24ME622	FINITE ELEMENT ANALYSIS	PCC	L T P C 3 0 0 3

Prerequisite:	24ME412

COURSE OBJECTIVES:

✓	To introduce the concepts of Mathematical Modeling of Engineering Problems.
✓	Understand the Fundamentals: Gain a strong understanding of the fundamental concepts and principles of finite element analysis.
✓	Apply FEA Techniques: Learn to apply FEA techniques to solve various engineering problems, including structural, thermal, and fluid flow problems.
✓	Utilize FEA Software: Develop skills in using commercial FEA software for practical problem-solving.
✓	Analyze Results: Interpret and validate the results obtained from FEA simulations.

UNIT - 1	INTRODUCTION TO FINITE ELEMENT ANALYSIS	8

Applications: *Simulates stress in bridges, aircraft wings, and buildings under loads. Predicting deformations and failure points.*

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and Continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.

UNIT - 2	ONE-DIMENSIONAL PROBLEMS	8

Applications: *Lightweight designs in bridges and aircraft frames, Axial stress in truss members, Crane booms, Turbine blades.*

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation –Transverse deflections and Natural frequencies of beams.

UNIT - 3	TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS	8

Applications: *Cooling fins in heat exchangers, Automotive radiators, Propeller shafts, Turbine blades with non-circular cross-sections, Helicopter rotors, Industrial mixers*

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts Quadrilateral

elements – Higher Order Elements.

UNIT - 4	TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS	8

Applications: *Rail wheels, Stresses for fuselage panels, Car body sheets, Rocket motor cases, Engine nozzles.*

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

UNIT - 5	ISOPARAMETRIC FORMULATION	7

Applications: *Wing skins, Satellite antennas, Cable-stayed bridges, Irregular deck geometries.*

Natural co-ordinate systems – Isoparametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software.

UNIT - 6	ADVANCED TOPICS AND APPLICATIONS	6

Applications: *Car crashes, Turbine blades, Wheel-rail contact, Safety structures.*

Nonlinear Analysis- Introduction to nonlinear problems (material, geometric, and boundary nonlinearity), Solution techniques for nonlinear FEA, Dynamic Analysis- Modal analysis and vibration analysis, Time-dependent problems and transient response, Optimization and Sensitivity Analysis- Design optimization techniques.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

1.	Apply the concept on the basics of finite element formulation.
2.	Apply finite element formulations to solve one dimensional problem.
3.	Apply finite element formulations to solve two dimensional scalar problems.
4.	Apply finite element method to solve two dimensional vector problems.
5.	Apply finite element method to solve problems on iso parametric element and dynamic Problems.
6.	Interpret FEA results, validate simulations, and make informed engineering decisions based on analysis.

TEXT BOOKS:

1.	Practical Finite Element Analysis, Second Edition, by Nitin S. Gokhale, 2025
2.	Finite Element Analysis, Published by Asoke K. Ghosh, PHI Learning Private Limited,

	2022
3.	Finite Element Analysis by Dr.S.Senthil, Lakshmi Publications, 2023
REFERENCES:	
1.	Application of Finite Element Analysis for Engineers, by Dr. Rajkumar Easwarapillai, Crown Publishing, 2026
2.	Finite Element Analysis: Theory and Application with ANSYS by Saeed Moaveni, Global Edition, Pearson, 2014
3.	Introduction to Nonlinear Finite Element Analysis by Nam-Ho Kim, Springer Cham, 2026
OTHER SOURCES:	
1.	https://www.sciencedirect.com/journal/finite-elements-in-analysis-and-design
2.	https://www.coursera.org/courses?query=finite%20element
3.	https://www.udemy.com/topic/finite-element-analysis

CO – PO MAPPING

CO	**PO**											**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	3	2	2	1	0	0	0	0	0	2	3	2	2
2	3	3	2	2	1	0	0	0	0	0	2	3	2	2
3	3	3	2	2	1	0	0	0	0	0	2	3	2	2
4	3	3	2	2	1	0	0	0	0	0	2	3	2	2
5	3	3	2	2	1	0	0	0	0	0	2	3	2	2
6	3	3	2	2	1	0	0	0	0	0	2	3	2	2
Low (1) Medium (2) High (3)														

Assessment Weightage:

Formative Assessment		**Summative Assessment**
CIA	Experiential Learning	End semester examination
20%	20%	60%

CIA- Continuous Internal Assessment

Assessment of course outcome

Cognitive level	CO1	CO2	CO3	CO4	CO5	CO6
R	20%	10%	10%	15%	20%	15%
U	20%	20%	20%	25%	15%	15%
Ap	60%	60%	60%	50%	55%	45%
An	0%	10%	10%	10%	10%	25%
E	0%	0%	0%	0%	0%	0%
C	0%	0%	0%	0%	0%	0%

Suggested experiential learning assessment activities

Vertical I (5 marks)	Vertical II (5 marks)	Vertical III (10 marks)
Assignments	Field Visit	Case Studies
The course instructor can choose different assessment activities based on students interest with reference to standing committee meeting SCM III & Academic council meeting ACM III.		

Recommended by BOS		Approved by ACM	
XX	Date:	XX	Date:

24ME621	MECHANICAL, ELECTRICAL, AND PLUMBING ENGINEERING	ESC	L T P C 3 0 0 3

Prerequisite:	24ME101, 24EEC01

COURSE OBJECTIVES:

✓	To understand the fundamentals of Mechanical, Electrical, and Plumbing systems in buildings.
✓	To describe design principles, standards, and codes related to Mechanical systems
✓	To illustrate design principles, standards, and codes related to Electrical systems
✓	To describe design principles, standards, and codes related to Plumbing and water supply systems
✓	To integrate MEP systems for sustainable and efficient building performance.
✓	To explore current trends and emerging technologies in MEP engineering.

UNIT - 1	INTRODUCTION TO MEP SYSTEMS	8

Applications: *Integrated building design- Residential and commercial building services- Industrial infrastructure planning- Smart building implementation- Facility management systems*

Overview of MEP Engineering - Building services and coordination - Codes and standards (National & International) - Role of MEP in smart buildings- **Reading layout drawing** - Basics of load estimation and system selection - MEP drawings and documentation.

UNIT - 2	MECHANICAL SYSTEMS IN BUILDINGS	8

Applications: HVAC design for hospitals and IT parks - Industrial ventilation systems - Fire safety planning in high-rise building - Cold storage and refrigeration unit - Green building mechanical systems

HVAC fundamentals (Heating, Ventilation & Air Conditioning) - Psychrometrics and air distribution systems - Refrigeration cycles - Fire protection systems - Elevators and escalators basics - Energy-efficient mechanical systems.

UNIT - 3	ELECTRICAL SYSTEMS IN BUILDINGS	8

Applications: Electrical layout design for commercial complexes - Street lighting systems - Solar rooftop installations - Data centre power management - Smart grid integration

Electrical load calculations - Power distribution systems - Transformers and switchgear - Earthing and lightning protection - Lighting design principles - Backup systems (DG sets, UPS) - Renewable integration (Solar PV).

UNIT - 4	PLUMBING AND WATER SUPPLY SYSTEMS	8

Applications: Residential water supply systems - Sewage treatment plants (STP) - Rainwater harvesting in institutions - Industrial water recycling - Sustainable plumbing design

Water supply and distribution systems - Plumbing materials and fixtures - Drainage and sewage systems - Storm water management - Rainwater harvesting - Water treatment basics - Pump selection and sizing.

UNIT - 5	MEP COORDINATION, BIM AND ENERGY MANAGEMENT	8
Applications: BIM-based project execution - Energy-efficient building retrofitting - Smart building automation - Green building certification projects - Integrated project delivery systems MEP coordination challenges - Building Information Modeling (BIM) for MEP - Clash detection and resolution - Energy auditing - Building automation systems (BAS) - Sustainable design practices - Green building rating systems (LEED, GRIHA).		
UNIT - 6	**BUSINESS STATISTICS AND CURRENT TRENDS**	**5**
Applications: Project cost forecasting - Performance analysis of building systems - Data-driven maintenance planning - Investment decision-making in infrastructure - Smart and net-zero building development Introduction to Business Statistics- Measures of central tendency and dispersion - Probability and decision-making - Regression and forecasting - Cost estimation and financial analysis - Risk analysis in MEP projects - Current trends in MEP: IoT in building services, AI-based predictive maintenance, Net-zero energy buildings, Prefabricated MEP system, Sustainable and resilient infrastructure.		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

1.	Describe the fundamentals, standards, and documentation of MEP systems in buildings.
2.	Describe the basic mechanical systems including HVAC and fire protection for buildings.
3.	Understand the principles of electrical distribution, lighting, and renewable integration systems.
4.	Develop plumbing and water supply system layouts for sustainable building applications.
5.	Interpret the BIM tools and energy management techniques for integrated MEP coordination.
6.	Utilize business statistics and emerging technologies for effective MEP project planning and decision-making.

TEXT BOOKS:

1.	Janis, R.R. and Tao, W.K.Y., *Mechanical and Electrical Systems in Buildings*, 7th Edition, Pearson Education, 2025.
2.	Elliott, G. Kenneth, Powell, L. Harrison and Al-Hussein, M., *MEP: A Practical Guide to Integrated Design, Delivery and Building Performance*, Wiley, 2019.
3.	Smith, Craig B., *Energy Management Principles: Applications, Benefits, Savings*, 2nd Edition, Elsevier, 2015.

REFERENCES:

1.	Haines, R.W. and Myers, M.E., *HVAC Systems Design Handbook*, 6th Edition, McGraw-Hill, 2020.
2.	Grondzik, W.T., Kwok, A.G., Stein, B. and Reynolds, J.S., Mechanical and Electrical Equipment for Buildings, 12th Edition, Wiley, 2019.

OTHER SOURCES:	
1.	https://app.learn-one.autodesk.com/learn/ondemand/collection/bim-for-mep-systems - Resource to learn Building Information Modeling specifically for MEP design and coordination.
2.	https://onlinecourses.swayam2.ac.in/nou24_ge85/preview - Focuses on sustainable building design, energy performance, passive systems and basic building science
3.	https://www.edx.org/course/energy-efficient-buildings-hvac-lighting-controls - Covers building energy performance, HVAC fundamentals, lighting systems and efficiency strategies.
4.	https://www.udemy.com/course/plumbing-fundamentals/ - Covers plumbing design basics, materials and fixtures.

CO – PO MAPPING

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
1	3	1	1	1	-	1	-	-	-	-	2	3	2	1
2	3	1	1	1	-	1	-	-	-	-	2	3	2	2
3	3	1	1	1	-	1	-	-	-	-	2	3	2	2
4	2	1	1	1	-	1	-	-	-	-	2	3	2	2
5	2	1	1	1	-	1	-	-	-	-	2	3	3	2
6	2	1	-	1	-	-	-	-	-	-	2	2	3	3
Low (1) Medium (2) High (3)														

Assessment Weightage:

Formative Assessment		Summative Assessment
CIA	Experiential Learning	End semester examination
20%	20%	60%

CIA - Continuous Internal Assessment

Assessment of course outcome

Cognitive level	CO1	CO2	CO3	CO4	CO5	CO6
R	15%	25%	20%	25%	20%	30%
U	85%	75%	20%	75%	80%	60%
Ap	0	0	0	0	0	10%
An	0	0	0	0	0	0
E	0	0	0	0	0	0
C	0	0	0	0	0	0

Suggested experiential learning assessment activities

Vertical I (5 marks)	Vertical II (5 marks)	Vertical III (10 marks)
Seminar with visual presentation	Field Visit	Technical Project
The course instructor can choose different assessment activities based on students interest with reference to standing committee meeting SCM III & Academic council meeting ACM III.		

Recommended by BOS		Approved by ACM	
XX	Date:	XX	Date:

24ME623	METROLOGY & QUALITY CONTROL ENGINEERING	PCC	L T P C 3 0 0 3

Prerequisite:	24ME411

COURSE OBJECTIVES:

✓	Understand the principles of measurement systems, standards, calibration, and uncertainty analysis.
✓	Apply linear and angular measurement techniques for engineering inspection and alignment.
✓	Analyze form, surface, and gear characteristics using conventional and coordinate metrology tools.
✓	Apply limits, fits, tolerances, and gauge design principles to ensure interchangeability in manufacturing.
✓	Use statistical quality control and quality management tools for monitoring and improving process performance.
✓	Introduce business statistics and emerging trends such as digital metrology, Industry 4.0, and data-driven quality control.

UNIT - 1	INTRODUCTION TO METROLOGY	8

Applications*: International calibration laboratories, national metrology institutes, industrial calibration labs, routine inspection and shop-floor measurements, workshops, and testing labs.*

Definition and scope of metrology – Standards of measurement: International, Primary, Secondary and Working standards – Calibration – Measurement systems and their elements – Classification of measurement methods – Errors in measurement: Gross, systematic and random errors – Accuracy, precision, sensitivity, repeatability and reproducibility – Uncertainty analysis and error propagation.

UNIT - 2	LINEAR AND ANGULAR MEASUREMENTS	8

Applications: *Routine production inspection, precision manufacturing and tool rooms, gear, cam, and profile checking, Alignment of lathe beds, milling machines, and grinders.*

Linear measurements: Vernier calipers, micrometers, slip gauges – Comparators: Mechanical, electrical, optical and pneumatic – Interferometry and laser-based measurements. Angular measurements: Clinometer, Bevel protractor, sine bar, angle gauges – Autocollimator – Applications in alignment and machine tool inspection.

UNIT - 3	FORM, SURFACE AND GEAR MEASUREMENTS	8

Applications: *Inspection of machine tool guideways, slideways, surface plates, bearings, shafts, pistons, engine cylinders, and hydraulic cylinders, Checking straightness of shafts, rails, and beams.*

Measurement of straightness, **measurement of screw threads using two-wire and three-wire methods**, flatness, roundness and cylindricity – Coordinate Measuring Machines (CMM): construction, types and applications. Surface metrology: Surface texture terminology – Roughness, waviness and lay – Stylus instruments – Optical methods – Surface roughness parameters (Ra, Rz, Rt). Gear measurement: Gear terminology – Measurement of pitch, runout and profile – Composite gear testing.

UNIT - 4	LIMITS, FITS, TOLERANCES AND GAUGES	8

Applications: *Automotive, aerospace, and machine tool industries, mass production and global manufacturing, shop floors due to speed and simplicity, repair and maintenance work.*

Limits, fits and tolerances – Fundamental deviations and tolerance grades – Systems of fits: Hole basis and shaft basis – Interchangeability and selective assembly – Taylor's principle – Types of gauges: Plug, ring and snap gauges – Design of gauges – Gauge materials and wear allowance.

UNIT - 5	QUALITY CONTROL AND STATISTICAL QUALITY CONTROL	8

Applications: *Product Quality and Customer Satisfaction, Process Monitoring and Control in Manufacturing, Cost Reduction and Productivity Improvement, standardization and Global Market Acceptance.*

Quality concepts – Quality assurance and quality control – Inspection methods: 100% inspection and sampling inspection – Acceptance sampling plans. Statistical Quality Control: Probability distributions – Control charts for variables ($\bar{X}$, R, S charts) – Control charts for attributes (p, np, c, u charts) – Process capability analysis (Cp, Cpk) – Introduction to Total Quality Management (TQM) and ISO 9001.

UNIT - 6	BUSINESS STATISTICS AND CURRENT TRENDS	5

Applications*: Smart Quality Control under Industry 4.0, Defect Detection and Prediction using AI and Machine Learning, Process Optimization through Data Analytics.*

Business statistics for engineering applications: Importance of statistics in manufacturing and quality management – Data collection and presentation – Measures of central tendency and dispersion. Current trends in quality and metrology: Industry 4.0 concepts in quality control – Digital metrology and smart measurement systems – Applications of data analytics, artificial intelligence, and machine learning in inspection, defect prediction, and process optimization. **laser metrology, machine vision, computed tomography, nano measurements, and 3D measurements**

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

1.	Explain measurement standards, measurement systems, errors, and uncertainty analysis in engineering measurements.
2.	Apply linear and angular measurement instruments to inspect components and machine tool alignment.
3.	Measure and analyze form accuracy, surface texture, and gear parameters using conventional and CMM-based techniques.
4.	Apply limits, fits, tolerances, and gauge design principles for ensuring dimensional accuracy and interchangeability.
5.	Use statistical quality control tools such as control charts, process capability indices, and sampling plans for process improvement.
6.	Apply basic business statistics and explain recent trends in quality control, digital metrology, and intelligent inspection systems.

TEXT BOOKS:	
1.	Raghuwanshi, B.S. and Mittal, L.R., Metrology and Quality Control, Khanna Publishers, New Delhi, 12th Edition, 2022
2.	Jain, Raghuwanshi and Mittal, Engineering Metrology and Measurements, Khanna Publishers, 18th Edition, 2024
3.	Mark Curtis, Francis T. Farago, "Handbook of Dimensional Measurement", Industrial Press, 6th edition, 2023.
4.	Raghavendra N.V. and Krishnamurthy. L., Engineering Metrology and Measurements, OxfordUniversity Press, 2023.
5.	Dotson Connie, "Dimensional Metrology", Cengage Learning, 2nd edition, 2021.
REFERENCES:	
1.	Beckwith, Marangoni and Lienhard, Mechanical Measurements, Pearson Education, *6th Edition, 2020*
2.	Montgomery, D.C., Introduction to Statistical Quality Control, John Wiley & Sons, 8th Edition, 2024.
3.	Gupta, S.C., Metrology and Quality Control, Khanna Publishers, New Delhi, 12th Edition, 2020.
4.	Ammar Grous, J "Applied Metrology for Manufacturing Engineering", Wiley-ISTE, 2020.
5.	Venkateshan, S. P., Mechanical Measurements, Second edition, John Wiley &Sons, 2020
OTHER SOURCES:	
1.	NPTEL – Engineering Metrology https://nptel.ac.in/courses/112104250
2.	NPTEL – Statistical Quality Control https://nptel.ac.in/courses/110105039
3.	MIT Open Course Ware – Measurement and Instrumentation https://ocw.mit.edu
4.	ZEISS Metrology Academy https://www.zeiss.com/metrology/academy
5.	Hexagon Manufacturing Intelligence – Metrology Training https://www.hexagonmi.com

CO – PO MAPPING

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	2	–	–	–	–	–	–	–	–	1	2	–	–
2	2	3	2	–	2	–	–	–	–	–	–	3	1	–
3	2	3	3	–	2	–	–	–	–	–	–	3	2	1
4	2	2	3	–	2	–	–	–	–	–	–	3	2	–
5	2	3	2	–	2	1	–	–	1	–	–	2	3	–
6	1	2	1	–	2	2	–	–	2	1	2	1	2	2
Low (1) Medium (2) High (3)														

Assessment Weightage:

Formative Assessment		**Summative Assessment**
CIA	Experiential Learning	End semester examination
20%	20%	60%

CIA- Continuous Internal Assessment

Assessment of course outcome

Cognitive level	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
R	20%	20%	20%	20%	20%	20%
U	40%	40%	40%	40%	40%	40%
Ap	40%	40%	40%	40%	40%	40%
An						
E						
C						

Suggested experiential learning assessment activities

Vertical I (5 marks)	Vertical II (5 marks)	Vertical III (10 marks)
20%	20%	60%
The course instructor can choose different assessment activities based on students interest with reference to standing committee meeting SCM III & Academic council meeting ACM III.		

Recommended by BOS		Approved by ACM	
XX	Date:	XX	Date:

24ME624	**OIL AND GAS PIPING ENGINEERING**		L T P C 3 0 0 3
Prerequisite:	24ME518, 24ME413		
COURSE OBJECTIVES:			
✓	Understand the fundamental principles and components of oil and gas piping systems.		
✓	Apply the codes and standards related to oil and gas piping engineering.		
✓	Compare different piping materials for various applications and describe maintenance strategies for piping.		
✓	Identify the construction methods and maintenance strategies for oil and gas pipelines.		
✓	Understand the safety regulations and environmental considerations in oil and gas piping engineering.		
UNIT - 1	**BASIC CONCEPTS, PROPERTIES OF FLUIDS AND FLOW CHARACTERISTICS**		8
Applications: Refinery Crude Transfer Pipeline, LNG Transfer Pipeline, Tank Farm Interconnecting Piping, Wellhead Flowline Assembly, Gas Gathering Manifold System, Christmas Tree Piping System Introduction to piping systems in the oil and gas industry- Overview of exploration, production, and transportation processes- Role of piping engineers in the oil and gas sector			
UNIT - 2	**PIPING DESIGN AND STANDARDS**		8
Applications: Cross-Country Crude Oil Pipeline, Natural Gas Transmission Pipeline, Refinery Process Piping System, Offshore Platform Riser Pipeline , High-Temperature Steam Piping System Piping design principles and considerations- Codes and standards applicable to oil and gas piping- Stress analysis and support design for piping systems			
UNIT - 3	**PIPING MATERIALS AND CORROSION PROTECTION**		8
Applications: Carbon Steel Crude Oil Pipeline, Stainless Steel Sour Gas Pipeline, Duplex Stainless Steel Offshore Flowline, Internally Coated Water Injection Pipeline, Chemical Injection Piping Line Selection of piping materials for different applications- Corrosion mechanisms and protection techniques- Maintenance strategies for preventing corrosion in pipelines			
UNIT - 4	**PIPELINE CONSTRUCTION AND INSPECTION**		8
Applications: Long-Distance Gas Pipeline Sections, Subsea Oil Pipeline, Hydrostatic Test Manifold Assembly, Intelligent Smart Pig Tool, Pipeline Repair Clamp, Welded Pipe Joint Assembly Construction methods for oil and gas pipelines- Inspection and testing procedures for pipeline integrity- Pipeline maintenance and integrity management practices			
UNIT - 5	**SAFETY AND ENVIRONMENTAL COMPLIANCE**		8
Applications: Emergency Shutdown Valve (ESDV), Pressure Relief Valve (PRV) Piping System, Gas Leak Detection Pipeline System, Firewater Piping System, SCADA-Based Pipeline Monitoring System, Oil Spill Containment Pipeline			

Safety regulations and standards in oil and gas piping operations-Environmental impact assessment and mitigation measures- Emergency response planning for pipeline incidents		
UNIT - 6	**CASE STUDIES AND APPLICATIONS**	5
Analysis of real-world oil and gas piping projects- Application of course concepts to industry-specific scenarios- Group projects and presentations on piping engineering challenges in the oil and gas sector		
		TOTAL: 45 PERIODS

COURSE OUTCOMES:	
At the end of the course the students would be able to	
1.	Describe the role of piping systems in the oil and gas industry.
2.	Apply relevant codes and standards in the design and construction of oil and gas piping.
3.	Describe corrosion mechanism in piping materials and its protection techniques.
4.	Select appropriate materials for oil and gas pipelines and to implement protection measures.
5.	Demonstrate the safety regulations, emergency response protocols, and environmental considerations.
6.	Analyze different oil and gas piping projects around the world.
TEXT BOOKS:	
1.	Mohinder L., Nayyar, Piping Handbook, McGraw-Hill, 7th Edition, 2000.
2.	Henry Liu, Pipeline Engineering, CRC Press, 1st Edition, 2019.
REFERENCES:	
1.	E. W. McAllister, Pipeline Rules of Thumb Handbook: A Manual of Quick, Accurate Solutions to Everyday Pipeline Engineering Problems. Oxford, U.K.: Gulf Professional Publishing, 2005.
2.	L. L. Shreir, R. A. Jarman, and G. T. Burstein, Corrosion and Materials in the Oil and Gas Industries. Oxford, U.K.: Butterworth-Heinemann, 1994.
3.	C. Becht IV, Process Piping: The Complete Guide to ASME B31.3. New York, NY, USA: ASME Press, 2013.
4.	T. O. Miesner and W. L. Leffler, Oil and Gas Pipelines in Nontechnical Language. Tulsa, OK, USA: PennWell Corporation, 2006.

CO – PO MAPPING

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	2	1	1	-	1	1	-	-	-	-	-	1	1	1
2	2	1	1	-	1	1	-	-	-	-	-	1	2	1
3	2	1	1	-	1	1	-	-	-	-	-	1	3	1
4	2	1	1	-	1	1	-	-	-	-	-	1	1	1
5	2	1	1	-	1	1	-	-	-	-	-	1	2	1
6	2	1	1	-	1	1	-	-	-	-	2	1	3	1
Low (1) Medium (2) High (3)														

Assessment Weightage:

Formative Assessment		**Summative Assessment**
CIA	Experiential Learning	End semester examination
20%	20%	60%

CIA - Continuous Internal Assessment

Assessment of course outcome

Cognitive level	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
R	25%	20%	25%	25%	20%	20%
U	75%	80%	75%	75%	50%	65%
Ap	-	-	-	-	-	15%
An	-	-	-	-	-	-
E	-	-	-	-	-	-
C	-	-	-	-	-	-

Suggested experiential learning assessment activities

Vertical I (5 marks)	Vertical II (5 marks)	Vertical III (10 marks)
Assignment	Field Visit	Paper Presentation
The course instructor can choose different assessment activities based on students interest with reference to standing committee meeting SCM III & Academic council meeting ACM III.		

Recommended by BOS		Approved by ACM	
XX	Date:	XX	Date:

24HSS06	Career Readiness And Professional Profile For Mechanical Engineers	EEC	L T P C 1 0 0 1

COURSE OBJECTIVES:

✓	To develop career awareness and professional readiness among mechanical engineering students.
✓	To enhance communication, resume writing, and interview skills.
✓	To provide exposure to industry expectations and workplace ethics.
✓	To build problem-solving, teamwork, and leadership abilities.
✓	To guide students in creating a strong professional profile.
✓	To prepare students for higher studies, entrepreneurship, and employment opportunities.

UNIT - 1	**Career Planning and Self-Assessment**	5

Applications: Career goal setting, personality assessment, skill gap analysis.

Introduction to career planning – SWOT analysis – Identifying strengths and weaknesses – Setting short-term and long-term goals – Career opportunities in Mechanical Engineering – Industry vs Higher studies – Government jobs vs Private sector.

UNIT - 2	**Communication and Professional Skills**	5

Applications: Workplace communication, presentation skills.

Verbal and non-verbal communication – Technical communication – Email etiquette – Presentation skills – Group discussion techniques – Interpersonal skills – Listening skills.

UNIT - 3	**Resume Building and Online Professional Profile**	5

Applications: Resume preparation, LinkedIn profile creation.

Resume formats – Writing effective resume and cover letter – Portfolio preparation – LinkedIn profile optimization – Personal branding – Digital presence for engineers.

UNIT - 4	**Interview Preparation and Placement Skills**	5

Applications: Campus interviews, job recruitment.

Types of interviews – HR and technical interviews – Frequently asked questions – Mock interviews – Aptitude and reasoning basics – Stress management during interviews.

UNIT - 5	**Industry Readiness and Workplace Ethics**	5

Applications: Industrial environment, professional conduct.

Industry expectations – Work ethics – Time management – Teamwork and leadership – Safety practices – Professional responsibility – Corporate culture.

UNIT - 6	**Entrepreneurship and Higher Studies**	5

Applications: Startup development, academic progression.

Entrepreneurship basics – Startup ecosystem – Innovation and idea generation – Funding opportunities –

Higher studies in India and abroad – GATE, GRE, TOEFL overview – Career pathways.	
TOTAL: 30 PERIODS	
COURSE OUTCOMES:	
At the end of the course the students would be able to	
1.	Identify career goals and evaluate personal strengths and weaknesses.
2.	Demonstrate effective communication and interpersonal skills.
3.	Develop professional resumes and online profiles.
4.	Perform effectively in interviews and placement processes.
5.	Understand workplace ethics and industry expectations.
6.	Explore entrepreneurship and higher education opportunities.
TEXT BOOKS:	
1.	M. S. Rao, Soft Skills: Enhancing Employability, I.K. International Publishing.
2.	Shiv Khera, You Can Win, Macmillan Publications.
REFERENCES:	
1.	Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press.
2.	Norman Vincent Peale, The Power of Positive Thinking.
3.	Dale Carnegie, How to Win Friends and Influence People.
4.	Harvard Business Review Guides (Career & Communication Series).
OTHER SOURCES:	
1.	NPTEL Courses on Soft Skills and Career Development.
2.	LinkedIn Learning Platform.
3.	MOOCs (Coursera, edX, Udemy).

CO – PO MAPPING

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	2	1	-	-	-	-	-	-	-	2	-	1	-	-
2	-	-	-	-	-	2	-	-	3	3	-	-	-	-
3	-	-	-	2	-	-	-	-	-	3	-	-	1	-
4	2	2	-	-	-	2	-	-	2	3	-	-	-	-
5	-	-	-	-	-	3	2	3	3	2	-	-	-	-
6	-	1	2	-	-	-	-	-	-	**2**	2	1	2	-
LOW (1) ; MEDIUM (2) ; HIGH (3)														

Assessment Weightage:

Formative Assessment		Summative Assessment
CIA		
50%		50%

CIA- Continuous Internal Assessment

Assessment of course outcome

Cognitive level	CO1	CO2	CO3	CO4	CO5	CO6
R	✓	✓				
U	✓	✓	✓			
Ap		✓	✓	✓		
An			✓	✓	✓	
E				✓	✓	✓
C			✓	✓	✓	✓

Suggested experiential learning assessment activities

Vertical I (5 marks)	Vertical II (5 marks)	Vertical III (10 marks)
Resume preparation and LinkedIn profile creation	Mock interview and group discussion	Mini project: Career plan / Startup idea presentation

Recommended by BOS		Approved by ACM	
XX	Date:	XX	Date:

24ME725	ENGINEERING ANALYSIS LABORATORY	PCC	L T P C 0 0 3 1.5
Prerequisite:	**24ME519**		
COURSE OBJECTIVES:			
✓	Analyzing the force and stress in mechanical components.		
✓	Analyzing deflection in mechanical components.		
✓	Analyzing thermal stress of mechanical components.		
✓	Analyzing heat transfer in mechanical components.		
✓	Analyzing the vibration of mechanical components.		
LIST OF EXPERIMENTS:			45
1.	Stress analysis of cantilever beam and simply supported beam.		
2.	Stress analysis of fixed beam.		
3.	Stress analysis of a plate with a circular hole.		
4.	Stress analysis of rectangular L bracket.		
5.	Stress analysis of an axi-symmetric component.		
6.	Stress analysis of a trusses.		
7.	Thermal stress analysis of plates and cylindrical shells.		
8.	Conductive heat transfer analysis of a 2D component.		
9.	Mode frequency analysis of cantilever beam and simply supported beam.		
10.	Harmonic analysis of a 2D component.		
TOTAL: 45 PERIODS			
COURSE OUTCOMES:			
At the end of the course the students is expected to be able to			
1.	Apply the effect of force and impact of stress on the mechanical components.		
2.	Evaluate the deflection occurring on the mechanical components.		
3.	Analyze the thermal stress and its mechanism of distribution in mechanical components.		

4.	Analyze the mechanism of heat transfer in mechanical components.
5.	Model and analyze the vibration effects on mechanical components.
6.	Conduct the harmonic frequency analysis to understand the behavior of components.

CO – PO MAPPING

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**	**3**
1	3	3	3	2	1	0	2	0	0	3	0	3	3	2
2	3	3	3	2	1	0	2	0	0	3	0	3	3	2
3	3	3	3	2	1	0	2	0	0	3	0	3	3	2
4	3	3	3	2	1	0	2	0	0	3	0	3	3	2
5	3	3	3	2	1	0	2	0	0	3	0	3	3	2
Low (1) Medium (2) High (3)														

Assessment Weightage:

Formative Assessment			**Summative Assessment**
CIA	Innovative project/ Field visit	Experimental practices	End semester examination
20%	10%	20%	50%

CIA- Continuous Internal Assessment

Assessment of course outcome

Cognitive level	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**	**CO6**
R	0	0	0	0	0	0
U	0	0	0	0	0	0
Ap	0	0	0	0	0	0

An	100	100	100	100	100	100
E	0	0	0	0	0	0
C	0	0	0	0	0	0

Recommended by BOS		Approved by ACM	
XX		XX	