson, 6th Edition.

DESIGN OF MACHINE ELEMENTS

24ME502

III B. Tech. Vth Semester

Lectures	:	2 Hours/Week	Tutorial	:	1	Practical	:	0
CIE Marks	:	40	SEE Marks	:	60	Credits	:	3

Pre-Requisite: Engineering Mechanics, Engineering Mathematics and Basic Physics

Course Objectives: Students will learn how to

➢	Gain appreciation and understanding of the design function in mechanical engineering, the steps involved in designing and the relation of design activity with manufacturing activity
➢	Select proper materials to different machine elements based on their physical and mechanical properties.
➢	Learn and understanding of the different types of failure modes and criteria.
➢	Design Procedure for the different machine elements such as fasteners, Power Screws, Springs etc.

Course Outcomes: After studying this course, the students will be able to

CO1	Apply the design procedure to engineering problems, including the consideration of technical and manufacturing constraints.
CO2	Select suitable materials in critical design applications.
CO3	Identify the loads, the machine members subjected and calculate static and dynamic stresses to ensure safe design.
CO4	Design various machine elements such as fasteners, Power screws and Springs etc.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												PSO's		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1										1	3	2
CO2	3	2	1										1	3	2
CO3	3	2	1										1	3	2
CO4	3	2	1										1	3	2

UNIT-I	(12 Hours)
BASICS: Basic procedure of machine design, requirements and design of machine elements, traditional design methods. Design synthesis, use of standards in design, preferred numbers and significance. Common engineering materials and their properties. **DESIGN FOR STATIC STRENGTH:** Simple Stresses, Combined stresses, Torsional and bending stresses, stress strain relation, various theories of failure, Factor of safety and its importance in design.	
UNIT-II	(12 Hours)
DESIGN FOR FATIGUE STRENGTH: Stress concentration, stress concentration factors, reduction of stress concentration, fluctuating stresses, fatigue failure, endurance limit, low cycle and high cycle fatigue, notch sensitivity, reversed stresses, design for finite and infinite life, Soderberg and Goodman lines, , Gerber equation. **THREADED JOINTS** – Basic types, bolt of uniform strength, materials and manufacture, Eccentrically loaded bolted joints in shear.	
UNIT-III	(12 Hours)
RIVETED JOINTS: Types of riveted joints, Failures of riveted joints, Eccentrically loaded riveted joints. **WELDED JOINTS:** Types of welded joints, Design of butt and fillet welded joints, Eccentrically loaded welded joints.	
UNIT-IV	(12 Hours)
POWER SCREWS: Types - Mechanics of power screws,self-locking of screw and stresses in screw, efficiency. **SPRINGS**: Introduction, Materials, Types of springs, Helical springs under axial load, leaf springs.	
Text Books :	1. V.B,Bhandari, " Design of Machine Element", Tata McGraw Hill book Co, Fourth Edition, 2017. 2. Joseph Shigley,Charles Mischke, Richard Budynas and Keith Nisbett " Mechanical Engineering Design", Tata McGraw-Hill book Co, Tenth edition,2020.
References :	1. Robert L.Norton "Machine Design", Pearson, Fifth edition, 2017. 2. R.S.Khurmi and J.K.Guptha "Design of machine elements", S Chand, 25th Edition, 2020. 3. www.nptel.iitm.ac.in/video

MANUFACTURING TECHNOLOGY

24ME503

III B. Tech. Vth Semester

Lectures	:	3 Hours/Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	40	SEE Marks	:	60	Credits	:	3

Pre-Requisite: Engineering Mathematics and Basic Physics

Course Objectives: Students will learn how

➢	To impart fundamental knowledge of engineering measurements, limits, fits, tolerances, and gauging systems used in manufacturing.
➢	To develop understanding of various precision measuring instruments and comparators for inspection and quality control.
➢	To provide knowledge on design principles of jigs, fixtures, and gear manufacturing processes used in production engineering.
➢	To introduce modern manufacturing concepts such as additive manufacturing along with traditional press working operations.
➢	To enable students to analyze manufacturing processes, tooling, and inspection techniques for improving accuracy and productivity.

Course Outcomes: After studying this course, the students will be able to

CO1	Apply concepts of limits, fits, tolerances, and interchangeability in engineering measurements and design of gauges.
CO2	Operate and interpret results from comparators and advanced measuring instruments for evaluating surface finish, threads, and machine tool performance.
CO3	Design and analyze jigs, fixtures, and understand gear manufacturing and additive manufacturing processes.
CO4	Evaluate and perform calculations related to press working operations such as blanking, drawing, and bending, including die design considerations.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1	2	–	–	–	–	–	–	1	3	2	–
CO2	3	2	–	2	3	–	–	–	–	1	–	1	2	3	–
CO3	3	2	3	1	2	–	1	–	1	1	–	1	3	2	3
CO4	3	2	3	1	2	–	1	–	1	–	1	1	3	2	2

UNIT-I	(12 Hours)
INTRODUCTION: Elements of engineering measurements, Standards of length, end and line standards. Theory of limits, Fits, Tolerances and their selection, Hole Basis and Shaft basis system, IS system of limits & fits, simple problems. Interchangeability, Selective Assembly. (6) **GAUGES:** Limit gauges, Taylor's Principle of limit gauging, Plug gauges, Ring gauges and Design of plain cylindrical plug and ring gauges. Slip gauges, Angle gauges, Sine bar. (6)	
UNIT-II	(12 Hours)
COMPARATORS: Sigma comparator, Solex pneumatic gauge, projectors, Tool Maker's Microscope, Auto collimator, Bore gauge. (5) **MEASUREMENT OF SURFACE FINISH:** Surface texture, roughness, waviness, Indian standard terminology, various methods of measuring surface finish, Tomlinson surface meter and Taylor Hobson Talysurf. (4) **MEASUREMENT OF SCREW THREADS:** Introduction-Types of threads-Measurement of outside diameter, root diameter, effective diameter using 3 wire method. (3)	
UNIT-III	(12 Hours)
JIGS &FIXTURES: Introduction, design considerations for jigs & fixtures. The principle of six point location, locating pins. Clamping and clamping devices. A few examples of drilling jigs like box type, template jig, inverted jig, indexing jig. Fixtures – Lathe and milling. (6) **GEAR MANFUACTURING :** Introduction to various gear manufacturing methods, gear shaping, gear hobbing - principles and methods, gear finishing methods. (3) **ADDITIVE MANUFACTURING:** Introduction to additive manufacturing, Rapid prototyping verses additive manufacturing, Classification of AM processes, Stereo lithography process, Advantages, limitations and applications of AM. (3)	
UNIT-IV	(12 Hours)
PRESS WORKING TOOLS: Major components of a press, shear action in die cutting operation, centre of pressure and its calculation, scrap strip layout for blanking. (6) **TYPES OF DIES –** compound die, combination die and progressive die. (3) **BENDING DIE** – Bending methods, spring back, bending allowance, bending force. (3)	

Text Books :	1. Engineering Metrology - R.K.Jain , Khanna publishers, 1st Esition, 2021. 2. A Text book of Production Engineering by P.C.Sharma, S.Chand& Co, Reprint 2019 Edition.
References :	1. A text book of Engg.Metrology – I.C.Gupta, Dhanpatrai Publications,1st Edition 2019 Reprint. 2. Manufacturing engineering & technology by Kalpakjian, Pearson Education / PHI, 7th Edition, 2013. 3. Manufacturing Science by Amitabha Ghosh, Ashok Kumar Mallik, Prentice Hall.2nd Edition, 2010.

ADVANCED STRENGTH OF MATERIALS

24ME504/PE1A

III B. Tech. Vth Semester

Lectures	:	3 Hours/Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	40	SEE Marks	:	60	Credits	:	3

Pre-Requisite: Engineering Mechanics, Engineering Mathematics and Basic Physics

Course Objectives: Students will learn how to

➢	To make the students to understand and analyze various types of beams, thick pressure vessels, rotating discs under various conditions including curved members, and to have the knowledge about strain energy of structural members under variety of loading conditions.

Course Outcomes: After studying this course, the students will be able to

CO1	Determine the stresses caused due to temperature effects and analyze the indeterminate beams
CO2	Determine the shear stresses in beams and analyze the beams under unsymmetrical loading
CO3	Describe the analysis of curved members and thick cylinders
CO4	Understand the centrifugal stresses caused in rotating discs and the fundamental concept of strain energy

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												PSO's		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2	2										2	2	1
CO2	2	2	2										2	2	1
CO3	2	1	1										2	2	1
CO4	2	2	2										2	1	2

UNIT-I	(12 Hours)
TEMPERATURE STRESSES AND DYNAMIC LOADING: Thermal effects, misfits and pre strains. Dynamic loading, suddenly applied load, inelastic effects and causes of failure. **STATICALLY INDETERMINATE BEAMS:** Introduction, analysis by the differential equations of the deflection curve, moment area method	
UNIT-II	(12 Hours)
SHEAR STRESSES IN BEAMS: Shear stresses in Rectangular beams, Shear stresses the webs of beams with flanges, Shear stresses circular beams **UNSYMMETRIC BENDING:** Introduction, Doubly symmetric beams with skew loads, pure bending of unsymmetric beams, generalized theory of pure bending of beams under lateral loads	
UNIT-III	(12 Hours)
BENDING OF CURVED MEMBERS: Introduction, Winkler-bach formula to determine the stresses in the curved beams of various cross sections such as rectangular, triangular, circular and trapezoidal **THICK PRESSURE VESSELS:** Thick cylinders, lame's theory, radial deflection, compound cylinder.	
UNIT-IV	(12 Hours)
CENTRIFUGAL STRESSES: Introduction, rotating ring, rotating disc (solid and hollow), disc of uniform strength **STRAIN ENERGY:** Expressions for strain energy under various loads (axial, pure shear, bending and torsion)	

Text Books :	1. 'Mechanics of Materials' by James M Gere and Barry J Goodno, Enhansed 9th Edition, Cenegage Publishers, 2020. 2. 'Strength of Materials' by Dr. Sadhu Singh, 1st Edition, Khanna Publishers, 2016.
References :	1. 'Mechanics of Materials' by Ferdinand J. Beer, Russell E. Johnston Jr, 8th Edition (in SI Units), Mc Graw Hill Publications, 2020. 2. 'Strength of Materials' by L. S. Srinath, Macmillan Publishers, 2000. 3. 'A text book of Strength of Materials' by R K Rajput, 7th Edition, S Chand Publications, 2018. 4. 'A text book of Strength of Materials' by R K Bansal, 6th Edition, Laxmi Publications, 2022.

I.C.ENGINES AND GAS TURBINES

24ME504/PE1B

III B. Tech. Vth Semester

Lectures	:	3 Hours/Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	40	SEE Marks	:	60	Credits	:	3

Pre-Requisite: Basic Physics and Thermal Engineering

Course Objectives: Students will learn how to

➢	Describe the Gas power cycles, working principles and alternative fuels of I.C engines.
➢	Demonstrate combustion phenomenon of SI and CI Engines and analyze the performance of IC engines.
➢	Describe the working of Reciprocating and rotary compressors.
➢	Describe the working of gas turbines and Jet propulsion systems and analyze its performance

Course Outcomes: After studying this course, the students will be able to

CO1	Explain the operation of gas power cycles, demonstrate the working principles of SI and CI engines and evaluate the role of alternative fuels in IC engines.
CO2	Understand the combustion behaviour of SI and CI engines, evaluate the performance of IC engines.
CO3	Describe the operation and working principles of reciprocating and rotary compressors.
CO4	Explain the working principles of gas turbines and jet propulsion systems and analyze their performance.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2		1			2	3	1					1	2	
CO2	2	1	1	1			1						2	1	
CO3	1					2							1	1	
CO4	2	2				1	1						1	2	

UNIT-I	(12 Hours)
GAS POWER CYCLES: Otto cycle, Diesel cycle, Dual combustion cycle, Brayton cycle, Problems **I.C.ENGINES:** Introduction, Basic engine nomenclature, classification of I.C. Engines, working principles of S.I. Engine, C.I. Engine, 4 stroke and 2-stroke engines - valve timing and Port Timing diagrams - Differences between S.I. & C.I. and 2 stroke & 4 stroke engines **ALTERNATIVE FUELS:** Liquid fuels - Alcohol, Methanol, Ethanol, Gaseous fuels – Hydrogen, Natural Gas and Liquefied Petroleum and Bio Fuels.	
UNIT-II	(12 Hours)
COMBUSTION PROCESSES: S.I. Engines- Normal combustion, abnormal combustion, Knock rating and Octane number**. CI Engines-** Ignition delay, combustion knock in C.I. engines, Knock rating and Cetane number. **TESTING OF I.C. ENGINES:** Indicator diagram, evaluation of Indicated Power, Brake power, Fuel consumption, SFC, Mechanical & thermal efficiencies, mean effective pressure, air-fuel ratio, Heat balance, Engine performance curves.	
UNIT-III	(12 Hours)
RECIPROCATING AIR COMPRESSORS: Classification, Reciprocating Air compressor with out and with clearance volume, volumetric efficiency, Multi-stage compression, Effect of inter cooling, optimum intermediate pressure in a two-stage compressor. **ROTARY COMPRESSORS:** Classification, working principle of Roots blower, Vane type compressor, Comparison of Reciprocating and Rotary compressors, Centrifugal compressor, Working and expression for Work done, Axial flow compressor, Surging, Choking and Stalling. Comparison of Centrifugal and Axial compressor	
UNIT-IV	(12 Hours)
GAS TURBINES: Closed and Open cycle gas turbines, analysis of closed cycle gas turbine, efficiencies of Compressor and turbine, cycles with intercooling, reheat and regeneration. **JET & ROCKET PROPULSION:** Basic principles of Jet propulsion - specific thrust, propulsive efficiency and overall thermal efficiency of a jet engine, Principles of Rocket propulsion, Types of rocket propulsion.	

Text Books :	1. Treatise on heat Engineering - Vasandani& Kumar-Metropolitan Book Company, New Delhi 2. Thermal Engineering- Rajput-Laxmi Pub, New Delhi 3. Internal Combustion Engines - V. Ganeshan , Tata McGraw – Hill Publishing Company Ltd.
References :	1. Fundamentals of I.C. Engines - P.W. Gill, J.H. Smith &Ziurys- IBH & Oxford publ, Mumbai. 2. A Course in I.C. Engines - M.L. Mathur& R.P. Sharma – Dhanpat Rai& Sons- New Delhi. 3. Gas Turbine Theory - Cohen, Rogers and Sarvanamuttu.

NANOTECHNOLOGY

24ME504/PE1C

III B. Tech. Vth Semester

Lectures	:	3 Hours/Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	40	SEE Marks	:	60	Credits	:	3

Pre-Requisite: Engineering Mechanics, Engineering Mathematics and Basic Physics

Course Objectives: Students will learn how to

➢	To familiarize with the fundamentals of nanotechnology, evolution of the nano-science and potential applications.
➢	To explore the available nanomaterials based on carbon, metals and metal oxides developed for industrial applications.
➢	To familiarize the existing synthesizing processes to develop various nano-surfaces and nanomaterials.
➢	To acquire sound knowledge on different characterization methods developed for studying nanomaterials.

Course Outcomes: After studying this course, the students will be able to

CO1	Understand the importance of nanotechnology for emerging engineering applications.
CO2	Differentiate the nanomaterials based on the composition and physical properties
CO3	Select appropriate process to produce nanomaterials in the form of powders or bulk structures.
CO4	Investigate the fundamental properties of nanomaterials by using appropriate characterization technique.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2		1	1	1	1	1	1	1		1	2	1	2
CO2	2	1	1	2	3	2	2	1	2	2		2	2	2	1
CO3	3	2	2		0	3	1	2	1	3		1	2	1	3
CO4	2	1	2	2	2	1		1	2	2	1	2	2	1	

UNIT-I	(12 Hours)
Introduction: History of nano science, definition of nanometer, nanomaterials, nanotechnology. Why nanomaterials? Properties of materials influenced by nanosize: mechanical properties, electrical properties, dielectric properties, thermal properties, magnetic properties, opto-electronic properties. Levels of structures, effect of size reduction on properties.	
UNIT-II	(12 Hours)
Different classes of nanomaterials: classification based on dimensionality-quantum dots, wells and wires, Carbon-based nanomaterials - bucky balls, carbon nanotubes, graphene, Metal based nanomaterials - nanogold, nanosilver and metal oxides, nanocomposites, nanopolymers, nanoglasses, nanoceramics, biological nanomaterials.	
UNIT-III	(12 Hours)
Synthesis and fabrication: Synthesis of bulk polycrystalline nanomaterials, growth of single crystals. Synthesis techniques for preparation of nanoparticle – bottom up approach – sol gel synthesis, hydrothermal growth, thin film growth, PVD and CVD; top down approach – ball milling, micro fabrication, lithography, mechanical processing-severe plastic deformation techniques.	
UNIT-IV	(12 Hours)
Charecterization of nanomaterials: X-Ray diffraction method, scanning electron microscopy (SEM), transmission electron microscopy (TEM), atomic force microscopy, particle size analysis. Applications of nanotechnology in medicine, surface science, energy and environment sciences. Challenges and limitations in processing, handling, toxicity and issues with safety measures.	
Text Books :	1. M.S Ramachandra Rao, Tatsuo Okada, Nano science and nano technology, Wiley publishers, 2013 2. B.S. Murty, P. Shankar, B. Raj, B.B. Rath, J. Murday, Textbook of Nanoscience and Nanotechnology Springer publishers, 2013
References :	1. Charles P. Poole, Jr., Frank J.Owens, Introduction to Nano Technology Wiley publishers. USA, 2007 2. Jermy JRamsden, Nanotechnology, Elsevier publishers, USA, 2016 3. M.AShah, K.AShah, Nanotechnology the Science of Small Wiley Publishers, 2015

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING (AIML)

24ME505/JO1A

III B. Tech. Vth Semester

Lectures	:	3 Hours/Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	40	SEE Marks	:	60	Credits	:	3

Pre-Requisite: Engineering Mathematics and Statistics

Course Objectives: Students will learn how to

➢	To understand PROLOG
➢	To know the Searching techniques of AI
➢	To know about the basics of machine learning
➢	Understand the steps involved in building and training ML models.

Course Outcomes: After studying this course, the students will be able to

CO1	Describe concepts of PROLOG language
CO2	Analyze various searching techniques
CO3	Explain the basic concepts of Machine Learning
CO4	Describe the data modeling for Machine Learning

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												PSO's		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	1	2	2	1	1						2	3	1
CO2	1	3	1	1	1	1	1						1	3	2
CO3	3	2	1	2	1	1	2						3	1	2
CO4	2	3	2	3	1	1	2						2	3	2

UNIT-I (12 Hours)

INTRODUCTION TO PROLOG: State the need of PROLOG,List the Key features of prolog, List the facts and rules of PROLOG,Describe how to install Prolog in Linux, List Advantages and Disadvantages of Prolog, State the Goals and terminology, Explain Variables, Explain Control Structures,Illustrate the usage of Arithmetic operators, State the importance of Matching in PROLOG,Explain Backtracking, List and explain the type's offcuts, Explain Recursion, Define List, Explain Lists with examples, Describe Dynamic databases, List and explain various Input/output operations List and explain various Input and Output Streams

UNIT-II	(12 Hours)
PROBLEMS AND SEARCH METHODS IN AI: Define Artificial Intelligence, List the AI Problems, Explain Underlying Assumption, List AI Techniques, Explain the level of model, State the Criteria for success, Define the problem as a state space search, List the Problem Characteristics, Define the production system, Explain the Production systems, List the Features of Production system, Explain about Searching problems, solutions, Define Un-informed Searching strategy,Define Informed Searching strategy, Explain Un-informed searching methods, Breadth First Search, Depth First Search, Greedy search,Brute force search, Explain Informed searching methods, Branch and bound, Hill climbing, Constraint satisfaction searching A*	
UNIT-III	(12 Hours)
Introduction to Machine Learning,Define Human Learning, Define Machine Learning, State the Need of Machine Learning,Explain Types of Machine Learning, Supervised Learning ,unsupervised Learning ,Semi-supervised Learning, Reinforcement learning, Compare Supervised, Unsupervised and Reinforcement Learning, Define the Basic Terminology - Model, Algorithm, Training data, Test data, Features and Labels Prediction, Target, Output. Explain the Importance and Applications of ML in real-world Domains (healthcare, finance, etc.),List the Tools used for Machine Learning, List the Advantages and Disadvantages of Machine Learning, Relation between AI, ML, and Deep Learning, Explain Workflow of a Machine Learning Project	
UNIT-IV	(12 Hours)
Process of Machine Learning, Discuss the data modeling, Types of data, Based on Data Format/Structure , Based on Label, Based on Data Type, Structure of the data , Discuss Data Quality and Remediation, Explain the data Pre-processing, Explain Dimensionality reduction, Importance of reducing features, Concept of Principal Component Analysis (PCA),Describe learning of the data model , Selecting a model , Key Parameters in Model Selection, Training a model, Explain Steps to Train a Machine Learning Model, Model Representation and Interpretability, Importance of Interpretability, Overfitting, Underfitting, and Cross-Validation,Reasons for Over fitting and How to Reduce Overfitting, Reasons for Under fitting and How to Reduce Underfitting, What is Cross-Validation and Why is it Needed, Advantages of Cross-Validation.	
Text Books :	1. Artificial Intelligence: Elaine Rich ,Kevin Knight, Mc-GrawHill. 2. Introduction to AI & Expert System: Dan Watterson, PHI. 3. Ethem Alpaydin, Introduction to Machine Learning, MIT Press 4. Tom M. Mitchell, Machine Learning, McGraw Hill Education
References :	1. Artificial Intelligence by Luger(Pearson Education) 2. Russel & Norvig, Artificial Intelligence :A Modern Approach, Pearson Education 3. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer 4. Sebastian Raschka, Python Machine Learning, Packt Publishing

DRONE TECHNOLOGIES

24ME505/JO1B

III B. Tech. Vth Semester

Lectures	:	3 Hours/Week	Tutorial	:	0	Practical	:	0
CIE Marks	:	40	SEE Marks	:	60	Credits	:	3

Pre-Requisite: NIL

Course Objectives: Students will learn how to

➢	Understand the basics of drone concepts, fundamentals of design, and fabrication of Drones
➢	Impart the knowledge of programming the drone, along with flying and operation of drone
➢	Understand the various applications of drone
➢	Understand the safety risks and guidelines of fly safely

Course Outcomes: After studying this course, the students will be able to

CO1	Understand the basics of drone concepts, fundamentals of design, and fabrication of Drones
CO2	Execute the suitable operating procedures for functioning a Drone
CO3	Develop Drone mechanism for specific applications
CO4	Understand the safety risks and guidelines of fly safely

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's											**PSO's**		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
CO-1	3	2	2	1	1	1					2	3	2	1
CO-2	2	2	1	2	3	1		2	1		2	2	2	1
CO-3	2	3	3	2	2	2		2		1	1	2	3	2
CO-4	1	1	1	1	1	3	3	1	1		2	1	1	1

UNIT-I	(12 Hours)
INTRODUCTION TO DRONE TECHNOLOGY: Concept-Vocabulary Terminology-History of drone-Types of current generation of drones based on their method of propulsion-Drone technology impact on the businesses-Drone business through entrepreneurship-Opportunities/applications for entrepreneurship and Employability **DRONE DESIGN and FABRICATION:** Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations	
UNIT-II	(12 Hours)
DRONE PROGRAMMING: The methods of programming drone- Download program -Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection. **DRONE FLYING AND OPERATION:** Concept of operation for drone -Flight modes-Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity -Removable storage devices- Linked mobile devices and applications	
UNIT-III	(12 Hours)
DRONE COMMERCI ALAPPLICATIONS: Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing	
UNIT-IV	(12 Hours)
FUTURE DRONES AND SAFETY: The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones-Increasing autonomy of drones -The use of drones in swarms	

Text Books:	1. Daniel Tal and John Altschuld, “Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation”, 2021 John Wiley & Sons, Inc. 2. Terry Kilby and Belinda Kilby, “Make: Getting Started with Drones “, Maker Media, Inc,
References:	1. John Baichtal, “Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs”, Que Publishing, 2016 2. Zavrsnik, “Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance”, Springer, 2018.Mechanics of Materials’ by Ferdinand J. Beer, Russell E. Johnston Jr, 8th Edition (in SI Units), Mc Graw Hill Publications, 2020.

SOFT SKILLS

24MEL501/SEC3

(Skill Enhancement Course)

III B. Tech. Vth Semester

Lectures	:	1 Hours/Week	Tutorial	:	0	Practical	:	2
CIE Marks	:	40	SEE Marks	:	60	Credits	:	3

Pre-Requisite: None

Course Objectives: Students will learn how to

➢	To make the engineering students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.
➢	To know the importance of interpersonal and intrapersonal skills in an employability setting.
➢	Actively participate in group discussions / interviews and prepare & deliver Presentations.
➢	Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of teamwork, Inter-personal relationships, stress management and leadership quality.

Course Outcomes: After studying this course, the students will be able to

CO1	Use appropriate body language in social and professional contexts.
CO2	Demonstrate emotional intelligence and life skills by managing stress, setting goals, and effectively organizing time in real-life situations.
CO3	Develop and deliver structured presentations using appropriate visual and oral techniques while applying cognitive skills for innovative thinking.
CO4	Utilize employability skills to perform effectively in group discussions, interviews, and team environments.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

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

LIST OF EXPERIMENTS

1. Body Language & Habitual Intelligence

a. Facial Expressions – Kinesics – Oculesics- Proxemics
b. Appearance and Grooming
c. Habit Science Fundamentals
d. Four Laws of Behaviour Change (Applied to Communication Skills)

2. Emotional Intelligence & Life Skills

a. Self-Awareness through Johari Window and SWOC analysis
b. Self-Motivation
c. Attitude & Personality Traits
d. Managing Stress
e. Goal Setting
f. Time Management

3. Business Presentations and Cognitive Skills

a. Preparing effective Presentations
b. Power Point Presentations
c. Poster Presentation/image presentation
d. Oral Presentation
e. Cognitive Skills: Lateral and Creative Thinking.

4. Employability Skills

a. Group Discussion
b. Team Building and Leadership Qualities
c. Resumé writing and Interview skills

References :

1. Personality Development and Soft skills (Second Edition), Barun K. Mithra. Oxford University Press: 2016
2. The Definitive Book of Body Language, Allan & Barbara. Pease International:2004
3. Working with Emotional Intelligence, Daniel Goleman. Bloomsbury:1998
4. English for Jobseekers, Lina Mukhopadhyay. Cambridge University Press:2013
5. The 7 Habits of Highly Effective People, Stephen R. Covey. St. Martin's Press:2014
6. Clear, James. *Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones*. Random House India, 2018.
7. De Bono, Edward. *Six Thinking Hats*. Revised ed., Penguin Books, 2000.

DESIGN AND METROLOGY LAB

24MEL502

III B. Tech. Vth Semester

Lectures	:	0	Tutorial	:	0	Practical	:	3
CIE Marks	:	40	SEE Marks	:	60	Credits	:	1.5

Pre-Requisite: None

Course Objectives: Students will learn how to

➢	Measure the taper angle using sine bar in conjunction with slip gauges, dial indicator, and surface plate.
➢	Measure the angle between surfaces using bevel protractor
➢	Use micrometer to determine diameter & thickness of given work piece and to use control charts to make decisions about the lot.
➢	Measure the chordal width and chordal height of given gear wheel using gear tooth vernier.
➢	Use bore dial gauge to measure the internal diameter of work piece & to check taper and ovality of the bore.
➢	Measure the taper of given work piece using taper plug gauge.
➢	Measure diameter and thickness using dial caliper.
➢	Measure pitch, depth and included angle of thread
➢	Measure pitch, depth, angle of given pitch gauge by using profile projector.

Course Outcomes: After studying this course, the students will be able to

CO1	To illustrate the concepts of accuracy and precision through experiments.
CO2	To Analyze limits and tolerances for engineering components.
CO3	To illustrate the use of various measuring tools measuring techniques.
CO4	To make student understand importance of statistical quality control techniques using experiments.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												PSO's		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2													2	
CO2	3		2		2									2	
CO3	2													2	
CO4	2													3	

LIST OF EXPERIMENTS

1. Angle measurement by Bevel Protractor.
2. Angle and taper measurement by sine bar.
3. Measuring effective dia. of thread using 3 - wire method.
4. Measuring gear tooth thickness using gear tooth vernier.
5. Measuring internal diameter using bore dial gauge.
6. Measuring external diameters using Micrometer& Plotting *X* & R Charts
7. Measuring different parameters of a thread / gear tooth using profile projector
8. Measuring different parameters of a thread / gear tooth using Tool Makers Microscope.
9. Measurement of external diameter and thickness using Dial caliper.
10. Measurement of taper angle using taper plug gauge.
11. Balancing machine
12. Wear & Friction measurement
13. Journal Bearing apparatus
14. Fatigue test
15. Photo elasticity bench setup

TEXT BOOKS

1. Metrology - R.K.Jain , Khanna publishers, 21st edition, 1984.
2. Mechanical Measurements & Control - by D.S. Kumar, 5th edition, 2019.

FUELS AND IC ENGINES LAB

24MEL503

III B. Tech. Vth Semester

Lectures	:	0	Tutorial	:	Nil	Practical	:	3
CIE Marks	:	40	SEE Marks	:	60	Credits	:	1.5

Pre-Requisite: None

Course Objectives: Students will learn how to

➢	To understand the determination of fuel properties such as kinematic viscosity, flash point, fire point, calorific value of fuels and carbon content of lubricating oil or fuels.
➢	To measure the consistency of lubricating greases by the penetrometer.
➢	To enable the students to understand the principles, working and performance of I.C engines
➢	To introduce the students the working of reciprocating air compressor and blower.

Course Outcomes: After studying this course, the students will be able to

CO1	Measure the fuel properties such as flash point, fire point, calorific value, carbon content and viscosity of given lubricating oils & fuels.
CO2	Understand the complete operation of 2-stroke and 4-stroke I.C engines through Valve timing and Port timing diagrams.
CO3	Analyze the performance of blower and compressor.
CO4	Determine the performance of both C.I. and S.I. Engines (Including single and multi cylinder) by using load test and heat balance test.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												PSO's		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	2		1						1		1	2	2	
CO2	3	2		1						1		1	2	2	
CO3	2	2	1	1	1					1		1	2	2	
CO4	2	2	1	1	1					1		1	2	2	

LIST OF EXPERIMENTS

CYCLE-I

1. Viscosity measurement using Saybolt viscometer.
2. Viscosity measurement using Engler's viscometer.
3. Carbon residue test using Conradson's carbon residue apparatus
4. Calorific value of LPG using Junker's Gas Calorimeter
5. Measurement of flash point using Abel's/Pensky-Martin's apparatus
6. Measurement of flash and fire points using Cleveland's open cup apparatus
7. Grease penetration test using Penetrometer apparatus

CYCLE-II

1. Valve timing diagrams on 4-stroke single cylinder petrol and diesel engine models.
2. Port Timing diagram on 2 stroke single cylinder petrol engine model.
3. Air compressor- to determine volumetric and isothermal efficiencies
4. Blower test rig- to determine overall efficiency
5. Two stroke single cylinder petrol engine – load test
6. Four stroke single cylinder diesel engine – load test
7. Four stroke four cylinder petrol engine – load test & heat balance test
8. Four stroke four cylinder petrol engine – Morse test
9. Four stroke four cylinder diesel engine – load test & heat balance test
10. Four stroke single cylinder petrol engine – variable compression ratio test

Any 5 Experiments from each cycle.

Technical Paper Writing and IPR

24ME506/MC03

III B.Tech. Vth Semester

Lectures	:	2 Hours/Week	Tutorial	:	0 Hour/Week	Practical	:	0
CIE Marks	:	40	SEE Marks	:	0	Credits	:	0

Pre-Requisite: None

Course Objectives: Students will

- To develop an understanding of the structure, style, and ethics of technical and scientific writing.
- To train students in effective academic communication, including research paper, thesis, and project report writing.
- To create awareness about various forms of intellectual property and the process of securing IP rights.
- To provide foundational knowledge on patents, copyrights, trademarks, and design rights

Course Outcomes: After studying this course, the students will be able to

CO1	Understand the fundamentals and importance of technical communication in engineering and research contexts.
CO2	Apply the standard procedures involved in the submission of research manuscripts to journals and conferences.
CO3	Prepare effective abstracts, posters, and oral presentations for communicating research outcomes.
CO4	Identify and differentiate various categories of IPR, including patents, copyrights, trademarks, trade secrets, and industrial designs.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes

	PO's												PSO's		
CO	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2						2		3					
CO2	2	3		2				2		3					
CO3	2	2	2					2	2	3					
CO4	2	2				2		2		3					
AVG	2	2.25	2	2		2		2	2	3					

Syllabus

UNIT-I (9 Hours)

Fundamentals of Technical Writing: Basics of technical communication, Types of technical documents: research papers, project reports, theses, Structure and components of a technical paper (Abstract, Introduction, Methods, Results, Discussion), Clarity, precision, and language usage in scientific writing, Ethics inwriting: plagiarism, data falsification, multiple submissions

UNIT-II (9 Hours)

Writing for Publication: Selection of journal/conference, understanding journal impact factor, indexing, and scope, Manuscript preparation and formatting guidelines, Submission process and peer review system, Responding to reviewers and revisions

UNIT-III	(9 Hours)
Presentation and Dissemination: Preparing abstracts, posters, and oral presentations, Tools for formatting and referencing (LaTeX, MS Word, EndNote, Mendeley, Zotero), Best practices for graphical and tabular data representation, Collaboration and authorship ethics, Copyright and open-access publishing.	
UNIT-IV	(9 Hours)
Introduction to IPR: Definition and need for Intellectual Property, Categories: Patents, Copyrights, Trademarks, Trade Secrets, Industrial Designs, Basic principles of patentability: novelty, non-obviousness, utility, National and international IPR organizations (WIPO, IPO, USPTO, EPO), IPR protection mechanisms in India, Sample Patent filing.	
Text Books:	1. M. Ashok Kumar & R. Murugesan, Research Methodology and IPR, Charulatha Publications. 2. R. N. Khandare, Research Methodology & IPR, S. Chand Publishing. 3. Michael Alley, The Craft of Scientific Writing, Springer.
Reference Books:	1. B.L. Wadehra, Law Relating to Intellectual Property, Universal Law Publishing Co 2. Day & Gastel, How to Write and Publish a Scientific Paper, Cambridge University Press.

SUMMER INTERNSHIP
24MEL504/INT01/PR
III B. Tech. Vth Semester

Lectures	:	0	Tutorial	:	0	Practical	:	0
CIE Marks	:	0	SEE Marks	:	100	Credits	:	2

Summer Internship at the end of IV semester carried out in industry is to be evaluated in V semester based report and certificate provided by the industry. The report and certificate will be evaluated by the department committee for 100 marks. 50 marks shall be for the report and certificate and 50 marks based on seminars/presentation to the department committee by the student.