



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

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

MECHANICAL ENGINEERING

V Semester

Sr No	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continual Assessment	End Sem Examination	Total
1	ME501T	Heat Transfer	3	-	-	3	30	70	100
2	ME501P	Heat Transfer Lab	-	-	2	1	25	25	50
3	ME502T	Energy Conversion-I	3	-	-	3	30	70	100
4	ME503T	Design of Machine Elements	3	-	-	3	30	70	100
5	ME503P	Design of Machine Elements Lab	-	-	2	1	25	25	50
1	ME504T	Operation Research & Industrial Engineering	3	-	-	3	30	70	100
6	ME505T	Professional Elective - I	3	-	-	3	30	70	100
7	ME506T	Open Elective - I	3	-	-	3	30	70	100
8	H 104	Foundational Humanities Elective	2	-	-	-	Audit		
9	AS502T	English for Engineers	2	-	-	2	15	35	50
10	ME507P	Technical Skill Development II**	-	-	2	1	50	-	50
11	ME508P	Career Development - III*	2	-	-	0	Audit		
Total			24	-	6	23	295	505	800

* Career Development (Interpersonal Skills, Aptitude and logical thinking)

** Technical Skill Development – Desirable to have industry skill enhancement

ME506T	Open Elective - I	H 104	Foundational Humanities Elective
ME506T	Automobile Engineering	H-103	Development of Societies
		H-104	Philosophy

ME505T	Professional Elective - I
ME505T(i)	Refrigeration and Air Conditioning
ME505T(ii)	Production and Operation Management
ME505T(iii)	Design Thinking
ME505T(iv)	Finance for Professionals

		June 2023	1.1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

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

MECHANICAL ENGINEERING

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ME501T	Heat Transfer	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> To compare the different modes of heat transfer and governing laws. To enable students to distinguish between steady and unsteady state heat transfer and their applications. To enable students to calculate heat transfer rate for steady & unsteady state heat transfer processes. To enable students to calculate heat transfer rate from different geometry under free and forced convection and radiation mode. To design and evaluate the heat exchanger performance. 	<ul style="list-style-type: none"> Explain the modes and governing laws of heat transfer and formulate analytical models to solve one dimensional steady state heat conduction problems for wall, cylindrical and spherical geometries. Estimate heat transfer rate for one dimensional steady state heat conduction from fins and unsteady state heat transfer process. Select appropriate non dimensional numbers & empirical correlations to estimate forced and free convection heat transfer, for internal and external flows. Explain governing laws of radiation and estimate heat transfer rate by radiation from ideal and real bodies. Evaluate heat exchanger performance by LMTD and NTU methods and design suitable heat exchanger geometry to deliver a desired heat transfer rate.

Unit I	[7Hrs]
Introduction to basic modes of heat transfer. Laws of heat transfer & conservation of energy. Introduction of general heat conduction equation in cartesian, cylindrical and spherical coordinates (No derivation). One dimensional steady state heat conduction equation for the plane wall, cylinder and sphere, overall heat transfer coefficient. Thermal resistance of composite structure, contact resistance, Critical thickness of insulation.	
Unit II	[7Hrs]
Extended surface, types of fins. Fins of uniform cross section area, Governing differential equation for fin. Temperature distribution and heat transfer rate under various geometrical & thermal boundary conditions (Analysis not needed), fin efficiency & effectiveness. Unsteady state heat transfer, lumped heat capacity analysis (Analysis not needed), Biot Number, Fourier's Number & its significance.	
Unit III	[8Hrs]
Forced convection, physical significance of non-dimensional parameter. Concept of thermal boundary layer thickness, local and average heat transfer coefficient. Empirical co-relations for external flow over flat plate and internal flows through pipe and non circular section, laminar & turbulent flow . Free or natural convection. Grashoff's number, Rayleigh number, flow over horizontal and vertical plate.	
Unit IV	[7Hrs]
Radiation, spectrum of radiation, black body radiation, radiation intensity, laws of radiation-Kirchhoff, Planck's, Wien's displacement law, Stefan Boltzmann. Emissivity, Absorptivity, Transmissivity, Reflectivity, Radiosity, Emissive power, Irradiation. Radiation exchange between parallel plate , shape factor for simple geometry & its laws, Radiation shields between parallel plates.	
Unit V	[7Hrs]
Heat exchanger: Classification, overall heat transfer coefficient, fouling factor, LMTD & effectiveness, NTU method of heat exchanger analysis for parallel, counter flow & cross flow arrangement, design aspect of heat exchangers, Introduction to compact heat exchanger.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Fundamentals of Heat & Mass Transfer	Incropera, F.P., Dewitt, D. P		John Wiley & Sons
2.	Engineering Heat and Mass Transfer	M.M. Rathor		Laxmi Publications Pvt. Ltd,

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Heat Transfer - A Practical Approach	Yunus A. Cengel,		Tata McGraw Hill Pub Co. Ltd.
2,	Heat Transfer,	J.P. Holman		McGraw Hill Book Co., New York.

		August 2023	1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

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

MECHANICAL ENGINEERING

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ME501P	Heat Transfer Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> To enable students to verify modes of heat transfer and governing laws by conducting experiments. To enable students to determine thermal conductivity of solid (metal /nonmetal) ,powdery substance and liquid. To enable students to determine convective heat transfer coefficient, overall heat transfer coefficient emissivity, Stefan Boltzmann constant, heat transfer rate and critical heat flux. 	<ul style="list-style-type: none"> Examine the effect of various parameters on heat transfer rate and verify the governing laws of modes of heat transfer. Experiment with steady and unsteady state to estimate thermal conductivity, thermal resistance and heat transfer rate for solid (metal & nonmetal), powdery substance and liquid. Determine the fin effectiveness and convective heat transfer coefficient for cylindrical and pipe surfaces under forced and free convection. Determine Stefan Boltzman constant and emissivity of solid surfaces and compare with theoretical value. Evaluate the effectiveness and heat transfer rate in parallel and counter flow heat exchanger and for heat pipe Evaluate heat transfer coefficient and rate in film wise and dropwise condensation and critical heat flux in boiling.

Minimum 8 experiments to be performed

Expt. No.	Title of the experiment
1	To determine the thermal conductivity of composite wall.
2	Determination of thermal conductivity of metal bar.
3	Determination of heat transfer coefficient in natural convection for vertical tube.
4	To determine heat transfer coefficient in forced convection for fluid flowing through a closed conduit.
5	Determination of Stefan Boltzmann constant.
6	Determination of emissivity of non-black body.
7	Determination of critical heat flux.
8	Determination of heat transfer rate in unsteady state.
9	Determination of temperature distribution & heat transfer rate from fin under free and forced convection.
10	To determine the effectiveness of a concentric tube heat exchanger , plate heat exchanger and heat pipe.
11	Determination of heat transfer coefficient in film wise & drop wise condensation. (Experiment beyond syllabus)
12	3-4 virtual lab experiments .(http://vlab.amrita.edu/?pg=bindex&bsub=login_page)

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Fundamentals of Heat & Mass Transfer	Incropera, F.P., Dewitt, D. P		John Wiley & Sons
2.	Engineering Heat and Mass Transfer	M.M. Rathor		Laxmi Publications Pvt. Ltd

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Heat Transfer - A Practical Approach	Yunus A. Cengel,		Tata McGraw Hill Pub Co. Ltd.
2	Heat Transfer,	J.P. Holman		McGraw Hill Book Co., New York.

		August 2023	1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

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

MECHANICAL ENGINEERING

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ME502T	Energy Conversion-I	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
<ul style="list-style-type: none">To impart knowledge of various components of the thermal power plant like boiler, nozzles, turbines, condensers and to assess the performance of above components.To familiarize students with fluidized bed boilers and their calculation.Analyze performance of steam turbine using graphical and analytical method.Identify the components of gas turbines, application of gas turbines	<ol style="list-style-type: none">Identify the components of thermal power plant; classify boilers, working of boilers, mounting, and accessories. Analyze the performance of boiler.Gain knowledge about fluidized bed boilers and their calculation. Identify the need, principle, applications of co-generation and distinguish between topping and bottoming cycle. Waste heat recovery systems.Analyze performance of steam turbine using graphical and analytical method. Categorize steam condenser, cooling tower, explain its working, applications and calculations of steam condenser performance.Identify the components of gas turbines, application of gas turbines and to analyze the performance of gas turbine.

Unit I	[8Hrs]
Principle of Steam Generation, Classification of Steam Generators, Fire Tube and Water Tube Steam Generators, Boiler Mountings and Accessories. Draught and Its Classification, Chimney Height, Chimney Diameter, Chimney Efficiency, Condition for Maximum Discharge. Performance of Steam Generators: Evaporation Capacity, Equivalent Evaporation, Boiler Efficiency.	
Unit II	[8Hrs]
Fluidized Bed Boilers: Bubbling, Circulating type (Elementary Treatment Expected). Fuel for Steam Generators. Co-generation: Introduction to co-generation, need, working principle and applications. Topping cycle and bottoming cycle. (Elementary Treatment Expected). Waste heat recovery systems: sources of waste heat, heat recovery for industrial applications.	
Unit III	[7Hrs]
Steam nozzles: Adiabatic expansion in nozzles, maximum discharge, critical pressure ratio and effects of friction, calculation of throat and exit areas, supersaturated flow, Wilson Line. Steam turbines: Working principle of steam turbines, classification of steam turbines, comparison of impulse and reaction turbines, compounding of steam turbines, governing of turbines.	
Unit IV	[7Hrs]
Analysis of steam turbines: Velocity diagrams, graphical and analytical methods, work, done, thrust and power, steam turbine efficiency, condition for maximum efficiency. Steam condensers: types of condensers, classification of condensers, quality and quantity of cooling water required, performance of surface condenser, Dalton's law of partial pressure, sources of air leakages and air removal, air ejectors. Cooling towers: wet cooling towers, dry cooling towers, cooling ponds.	
Unit V	[7Hrs]
Gas Turbines: Brayton cycle, open cycle & closed cycle gas turbine, application of gas turbines, isentropic efficiency, small stage efficiency, pressure losses, effect of inter-cooling, reheat and regeneration, fuel-air ratio, combustion efficiency, performance analysis of gas turbine.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Thermal Engineering	R. K. Rajput		Laxmi publications
2.	Thermal Engineering,	Mahesh M. Rathore		Tata McGraw-Hill Education

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	A Course in Power Plant Engineering	C.P. Arora & V.M. Domkundwar		Dhanpat Rai & Sons
2.	Thermal Engineering	Mathur & Mehta		Jain Brothers Publications

		August 2023	1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	

**FIFTH SEMESTER**

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ME503T	Design of Machine Elements	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
The primary objective of this course is to make students well conversant with generalized design and selection process of various standard machine components and mechanical power transmission drives.	<ul style="list-style-type: none">■ Describe general process of design of machine elements, design considerations and classifications. And able apply basic theory and principals of product design and development■ To design shaft and suggest suitable bearing for given loading condition.■ Design and select flexible power transmission elements (belts, chain and drives.). Design and analyze performance of plate clutches.■ Use principles and procedures for design and selection of various types of gear drives■ Analyze forces and stresses on structural welded and riveted joints, And suggest suitable specifications of flange coupling.

Unit I	[5Hrs]
Introduction to Mechanical Engineering Design: General design process, Classification of machine design, Design considerations, Material selection, Material classification and standard designation in various systems. Introduction to Product Design & Development: Importance of product design, types of design, product definition, product specification, Phases of product development	
Unit II	[9Hrs]
Design of shaft: Design of shaft subjected to torsional, bending load, ASME code for shaft design. Design of bearings: Introduction to hydrodynamic and hydrostatic bearings, Classification of antifriction bearings, selection of ball bearings.	
Unit III	[9Hrs]
Introduction to frictional Drives(Belt and Clutch), Design of V-Belt and roller chain drives. design of single and multi-plate clutch.	
Unit IV	[9Hrs]
Design of spur, and worm-worm gear drives.	
Unit V	[8Hrs]
Design of welded, riveted joints subjected to axial and eccentric loading. Design of flange couplings.	

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.
4.	Design Data book	B.D. Shiwalkar		Central Techno publications

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Hand book of Machine Design	Shigley & Mischke		McGraw Hill education.
2.	Mechanical Engineering Hand book Vol 1 & 2,	Kent, John		Willey & Sons.
3	Design of Machine Elements,	B.D. Shiwalkar		Central Techno publications

		August 2023	1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	

**FIFTH SEMESTER**

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ME503P	Design of Machine Elements Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
The primary objective of this course is to make students well conversant to solve, suggest solution for real life problems related to design of mechanical components and elements of power transmission system.	<ul style="list-style-type: none">☐ Evaluate forces and stresses acting on various components of mechanical power transmission system.☐ Suggest suitable design specification of standard machine component. Interpret OEM catalogue of Standard machine component.☐ To work in team to solve real life problem related to mechanical power transmission system used in machines and mechanisms.

Minimum 8 experiments to be performed

Expt. No.	Title of the Practicals
1	Design of Shaft for given mechanical system.
2	Design and Selection of bearing for shaft design in experiment no. 1.
3	Design of belt drive(Flat/Belt)
4	Design and selection of spur gear drive.
5	Design and selection of helical gear drive.
6	Design and selection of Worm gear gear drive.
7	Design of Clutch
8	Analysis of brakes
9	System Design:- To design real life mechanical power transmission comprising of minimum 4 components.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Design Data book	B.D. Shiwalkar		Central Techno publications
2.	Hand book of Machine Design	Shigley & Mischke		McGraw Hill education.
3	Design of Machine Elements	Sharma & Purohit		PHI.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Design Data Hand Book	Mahadevan		CBS publishers
2.	Machine Tool Design Data Book			CMTI
3	Hand book of Machine Design	Shigley & Mischke		McGraw Hill education.
4	Mechanical Engineering Hand book ,	Kent, John	Vol 1 & 2	Wiley & Sons.

		August 2023	1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

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

MECHANICAL ENGINEERING

ARISE & SHINE

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ME504T	Operation Research and Industrial Engineering	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> To develop mathematical models to identify one or more "optimal" solutions for industrial problems. Application of methods of Industrial engineering for method modification and improvement of productivity and use of various quality concepts 	<ul style="list-style-type: none"> Apply quantitative approach to problem solving in real life industrial situations Apply project management and allocation model for time and cost optimization. Plan application of work study and ergonomics principles for productivity improvement in industry Develop demand analysis model and maintenance management strategy for industry. Interpret Quality Management system and quality control tools for application in industry

Unit I [8Hrs]

Introduction to Operation research, characteristics, phases & methodology of O.R., Linear Programming: -Introduction, Linear programming problem formulation, LPP solution by Graphical Method, Simplex Method, Big M method

Unit II [8Hrs]

Project Management, Network analysis, CPM, PERT, Concept of Crashing. Assignment Model –Introduction, Variants of Assignment Problems.

Unit III [8Hrs]

Productivity, Types of productivity, factors affecting productivity. Work study and methods study: Definitions, objectives, steps in method study, process chart, Work measurement: Objectives, definition, stop watch study, work sampling, PMTs, Introduction of MOST, Ergonomics, Principles of motion economy, Occupational health and safety.

Unit IV [8Hrs]

Forecasting: Need for forecasting, Qualitative methods of forecasting, time series analysis, least square method, moving average method, Maintenance: Objectives, Types of maintenance, preventive, predictive, break down maintenance.

Unit V [8Hrs]

Quality, quality of design, quality of conformance, Quality Control: Definition, function, objective, characteristics., process control charts, Quality cost, Acceptance sampling, OC curves, sampling plans, Quality assurance & quality Planning, Quality audit, ISO series of standards, BIS 14000. , Quality Circle, Just in Time (JIT), Kaizen, Poka Yoke. Quality circles, Six sigma

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Operation Research	D.S. Hira & P. Gupta,	1995	S. Chand
2.	Work Study	George Kanawaty	1992	International Labour Organisation
3.	Statistical Quality control	M.Mahajan	1999	Dhanpat Rai and Co.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Operation Research	J. K. Sharma,	2009	Macmilan Publishers
2.	Motion & Time study	R.M. Barnes	1991	John Wiley.

		August 2023	1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	



FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ME505T(i)	Professional Elective - I : Refrigeration and Airconditioning	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none">To introduce the basic concept of refrigeration and air conditioning and to further carry out their engineering analysis.To make student aware of the conventional and new refrigeration systems, cryogenics, air conditioning with psychrometric, heat load calculations, design of air conditioning system & transmission and distribution of conditioned air.To enhance students knowledge about environmental impact of refrigerants and alternative refrigerants.	<ul style="list-style-type: none">Describe the working principle, constructional details of different components and their controls for conventional and new refrigeration systems and to select the appropriate refrigerant in the light of contemporary issues of ozone depletion and global warming.Design and analyze refrigeration systems using basic principles of thermodynamics and the refrigerant property charts.Apply the basic principles of psychrometry and fluid mechanics for achieving thermal comfort to ensure better health and work productivity.Design and analyze air-conditioning systems using the basic principles of thermodynamics, psychrometry and fluid mechanics.

Unit I	[7Hrs]
Air cycle refrigeration: The Reversed Carnot Cycle, Gas as a Refrigerant in Reversed Carnot Cycle, Limitations of Reversed Carnot Cycle, Reversed Brayton or Joule or Bell-Coleman Cycle, Application to Aircraft Refrigeration	
Unit II	[9Hrs]
Vapour Compression System: Modifications in Reversed Carnot Cycle with Vapour as a Refrigerant, Vapour Compression Cycle, Vapour Compression System Calculations, Standard Rating Cycle and Effect of Operating Conditions, Actual Vapour Compression Cycle	
Refrigerants: Properties, classification, nomenclature, its global warming & ozone depletion potential, alternate refrigerants.	
Unit III	[8Hrs]
Multipressure Systems:- Introduction, Multistage or Compound Compression, Multi-Evaporator Systems	
Other refrigeration systems: Vapour-Absorption System, vortex tube, thermoelectric refrigeration	
Unit IV	[9Hrs]
Properties of Moist Air:- Psychrometric Properties, DBT, WBT, DPT, Thermodynamic WBT, Psychrometric Chart	
Psychrometry of Air-Conditioning Processes: Mixing Process, Basic Processes in Conditioning of Air, Psychrometric Processes in Air-Conditioning Equipment, Simple Air-Conditioning System, Summer Air Conditioning-apparatus Dew Point, Winter Air Conditioning	
Unit V	[7Hrs]
Transmission and Distribution of Air - Room Air Distribution, Total, Static and Velocity Pressures, Friction Loss in Ducts, Dynamic Losses in Ducts, Air Flow through a Simple Duct System, Air-duct Design, Processing, Transmission and Distribution of Air in Clean Rooms, Air Locks, Air Curtains and Air Showers	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Refrigeration and Airconditioning	C.P. Arora	3 rd Edition, 2017	Tata McGraw Hill,
2.	A text book of Refrigeration and Air Conditioning	Khurmi R.S., Gupta, J. K	2006	Eurasia Publishing housing (P) Ltd, New Delhi

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	A course in Refrigeration and Air conditioning	Arora, S. C., Domkundwar, S	2018	Dhanpat Rai (P) Ltd., New Delhi

		August 2023	1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

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

MECHANICAL ENGINEERING

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ME505T(ii)	Professional Elective-I: Production & Operation Management	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
The students are expected to understand concepts of production and operations management in an organization and expose to analytical methods.	<ul style="list-style-type: none">Classify various operations management techniques and be able to select and apply suitable processes for an engineering product.Infer various product & process design and analysis, and be able to select and apply suitable processes for new Product DevelopmentDescribe various Factors Influencing Plant LocationIllustrate the Application of various planning techniques like capacity, Facility, material requirement and aggregateIllustrate the Application of Integrated Materials Management techniques

Unit I	[8Hrs]
INTRODUCTION TO PRODUCTION AND OPERATIONS MANAGEMENT Role of Operations Management in total management System- Functions of Production Management- Relationship between production and other functions - Definition - Systems Concept of Production. Types of Production Systems: Flow Shop - Job Shop - Batch Manufacturing - Toyota Production System- CAD and CAM- Automation in Production.	
Unit II	[7Hrs]
PRODUCT & PROCESS DESIGN AND ANALYSIS Product Design and Analysis New Product Development - Steps of Product Design. Production Planning and Control Process Planning and Design: Selection of Process - Process Selection Decision - Process Planning Design - Responsibilities of Process Planning Engineer - Steps in Process Planning - Process Design - Process Research -Value Analysis/Value Engineering- Inter Relationship between product life cycle and process life cycle.	
Unit III	[7Hrs]
PLANT LOCATION & PLANT LAYOUT Plant Location: Factors Influencing Plant Location - Single Facility Location Problem - Multifacility Location Problems - Model for Multi-facility Location Problem - Classification of Layout - Advantages and Limitations of Product Layout - Objectives - Work Flow patterns - Factors for good layout design - REL (Relationship) Chart - Layout Design Procedures.	
Unit IV	[7Hrs]
PRODUCTION PLANNING MANAGEMENT Capacity and Facility Planning: Importance of capacity planning- Capacity measurement - Capacity Requirement Planning (CRP) process for manufacturing and service industry- Material Requirement Planning (MRP) and Control: MRP concept and process - Inventory control systems and techniques - JIT and Lean manufacturing- Embedded JIT and MRP - Network techniques. Aggregate production planning	
Unit V	[7Hrs]
MATERIALS MANAGEMENT Components of Integrated Materials Management: Materials Planning - Inventory Control -Purchase Management - Stores Management. Quantity Discount - Implementation of Purchase Inventory Model - Purchasing Management. Stores Management: Incoming Materials Control - Store Accounting - Obsolete Surplus and Scrap Management - ABC Analysis - XYZ Analysis - Computer Aided Techniques in POM.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Production and Operations ManagementII	Panneerselvam		PHI.
2.	Production and Operations Management,	Ajay K Garg,		TMH.
3.	Production Operations Management,	Prof. L.C. Jhamb:	18 th	Everest Publishing House.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Production and Operations Management,	Dipak Kumar Bhattacharyya,		Universities Press.
2.	Operations Management: Theory and Practice	B. Mahadevan,		Pearson.

		August 2023	1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

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

MECHANICAL ENGINEERING

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ME505T(iii)	Professional Elective-I: Design Thinking	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
<ul style="list-style-type: none">Learn design thinking concepts and principlesUse design thinking methods in every stage of the problemLearn the different phases of design thinkingApply various methods in design thinking to different problems	<ul style="list-style-type: none">Define key concepts of design thinkingPractice design thinking in all stages of problem solvingApply design thinking approach to real world problems

Unit I	[8Hrs]
INTRODUCTION: Why Design? - Four Questions, Ten Tools - Principles of Design Thinking - The process of Design Thinking - How to plan a Design Thinking project.	
Unit II	[8Hrs]
UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM: Search field determination - Problem clarification - Understanding of the problem – Problem analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs.	
Unit III	[8Hrs]
IDEATION AND PROTOTYPING: Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Startup Method for Prototype Development - Visualization and presentation techniques.	
Unit IV	[8Hrs]
TESTING AND IMPLEMENTATION :Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking.	
Unit V	[8Hrs]
FUTURE:Design Thinking meets the corporation – The New Social Contract – Design Activism – Designing tomorrow.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Handbook of Design Thinking - Tips & Tools for how to design thinking	Christian Mueller-Rosenberg	2021	Independently Published
2.	Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation	Tim Brown	2019	Harper Collins

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Design Thinking for Strategic Innovation	Idris Mootee	2021	Wiley

		August 2023	1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	



Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ME506T	Open Elective-I : Automobile Engineering	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
<p>1. To enable students to understand the basic concepts of automobile and its components. It includes information of different chassis, frame, power plant, clutch, gear box, transmission system, brakes, steering systems, wheels, tyres, suspension systems and electrical systems used in automobile.</p> <p>2. To enable students to study Electric vehicles, Hybrid vehicles, Fuel cell vehicles Alternative energy sources, Body and Safety Considerations and Modern Developments in Automobiles.</p>	<ul style="list-style-type: none">■ Classify and identify the main components of Chassis and frames. Explain the construction and working of fuel supply systems, cooling systems and lubrication systems used in automobile.■ Illustrate the functions of different types of automobile clutches and gear boxes. Select clutch and gear box for particular application. Explain the working of transmission system, its components such as propeller shaft, drives, differential and axles.■ Describe the working of different brakes, steering systems suspension systems and its components.■ Explain the functions of automobile electrical system like battery, lighting circuit, horn, wiper, panel board instrument, ignition system and automobile air-conditioning. Compare/ classify wheels and tyres of an automobile■ Express the need and functional requirements of Electric and hybrid vehicles and latest trends in Automobile such as importance of safety considerations in automobiles, the recent technological development and automotive safety.

Unit I	[8Hrs]
Introduction to Automobile: Chassis and Frame: Layout of chassis & its main components. Types of frames, conventional Frames and unitized chassis, articulated, rigid vehicles, prime movers, Power Plant: Constructional features of different types of engines used in automobiles. Fuel supply systems, cooling systems, lubrication systems.	
Unit II	[7Hrs]
Transmission system: Clutch: Necessity, requirements of a clutch system. Types of Clutches, centrifugal clutch, single and multiplate clutch, fluid clutch. Gear Box: Necessity of transmission, principle, types of transmission, sliding mesh, constant mesh, synchromesh, transfer gear box, gear selector mechanism, lubrication and control. Torque converter, semiautomatic and automatic transmission. Propeller shaft, drives, differential and axles.	
Unit III	[7Hrs]
Brakes, Steering systems and Suspension system: Brakes: Need & types, mechanical, hydraulic & pneumatic brakes, electrical brakes, engine exhaust brakes, drum and disc brakes, comparison and details of components. Brake adjustment 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, rubber, plastic, hydro and pneumatic suspension system	
Unit IV	[7Hrs]
Electrical systems, Wheels and Tyres: Automobile Battery, lighting circuit, horn, side indicator, wiper and panel board instruments. Battery, magneto and electronic ignition systems. Automobile air-conditioning. Wheels and Tyres: Types of wheels, wheel dimensions, tyre, desirable tyre properties, types of tyres, comparison of radial and bias-ply tyres, tyre construction, factor affecting tyre life, precautions regarding the tyres and wheel balancing.	
Unit V	[7Hrs]
Electric vehicles, Hybrid vehicles and Fuel cell vehicles. Alternative energy sources, CNG, LPG, biodiesel, bio-ethanol and hydrogen fuels in automobiles. Body and Safety Considerations and Modern Developments in Automobiles: Requirements of automobile body, safety considerations, crash worthiness. Recent advances in automobiles such as ABS, electronic power steering, Active suspension, collision avoidance, intelligent lighting, navigational aids and electronic brake distribution system.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Automobile Engineering Vol I and II	Kripal Singh		Standard Publications
2.	Automobile Engineering	R. K. Rajput		Laxmi Publications (P) Ltd.
3.	Automobile Engineering	G.B.S. Narang		Khanna Publishers

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Motor Vehicle	Newton & Steeds		Life & Sons Limited
2.	Automotive Mechanics	Joseph Heitner		McGraw Hill pub. Co

		August 2023	1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	

ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.Tech. Scheme of Examination & Syllabus 2023-24**MECHANICAL ENGINEERING****FIFTH SEMESTER**

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ME507P	Technical Skill Development-II	-	-	2	1	50	-	50

Course Objectives	Course Outcomes
<ul style="list-style-type: none"> ■ To demonstrate the basic understanding of design process ■ To prepare analytical models of basic engineering structures. ■ To effectively analyze and interpret the outcomes of analytical evaluations using modern tools. 	<ul style="list-style-type: none"> ■ Perform design evaluation of simple engineering structures. ■ Propose methods for analytical evaluation of basic engineering problems and develop its solution. ■ Evaluate and interpret the outcome of analytical evaluation.

Problem Statement: Design and evaluation of deflection behavior for a cantilever beam using numerical and analytical techniques.(All the following experiments have to be performed)



Expt. No.	Title of the experiment
1	Calculate the deflection in a cantilever beam when it is subjected to a point load
2	Calculate the stress response of the cantilever beam
3	Create points, lines, surfaces
4	Create Closed volume using surfaces
5	Define thickness, material properties using Hypermesh
6	Discretization of surfaces and assigning thickness and material property to it.
7	Define Force as a vector and fixing discretized surfaces
8	Perform linear static analysis using optistruct
9	Evaluate and interpret the outcome of linear static analysis

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Design Data for machine elements	B.D.Shiwalkar		Denett
2.	Fundamentals of strength of materials	P. N. Chandramouli		PHI Learning

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Applied mechanics and strength of materials	R.S.Khurmi		S. Chand/Eurasia Publishing co. Pvt. Ltd.

		August 2023	1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

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

MECHANICAL ENGINEERING

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
ME508T	Career Development-III	2	-	-	0	-	-	-

Course Objectives	Course Outcomes
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 reasoning ability.	<ul style="list-style-type: none">■ To analyze the questions on blood relations, direction sense and utilize time effectively in solving OBQ.■ To understand the situation given in analytical reasoning questions and simplify it using best possible method.■ To analyze and solve questions on cubes and dice and able to construct Venn diagram.■ To understand and select correct alternative for verbal and non-verbal questions based on classification, analogy, images and coding-decoding.■ To examine the given situation in questions based on logical thinking, binary logic, data sufficiency and conclude the correct answer.

Unit I	[4 Hrs]
Blood relations, problems on direction sense, operator based questions.	
Unit II	[4 Hrs]
Analytical reasoning i.e. linear seating arrangement, circular seating arrangement, selection, order sequence, network and distribution.	
Unit III	[6 Hrs]
Cubes and dice, questions on Venn diagram.	
Unit IV	[6 Hrs]
Classification, Analogy i.e. number analogy, letter analogy, word analogy & non-verbal analogy, number and letter series questions, coding-decoding, Logical sequence of words, Non verbal reasoning i.e. mirror image, water image, paper folding problems and paper cutting problems.	
Unit V	[6 Hrs]
Logical thinking i.e. statement & conclusions, statement & assumption, cause & effect, matching definitions etc., binary logic, questions on data sufficiency, puzzles.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	A Modern approach to Verbal & Non Verbal Reasoning	R.S.Agrawal		S.Chand and Company Pvt. Ltd
2.	Reasoning Verbal and Non Verbal	K.P. Singh		Viva Publishers Pvt. Ltd

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Verbal & Non verbal Reasoning	Rajesh Kumar Thakur		Prabhat Publishers

		August 2023	1	Applicable for 2023-24
Chairman - BoS	Dean – Academics	Date of Release	Version	