SEMESTER VI

Sr.No	Course Category	Course Code	Course Title	Hours per Week			Credits	Maximum Marks			
				L	T	P		Mid Sem Examination	Continual Assessment	End Sem Examination	Total
1	PCC	**23ME601T**	Dynamics of Machines	**3**	**-**	**-**	**3**	**15**	**15**	**70**	**100**
2	PCC	**23ME601P**	Dynamics of Machines Lab	**-**	**-**	**2**	**1**	**-**	**25**	**25**	**50**
3	PCC	**23ME602T**	Industrial Engineering	**3**	**-**	**-**	**3**	**15**	**15**	**70**	**100**
4	PEC	**23ME603T**	Program Elective course- III	**3**	**-**	**-**	**3**	**15**	**15**	**70**	**100**
5	PEC	**23ME604T**	Program Elective course -IV	**3**	**-**	**-**	**3**	**15**	**15**	**70**	**100**
6	AEC	**23AS601T**	Economics & Management	**2**	**-**	**-**	**2**	**7.5**	**7.5**	**35**	**50**
7	ELC	**23ME605P**	Project - I	**-**	**-**	**4**	**2**	**-**	**50**	**-**	**50**
8	SEC	**23ME641P**	Career Development – VI	**-**	**-**	**2**	**1**	**-**	**50**	**-**	**50**
9	OE	**23ME661O**	Open Elective- III	**3**	**-**	**-**	**3**	**15**	**15**	**70**	**100**
10	MDM	**23ME631M**	Multidisciplinary Minor – IV	**3**	**-**	**-**	**3**	**15**	**15**	**70**	**100**
Total				**20**	**-**	**8**	**24**	**97.5**	**222.5**	**480**	**800**

Career Development - VI: Training on soft skills (Group Discussions, Interview techniques)

Open Elective - III	
23ME661O	Renewable Energy Resources

Multi-disciplinary Minor-IV	
23ME631M	Vehicle Engineering

Program Elective course -III	
23ME603T(i)	Passive Heating and Cooling of Building
23ME603T(ii)	Sustainable Production System
23ME603T(iii)	Design of Mechanical Power Transmission system

Program Elective course -IV	
23ME604T(i)	HVAC System Design-I
23ME604T(ii)	Advances in Project and Quality Management
23ME604T(iii)	Machine Fault Diagnosis

		July 2025	**NEP 1.0**	**Applicable for 2025-26**
Chairman - BoS	**Dean – Academics**	**Date of Release**	**Version**	

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B. Tech. Scheme of Examination & Syllabus 2023-24

MECHANICAL ENGINEERING

SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23ME601T	Dynamics of Machines	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
The course is designed to: 1. Explain the machine dynamics through basic principles to interpret their application and examine near to life problems due gyroscopic effect. 2. Explain the methodology to analyze dynamic force conditions in planer linkages and cams to determine required driving torque condition. 3. Familiarize learner with the concept unbalance forces due to rotating and reciprocating masses in a mechanical system and estimate (graphically/ analytically) the balancing masses required for safe and smooth operation of these mechanical systems. 4. Familiarize learner with the concept and application of flywheels and governors in a mechanical system and evaluate the required condition to be incorporated in mechanical systems. 5. Explain the concept of vibration in various mechanical systems and distinguish vibration characteristics for 1 & 2 DOF systems to evaluate the conditions for its control & use.	**Students will be able to:** 1. Comprehend the machine dynamics through basic principles to interpret their application and examine near to life problems due gyroscopic effects and determine the conditions for stability of ships, airplanes and automobile. 2. Analyze dynamic force conditions in planer linkages and cams to determine required driving torque condition (graphically/ analytically). 3. Estimate the unbalanced forces due to rotating and reciprocating masses in a mechanical system and calculate (graphically/ analytically) the balancing masses required for safe/smooth operation of these mechanical systems. 4. Identify the requirement of governor and flywheel in a mechanical system and calculate the required condition to be incorporated in mechanical systems. 5. Recognize and interpret the concept of vibration in various mechanical systems and distinguish vibration characteristics for 1 & 2 DOF systems to evaluate the conditions for its control and use.

Unit I **[9 Hrs]**

Gyroscopic Effect: Introduction, precession motion, Effect of gyroscopic couple on shaft bearings, airplane, naval ship, vehicle stability. Introduction to electronic gyroscopes and its applications in the modern automobiles.

Unit II **[9 Hrs]**

Dynamic force analysis: Concepts in machine element dynamics. D'Alembert principle. Application of these approaches for equilibrium of mechanisms, Static and Dynamic force analysis of planar linkages such as four bar chain and reciprocating mechanism by graphical method, Analytical method. Cam
dynamics and jump-off phenomenon

Unit III **[9 Hrs]**

Balancing of rotating masses: in one and several planes, static and dynamic balancing machines. [Graphical and analytical treatment]

Balancing of reciprocating masses: in single and multi-cylinder engines, (inline and radial). Primary and secondary balancing analysis. [Graphical and analytical treatment]

Unit IV **[9 Hrs]**

Flywheel - Turning moment Vs crank angle diagram for single- cylinder and multiple-cylinder engines, flywheel application in punching machines. [Analytical treatment]

Speed Governors: Centrifugal & inertia governors. Types- Watt, Porter, Proel & Hartnel governor, Operating characteristics of governors.

Unit V **[9 Hrs]**

Vibration Analysis: Types of vibration, degree of freedom, method of vibration analysis of un-damped and damped free & forced vibration system. Types of damping and Logarithmic decrement. Whirling of shaft and critical speed of rotors. Torsional oscillation of two-disc and three disc rotors, torsional vibration of a geared system.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Theory of Machine	S. S. Rattan		Tata McGraw Hill
2	Theory of Machines	P L Ballaney		Khanna Publications
3	Mechanical Vibrations	V. P. Singh,		Dhanpatrai & Co.

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Theory of Machines and Mechanisms	J.E.Shigley and J. J. Uicker		Oxford University Press
2	Theory of Machines and Mechanisms	Ghosh & Mallik,		Affiliated East- West Press
3	Mechanical Vibrations	S. S. Rao,		Addison-Wesley Longman

		July 2025	NEP 1.0	Applicable for 2025-26
Chairman - BoS	Dean – Academics	Date of Release	Version	

SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23ME601P	Dynamics of Machines Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
1. Make students understand the concepts of dynamics of the machines, effect of dynamic forces involved in various machine components, unbalances in the system due to these forces causing vibration and vibration control techniques. 2. To introduce the learner with the dynamics of rotating and energy absorbing components like gyroscope, governors and flywheels.	**Student will be able to:** 1. Demonstrate the concept of gyroscopic effect through the working model. 2. Analyze the performance of mechanisms and perform dynamic force analysis of linkages and cams. 3. Demonstrate record and interpret data of vibration characteristics of mechanical vibratory systems. 4. Perform analysis of flywheels and Governor. 5. Identify the importance of safety, team work and effective communication for conduction of activity.

LIST OF EXPERIMENTS

Minimum 8 practical's to be performed

Exp. No.	Title of Experiment
1	Performance characteristics of Gyroscope.
2	Dynamic balancing of rotating masses.
3	Performance characteristics of Governor.
4	Performance of dynamic force analysis of four bar mechanisms/ slider cranks mechanism.
5	Determination of natural frequency of Free longitudinal vibration of single DoF system
6	Determination of natural frequency Torsional vibration of Single and Two rotor system.
7	Determination of radius of gyration using Torsional vibration of bifilar and trifilar pendulum.
8	Determination of Critical speed of shafts using FFT analyser.
9	Determination of logarithmic decrement using FFT analyser.
10	Performance on flywheel of an engine in IC engine laboratory./ virtual lab

Text Books

S.N	Title	Authors	Edition	Publisher
1	Theory of Machine	S. S. Rattan		Tata McGraw Hill
2	Theory of Machines	P L Ballaney		Khanna Publications
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SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23ME602T	Industrial Engineering	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
1. Learn and apply the fundamental concepts of productivity, work study, method study, and ergonomics to improve efficiency in industrial operations 2. Acquire knowledge of forecasting techniques, maintenance strategies, and quality control tools to support effective decision-making and performance improvement in manufacturing and service systems.	**Student will be able to:** 1. Analyze and improve industrial productivity by applying work study techniques. 2. Evaluate and optimize work performance by applying work measurement techniques and ergonomic principles to improve operator efficiency, workplace design, and man–machine systems. 3. Apply appropriate forecasting techniques to predict future trends and support effective decision-making. 4. Develop maintenance management strategy for industry. 5. Interpret Quality Management system and quality control tools for application in industry.

Unit I	**[9 Hrs]**
Work Study : Productivity- Concept and objectives of productivity. Types of productivity, factors affecting productivity. Tools and techniques to improve productivity, Measurement of productivity. Work study and methods study: Definitions, objectives, steps in method study, process charts, string diagram, motion study	
Unit II	**[9 Hrs]**
Work measurement: Objectives, definition, stop watch study, work sampling, PMTs, MTM. Ergonomics: Objectives, human factors in Engg. Man machine system, Display design, design controls. Principles of motion economy, MOST	
Unit III	**[9 Hrs]**
Forecasting: Need for forecasting, classification of forecasting methods, like judgmental technique, time series analysis, least square method, moving average method.	
Unit IV	**[9 Hrs]**
Maintenance: Objectives, Types of maintenance, preventive, predictive, break down maintenance, Reliability, Failure data analysis, MTBF, MTTR, Bath tub curve, series parallel system.	
Unit V	**[9 Hrs]**
Quality Control: Definition, function, objective, characteristics. Quality, quality of design quality of conformance, process control charts and process capability. Types of sampling concepts & significance. Acceptance sampling, OC curves, Statistical Quality Control: Quality assurance & quality Planning, Quality audit, Vendor quality rating, TQM, ISO series, BIS 14000. Six Sigma, 7 QC tools , Fish bone diagram	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Work Study	George Kanawaty	1992	International Labour Organisation
2.	Statistical Quality control	M.Mahajan	1999	Dhanpat Rai and Co.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Motion and Time study	R.M. Barnes	1991	John Wiley.

SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits		Evaluation		
						MSE	CA	ESE	Total
23ME603T(ii)	PE-III Sustainable Production System	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
1. To develop understanding of sustainable production systems, green manufacturing principles, and their role in addressing global environmental challenges. **2.** To enable students to analyze and apply green design, sustainable supply chain practices, and environmental regulations for improving industrial sustainability.	**Student will be able to:** 1. Explain the concepts of sustainability, sustainable production systems, and green manufacturing, including key challenges and global environmental issues. 2. Apply principles of green design such as design for recycling, disassembly, and energy/material conservation to minimize environmental impacts. 3. Analyze green supply chain management (GSCM) frameworks, including enablers, reverse logistics, and sustainability performance metrics. 4. Interpret international and national environmental regulations, treaties, and legislations and assess their impact on different industrial sectors. 5. Demonstrate understanding of green manufacturing technologies, 3R/6R approaches, and environmental management systems such as ISO 14001 for sustainable industrial development.

Unit I	**[9 Hrs]**
Introduction, Need & Challenges for Sustainable Production System, Global Environmental Issues Concept of sustainability, Factors governing sustainable development, Introduction of Green Manufacturing and Sustainable Manufacturing - Understand global business conditions, need for integrating sustainability in Production, Green Manufacturing Practices - Indian scenario	
Unit II	**[9 Hrs]**
Green Design: Environmental effects of design – Environmental damage – In efficient energy use ,Material flow and Material recycling – Emission less manufacturing, Design for recycling. Design for disassembly, Design for Energy and material conservation. Carbon footprint & carbon credits	
Unit III	**[9 Hrs]**
Green supply chain Management: - Need for Green Supply Chains, Implications of modern supply chain management,The supply chain strategy – Ingredients of green supply chain strategy. Reverse logistic,Evaluating the impact of GSCM activities on sustainability performance measurement. GSCM enablers, Challenges and issues in GSCM	
Unit IV	**[9 Hrs]**
International and National Green regulations, International Treaties, International and National Regulation on Environmental Sustainability and its Sectorial Impact, Evolution of Regulatory and Voluntary Programs: from End-of-Pipe to Pollution Prevention Environment legislations	
Unit V	**[9 Hrs]**
The Three R's (Reduce, Recycle and Reuse) in GM:& 6R's in SM ,GM Technologies and framework for sustainable development , Requirements, ISO 14001 , implementation, ,Environmental Management and Social Dimensions Revisiting complex issues	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	"Handbook of environmentally conscious manufacturing" :	Edited by: Christian N. Madu London		Kluwer Academic Publishers, 2001.
2.	Green Manufacturing for Sustainable Production: Green and sustainable manufacturing	Minhaj A. Rehman Rakesh Shrivastava		Greenleaf Pub., 2001.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	An Introduction to Alternative Energy Sources:	Ranky, P.G.		An interactive multimedia 3D eBook publication by CIMware USA, Inc. and CIMware Ltd., UK.
2.	"Greener manufacturing and operations: from design to delivery and back'	Joseph Sarkis		Greenleaf Pub., 2001.

		July 2025	NEP 1.0	Applicable for 2025-26
Chairman - BoS	Dean – Academics	Date of Release	Version	

SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23ME603T(iii)	PE – IV Design of Mechanical Power Transmission System	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
1. This course is aimed to make the students conversant with design principles and procedures for design and selection of mechanical power transmission components like belts, gears, chain, couplings and power screws. Also, students can correlate OEM catalogue of standard machine components.	**Student will be able to:** 1. Select and design flat belt and V-belt drive for given application. 2. Apply principles and procedures for design and selection of spur and helical gear drives. 3. Apply principles and procedures for design and selection of bevel gear drive and worm gear drive. 4. Analyze various forces on mechanical couplings, power screw and select suitable specifications for gear application

Unit I	**[9 Hrs]**
Design of Flat belt drive: Introduction to frictional drives, types of belts & belt material, analysis of belt tension, condition for transmitting maximum power, design of flat belt drive, flat belt pulley design. Design of V belt drive: Types of V-belt, analysis of V-belt tension, design and selection of V belt & pulley.	
Unit II	**[9 Hrs]**
Design of Spur gear drive: Terminologies of spur gear, forces on spur gear drive, Speed ratios and number of teeth, force analysis, tooth stresses, dynamic effects, fatigue strength, gear materials, design of spur gear drive based on strength and wear considerations, Gear blank design. Design of Helical gear drive: Terminologies of helical gear, formative number of teeth,forces on helical gear, design of helical gear drive based on strength and wear considerations, Gear blank design.	
Unit III	**[9 Hrs]**
Design of Bevel Gear Drive: Introduction and terminologies of bevel gear, types of bevel gear, force analysis of bevel gear drive, design of bevel gear drive. Design of Worm and Worm Gear: Introduction and terminologies of worm and worm gear drive, enveloping of worm gear drive,Thermal considerations, materials-forces and stresses, efficiency, design and calculations of various forces and stress in worm and worm gear drive.	
Unit IV	**[9 Hrs]**
Design of Roller chain drive: Introduction to chain drive, chain designation, chordal action, design and selection of chain dirve, design of sprocket. Design of Wire rope drive: Introduction to wire ropes, various phases of operation of wire rope, forces and stress calculations in each phase, determination of factor of safety in each phase, design of wire rope, sheave and drum.	
Unit V	**[9 Hrs]**
Design of Coupling: Types and classification of shaft coupling, forces and stresses on parts of coupling, design of rigid flange coupling, design of flexible bush-pin coupling. Design of Power Screws: Introduction, Forms of thread, torque for lifting and lowering load, self-locking screw, efficiency, collar friction, design of screw and nut.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Design of Machine Elements	V. B. Bhandari.,		McGraw Hill education.
2.	Machine Design	P.H. Black.		TMH.
3.	Mechanical Engg. Design,	Shigley		TMH.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Design Data Book	B.D. Shiwalkar		Central Techno publications

		July 2025	NEP 1.0	Applicable for 2025-26
Chairman - BoS	Dean – Academics	Date of Release	Version	

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B. Tech. Scheme of Examination & Syllabus 2023-24

MECHANICAL ENGINEERING

SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23ME604T(iii)	PE – IV Machine Fault Diagnosis	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
1. Understand the basics of Condition Monitoring Techniques (CBM) which would give insight into machine fault finding in mechanical components. 2. Select appropriate instrumentation for CBM. 3. Analyzed signals sensed by the instrumentation by using appropriate signal processing techniques. 4. Explore the research prospect in the area of CBM.	**Student will able to:** 1. Select appropriate maintenance strategy for machine condition monitoring. 2. Identify and distinguish between the types of machinery failure 3. Develop data acquisition system for machine fault diagnosis. 4. Select appropriate signal processing technique to detect machine fault. 5. Analyse signal for determination of presence of fault, location of fault, level of fault severity and remaining useful life of component.

Unit I	**[9 Hrs]**
Maintenance Strategies: Basic maintenance strategies, maintenance concepts, factors which influence the maintenance strategy, periodic monitoring, continuous monitoring, condition monitoring techniques for fault detection, concept of machine condition based monitoring (CBM), CBM techniques, and effectiveness of CBM across all types of faults.	
Unit II	**[9 Hrs]**
Introduction to machine failures: Machinery failure and types of faults, equipment life cycle, bath tub curve, causes of failure, ways of preventing equipment failure, , frequency of failure, various failure mechanisms.	
Unit III	**[9 Hrs]**
Design of measurement system in CBM: Sensors & transducers, displacement sensor, velocity pickup, accelerometer, piezo-sensor, acoustic sensors, different sensors in measurement for machine fault detection, selection of sensors (frequency), accuracy, static and dynamic characteristics of sensor, Data Acquisition, single channel & multi-channel DAQ system, Signal Conditioning and its functions, sampling rate, selection of sampling rate, sampling errors, Nyquist theorem of sampling, Signal Processing,	
Unit IV	**[9 Hrs]**
Signal Analysis: Basics of signal, classification of signals, Signal generation from various failures (characterization), Signal Processing Techniques, Selection of Signal Processing Techniques to detect machine failure, signal analysis in time domain, time domain statistical parameters, signal analysis in frequency domain, Fast Fourier Transform (FFT), wavelet transform, time-frequency analysis, signal analysis softwares.	
Unit V	**[9 Hrs]**
Fault Detection: Machine faults and their severity, Bend pulley failure analysis, rotor imbalance detection, bearing terminology, shaft misalignment detection Bearing Fault, bearing characteristic frequency calculations, gear terminology, Gear Fault, gear mesh frequency calculations Balancing Defects, Shaft Misalignment, bent shaft, looseness, soft foot. Remaining useful life of a component.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Introduction to Machinery Analysis and Monitoring	John S. Mitchell	1993	Penn Well Books
2.	Maintenance Engineering and Management	R. C. Mishra, K. Pathak	2002	Prentice Hall of India Pvt. Ltd.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Machinery Condition Monitoring Principles and Practices	Dr. Amiya R. Mohanty	2014	CRC Press
2.	Vibration-Based Condition Monitoring – Industrial, Aerospace and Automotive applications	Robert Bond Randall	2011	John Wiley & Sons Ltd

		July 2025	NEP 1.0	Applicable for 2025-26
Chairman - BoS	Dean – Academics	Date of Release	Version	

SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23ME604T(ii)	PE – IV Advances in Project and Quality Management	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
1. To develop an understanding towards a structured approach for Project Management of Industrial projects and Quality Management practices in industry	**Student will be able to:** 1. Apply structured approach based on project management concepts for project lifecycle management 2. Conduct feasibility analysis of project for identification of growth potential of project 3. Estimate project costs and Project budgeting 4. Analyse quality problems in business and apply relevant tools and techniques of quality improvement 5. Assess the various philosophies, theoretical frameworks and practices of quality in implementing quality management

Unit I	**[9 Hrs]**
Project Management Definition, Characteristics of Project ,Performance Parameters: Time, Cost & Quality,Classification of Projects: Sector based, Investment based, Technology based, Cause based, Project Life Cycle Phases – Concept/Initiation Phase: Parameters Involved in Project Identification. Sources of New Project Ideas	
Unit II	**[9 Hrs]**
Project Conceptualization & Feasibility Analysis, Project Definition Phase: Project Formulation & Feasibility. Preparation of Project Feasibility Report & Specification; Aspects of Project Feasibility Managerial/Organization: Promoters Background, Criteria of Evaluation, Marketing/Commercial: Demand & Supply, Competition, Market Survey, Porter's 5 Forces	
Unit III	**[9 Hrs]**
Planning & Organization Phase: Project Planning, Scheduling & Monitoring, Statement of Works, Project Specifications, Work Breakdown Structure, Project Cost Estimation: Need, Causes of Cost & Time Overruns. Types of Project Cost Estimates, Cost of Project, Means of Finance, Project Budgeting & Control	
Unit IV	**[9 Hrs]**
Principles of Quality Management, Pioneers of TQM, Quality costs, Quality system Customer Orientation, Benchmarking, The seven tools of quality, Process Capability, Six Sigma.	
Unit V	**[9 Hrs]**
Just in time manufacturing, KAIZEN, POKA -YOKE, Kanban system, Quality Circles, Cost of quality	

Text Books

S. N	Title	Authors	Edition	Publisher
1.	Project Management	S. Choudary	Sixth	Tata McGraw Hill
2.	Project Management & Control	Narendra Singh	2017	Himalaya Publishing House
3.	Total Quality Management for Engineers	Mohamed Zairi	1991	Woodhead Publishing Limited 1991

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Project Management	Maylor H.	2009	Pearson Education Asia, New Delhi
2.	Project Management	Pardeep Pai	2019	Pearson Education Asia, New Delhi

		July 2025	NEP 1.0	Applicable for 2025-26
Chairman - BoS	Dean – Academics	Date of Release	Version	

SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits		Evaluation		
						MSE	CA	ESE	Total
23AS601T	Economics & Management	2	-	-	2	7.5	7.5	35	50

Course Objectives	Course Outcomes
1. To enable students to apply economic principles for business decisions and assess the impact of macro-economic factors on the economy. 2. To enable students to analyze and integrate the core functions of management, marketing, finance and human resource management for effective business decision making.	**Student will be able to:** 1. Apply economic principles for business decisions by understanding production cost relationships 2. Assess impact of macroeconomics and government policies on business and economy. 3. Recognize key management, marketing, financial and HRM functions and their role in effective business decision-making

Unit I	**[10Hrs]**
Economics, Classification of economics, Industrial economics, Consumer demand, Law of Demand, Determinants of demand, Demand forecasting, Law of supply, Types of Elasticity of demand, Concept of Production, Factors of Production, types of cost, cost curves,	
Unit II	**[10Hrs]**
Market Structures-Perfect competition, Monopoly and Monopolistic competition, Functions of central bank, Inflation, Deflation, Recession, National income, GDP, GNP, Liberalization, Privatization and Globalization	
Unit III	**[10Hrs]**
Definition of management, functions of management, Functions of human resources Management, Marketing Management, Functions of Marketing Management. Methods of pricing, advertising and sales promotion. Financial Management, functions of financial management, Sources of finance.	

Text Books

S. N	Title	Authors	Edition	Publisher
1.	Managerial Economics	D.N. Dwivedi	8th	Vikas Publishing
2.	Modern Economic Theory	K.K. Dewett	2005	S. Chand Publisher
3.	Industrial Management	Dr.I.K. Chopde, Dr.A.M. Sheikh	Revised edition	S. Chand Publisher

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Industrial Organization and Industrial economics	T.R. Banga, S.C. Sharma	2006	Khanna Publishers
2.	Industrial Economics & Entrepreneurship Development	A.M.Shiekh	2015	S Chand & Co Ltd.

SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23ME605P	Project - I	-	-	4	2	50	-	50

Course Objectives	Course Outcomes
1. To introduce the types of projects and make the learner familiar with the project methodology. 2. To explain the process of literature review and enable students to write problem statements and set objectives to achieve solution of the problem. 3. To enable students to develop the skill of effective oral and writing communication, collaborative and team work.	**Student will be able to:** 1. Develop self-learning ability by searching and organizing information and literature related to project work. 2. Exhibit the skill to communicate effectively in both written and oral form. 3. Acquire collaborative skill and interpersonal relationship by working in a group.

Module 1 : Introduction to Project its Planning and management
- Introduction to types of academic projects
- Overview of project management principles
- Project scope, objectives and constraints
- Work break down structure
- Project scheduling

Module 2 : Literature Review
- Introduction to types of literature and their sources
- Literature management
- Methodology to Conduct a thorough literature review related to the chosen project area
- Identify existing solutions and research gaps
- Compiling findings of literature review

Module 3: Problem Definition and Objective Setting
- Clearly define the project problem and objectives
- Set measurable goals for the project

Module 4: Conceptual Design / research area /
- Preliminary Design
- Generate initial design concepts
- Select the most viable design based on evaluation criteria

Module 5: Oral communication & Technical writing
- Effective oral presentation to convey findings of preliminary project work
- Writing initial part of project thesis

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Research Methodology: Methods and Techniques	Kothari C..R.	2nd Revised Edition, 2004	New Age International Pvt Ltd
2	Design and Analysis of Experiments	Douglas C. Montgomery	9th Edition , 2017	John Wiley & Sons

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Research Methodology: A Step-by-Step Guide for Beginners	Ranjit Kumar	5th Edition , 2022	SAGE Publications
2.	Statistics for Experimenters: Design, Innovation, and Discovery	Paul D. Berger	2nd Edition ,2016	CRC Press

		July 2025	NEP 1.0	Applicable for 2025-26
Chairman - BoS	Dean – Academics	Date of Release	Version	

SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23ME641P	Career Development – VI	-	-	2	1	50	-	50

Course Objectives	Course Outcomes
1. This course is aimed to make the students conversant with the preparation needed for placement in core and IT industry. The designed course will make students to understand the short cut tricks and techniques of problem solving in quantitative ability.	**Student will be able to:** 1. To apply concepts of permutation and combination along with probability for solving numerical. 2. To construct venn diagram for word problems and answer the questions based on it. 3. To analyze and solve questions logical thinking. 4. To apply theorems and formula of plane and solid geometry in solving quantitative ability questions on related topics. 5. To analyze and solve questions on data interpretation and non-verbal reasoning.

Unit I	**[6 Hrs]**
Introduction to permutation and combination, formulating the question of permutation and combination, problems on finding probability of an event.	
Unit II	**[6 Hrs]**
Introduction to venn diagram. Formulation of 2 circle and 3 circle venn diagram problems.	
Unit III	**[6 Hrs]**
Problems on logical thinking (Syllogyms). Statement and conclusion, statement and argument, cause and effect. Problems on truth tables.	
Unit IV	**[6 Hrs]**
Problems on geometry and mensuration. Plane geometry problems on triangle, quadrilateral and circle. Solid geometry problems on cube, cuboid, prisms, pyramids, cone and sphere.	
Unit V	**[6 Hrs]**
Introduction to data interpretation, problems on tabular data, bar chart, pie chart and line graph. Non-verbal reasoning questions.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Quantitative Aptitude	R.S.Agrawal		S.Chand and Company Pvt. Ltd
2.	Quantitative Aptitude	Shripad Deo		Allied Publishers Pvt. Ltd
3.	Quantitative Aptitude	Dinesh Khattar		Pearson Publishing House

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Quantitative Aptitude for CAT	Arun Sharma		McGraw Hill Education

SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits		Evaluation		
						MSE	CA	ESE	Total
23ME661O	OE – III Renewable Energy Resources	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
1. To develop a fundamental understanding of various renewable and non-conventional energy sources, including their characteristics, potential, and global relevance. 2. To familiarize students with technologies and engineering principles involved in the utilization of solar, wind, biomass, geothermal, ocean, and advanced renewable systems. 3. To create awareness of environmental, operational, and sustainability aspects associated with renewable energy technologies and their role in future energy systems.	**Student will be able to:** 1. Explain the, measurement techniques of solar radiation and basic principles, and characteristics of solar energy systems. 2. Compare and analyse different types of solar collectors and evaluate their suitability for various thermal and photovoltaic applications. 3. Describe and examine biomass and biogas energy systems, including their generation processes and applications. 4. Describe the working principles of wind, tidal, and ocean thermal energy technologies. 5. Explain and evaluate geothermal energy systems and Magneto Hydro Dynamic (MHD) power generation with respect to classification, operation, and environmental impacts.

Unit I	**[9 Hrs]**
Solar Energy: Introduction, solar constant, spectral distribution of solar radiation, beam & diffuse radiation, solar radiation measuring instruments. Solar radiation geometry and solar angles. Solar flat plate collectors: Types of collectors, liquid flat plate collectors, solar air heaters, collector efficiency, novel designs of collector.	
Unit II	**[9 Hrs]**
Concentric collectors: line focusing, point focusing and non-focusing type, central receiver concept of power generations, compound parabolic collector, and comparison of flat & concentric collectors. Applications of solar energy to water heating, space heating, space cooling, drying, refrigeration, distillation, pumping. Solar furnaces, solar cookers, solar thermal electric conversion, solar photo-voltaic.	
Unit III	**[9 Hrs]**
Biogas: - Introduction, bio gas generation, fixed dome & floating drum biogas plants, their constructional details, raw material for biogas production, fuel properties of biogas and utilization of biogas. Biomass: Introduction, methods of obtaining energy from biomass, Incineration, thermal gasification, classification of gasifiers & constructional details, applications of gasifiers.	
Unit IV	**[9 Hrs]**
Wind and Ocean energy: Power in wind, forces on blades. Basic principle of wind energy conversion, site selection consideration, wind data and energy estimation. Basic components of WECS, classification of WEC systems. Ocean energy: Introduction, ocean thermal electric conversion, open and closed cycle of OTEC, energy from tides, basic principles of tidal power & components of tidal power plants.	
Unit V	**[9 Hrs]**
Geothermal energy: Introduction, classification of geothermal systems, vapour dominated & liquid dominated system and petrol-thermal systems, applications of geothermal energy, operational & environmental problems. Magneto Hydro Dynamic power generation: Introduction, principles of MHD power generation, MHD open and closed systems, their comparative study.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Renewable Energy Resources: Basic Principle and Applications	G.N.Tiwari, M.K. Ghosal	1 August 2004	Narosa publication
2.	Non-Conventional Energy Sources	G .D . Rai	1 January 1988	Khanna publishers

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Non-Conventional Energy Resources	B.H.Khan	3RD edition	Tata Mc-Graw Hill
2.	Renewable Energy Sources and Emerging Tech	. D. P. Kothari	1 January 2011	Prentice Hall India

		July 2025	NEP 1.0	Applicable for 2025-26
Chairman - BoS	Dean – Academics	Date of Release	Version	

SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23ME631M	MDM – IV Vehicle Engineering	3	-	-	1	15	15	70	100

Course Objectives	Course Outcomes
1. To impart foundational knowledge of automobile body types, constructional features, and design considerations. 2. To develop understanding of vehicle transmission, braking, steering, and suspension systems and their functional principles. 3. To introduce modern vehicle technologies, including hybrid, electric, and fuel-cell vehicles. 4. To provide awareness of automotive safety standards and pollution control norms governing vehicle design and performance in India.	**Student will be able to:** 1. Classify and describe different car body types and constructional methods. 2. Explain the working principles of transmission, clutch, gearbox, axles, and driveline components. 3. Analyze and compare braking, steering, and suspension systems and their role in vehicle performance and safety. 4. Identify and interpret the architectures and operating principles of EVs, HEVs, PHEVs, and FCVs. 5. Interpret and apply Indian safety regulations, emission standards (BS norms), and vehicle noise limits relevant to automotive engineering.

Unit I: Car Body Details	**[9Hrs]**
Classification of car bodies: Saloon, Convertibles, Limousine, Estate van, Racing and Sports cars. Constructional details: Frame construction, Double-skin construction, Metal sections used, Regulatory considerations, Conventional vs. Integral construction	
Unit II: Transmission system	**[9Hrs]**
Clutch, Necessity, requirements of a clutch system. Types of Clutches, Gear Box: Necessity of transmission, principle, types of transmission, lubrication and control. Torque converter, semiautomatic and automatic transmission. Propeller shaft, drives, differential and axles.	
Unit III: Brakes, Steering systems & Suspension systems	**[9Hrs]**
Brakes: Need & types, mechanical, hydraulic & pneumatic brakes, electrical brakes, drum and disc brakes. Steering systems: principle of steering, center point steering, steering linkages, steering geometry and wheel alignment, power steering. Suspension systems: Function of spring and shock absorber, conventional and independent suspension system, Telescopic shock absorber, linked suspension systems.	
Unit IV: Electric Vehicles and New Age Vehicles	**[9Hrs]**
HEV Fundamentals: Vehicle Basics, Vehicle speed, EV powertrain, Hybridization of the Automobile: Basics of EV, Basics of the HEV, Basics of Plug-In Hybrid Electric Vehicle (PHEV) and Vehicle Architecture: Series Hybrid Vehicle, Parallel Hybrid Vehicle, Basics of Fuel Cell Vehicles (FCVs)	
Unit V: Safety And Pollution Norms	**[9Hrs]**
Indian Vehicle safety regulations and Components: BIS, Crash testing basics and NCAP rating criteria, Bharat Stage (BS-IV to BS-VI) emission norms, Noise pollution limits and vehicle noise testing.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Automobile chassis and body engineering	K.V. Fadadu, B.H. Kadiya	1st	Books India publications
2.	Vehicle Body Engineering	J. Pawlowski, G.H. Tidbury	1st	Century

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Handbook of Automotive Body and Systems Design	John Fenton	1st	Wiley
2.	Automotive engineering: lightweight functional and novel materials	Brian Cantor, P. Grant, C. Johnston	1st	Taylor & Francis