FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22ME501T	Heat Transfer	3	-	-	3	30	70	100

Course Objectives

1. To compare the different modes of heat transfer and governing laws.
2. To enablestudents to distinguish between steady and unsteady state heat transfer and their applications.
3. To enable students to calculate heat transfer rate for steady & unsteady state heat transfer processes.
4. To enable students to calculate heat transfer rate from different geometry under free and forced convection and radiation mode.
5. To design and evaluate the heat exchanger performance.

Course Outcomes

- 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 ad 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, and cylinder, overall heat transfer coefficient. Th resistance of composite structure (wall, and cylinder) , contact resistance, Ccritical thickness of insulation for cylinder.

Unit II **[7Hrs]**

Extended surface, types of fins. Fins of uniform cross section area, Governing differential equation for fin. Ttemperature distribution and heat transfer rate under various geometrical & thermal boundary conditions (Analysis not needed), fin efficiency & effectiveness.
8QVWHDG\ VWDWH KHDW WUDQVIHU OXPSHG 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 correlations for external flow over flat plate and internal flows through pipe ,laminar & turbulent flow .
Free or naturalconvection * U D nVmlK eRRayleigh number,flowover horizontaland verticalplate.

Unit IV **[7Hrs]**

Radiation, spectrum of radiation, black body radiation, radiation intensity, laws of radiation n U F KK R I I displacement law, Stefan Boltzmann. Emissivity, Absorptivity, Transmissivity, Reflectivity, Radiosity, Emissive power, Irradiation. Radiation exchange between parallel plate, shape factfor simple geometry & its laws, Radiation shield between parallel plates.

Unit V **[7Hrs]**

Heat exchanger: Calssification, overall heat transfer coefficient, fouling factor, LMTD & effectiveness, NTU method of heat exchanger analysis for parallel & counter flow single pass arrangement, design aspect of heat exchangers, Introduction to compact heat exchanger.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Fundamentalsof Heat & Mass Transfer	Incropera,F.P., Dewitt,D. P		ohn Wiley & Sons
2.	EngineeringHeat and Mass Transfer	M.M. Rathor		LaxmiPublicationsPvt. Ltd,

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Heat Transfer- A PracticalApproach	YunusA. Cengel,		Tata McGrawHill Pub Co. Ltd.
2,	Heat Transfer,	.P. Holman		McGrawHillBookCo., New York.

		July 2024	1	Applicable for 2024-25
Chairman - BoS	Dean – Academics	Date of Release	Version	

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22ME501P	Heat Transfer Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
1. To enable students to verify modes of heat transfer and governing laws by conducting experiments. 2. To enable students to determine thermal conductivity of solid (metal /nonmetal) ,powdery substance and liquid. 3. To enable students to determine convective heat transfer coefficient, overall heat transfer coefficient emissivity, Stefan Boltzmann constant, heat transfer rate and critical heat flux.	• 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.	FundamentalsofHeat & Mass Transfer	Incropera,F.P., Dewitt,D. P		ohn Wiley & Sons
2.	EngineeringHeat and Mass Transfer	M.M. Rathor		LaxmiPublicationsPvt. Ltd

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Heat Transfer- A PracticalApproach	YunusA. Cengel,		Tata McGrawHill Pub Co. Ltd.
2	Heat Transfer,	.P. Holman		McGrawHill Book Co.,New York.

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22ME502T	Energy Conversion-I	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
• 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	1. Identify the components of thermal power plant; classify boilers, working of boilers, mounting, and accessories. Analyze the performance of boiler 2. 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. 3. Analyze performance of steam nozzles analytically and steam turbine using graphical and analytical method Categorize steam condenser, cooling tower, explain its working, applications and calculations of steam condenser performance. 4. Identify the components of gas turbines, application of gas turbines and to analyze the performance of gas turbine.

Unit I	[7Hrs]
Principle of Steam Generation, Classification of Steam Generators, Fire Tube and Water Tube Steam Generators, Boiler Mounting and Accessories. Draught and its Classification, Chimney Height, Chimney Diameter, Chimney Efficiency. Performance of Steam Generators: Evaporation Capacity, Equivalent Evaporation, Boiler Efficiency.	
Unit II	**[7Hrs]**
Fluidized Bed Boilers: Bubbling, Circulating type. 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, 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. Steam condensers: types of condensers, classification of condensers, quality and quantity of cooling water required S H U I R U P D Q F H R I V X U I D F H F R Q G H Q V H U Laire jec' toD s. CooWling Q ¶ 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, effect of inter-cooling, reheat and regeneration, 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		ain Brothers Publications

FIFTH SEMESTER

CourseCode	CourseName	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22ME503T	Designof 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 andselectionprocess of various standard machine components andmechanical power transmission drives.	• Describe general process of design of machine elements, design considerations andclassifications. Andable apply basic theory and principals of product design anddevelopment • To design shaftandsuggest suitablebearing forgiven loading condition. • Design andselect flexible power transmission elements (belts, chain and drives.). Design andanalyze performance of plate clutches. • Use principles andprocedures fordesign andselectionof various typesof gearboxes • Analyzeforces andstresses onstructural elded and riveted joints, And suggest suitable specifications of flange coupling

Unit I	8 Hrs
Introduction to MechanicalEnineering Design : General design process, Classification of machinedesign, Design considerations, Material selection, Materials classification andstandard designation in various systems.Introduction to Product Design & Development: Importance of product design, types of design, product definition, product specification, Phasesof product development	
Unit II	**8 Hrs**
Design of shaft: Design of shaft subjected to torsional, bending load, ASME code for shaft design. Design of bearings: Introduction to hydrodynamic andhydrostatic bearings, Classification of antifriction bearings , selection of ball bearings .	
Unit III	**8 Hrs**
Introduction to frictional Drives (Belt and Clutch), Design of V-Belt androller chaindrives. design of sinle and multiplate clutch.	
Unit IV	**8 Hrs**
Introduction togearboxes, gear teminoloies, design ofspur gearbox, design ofworm -worm gearboxes.	
Unit V	**8 Hrs**
Introduction andtypes toelded, riveted joints (structural applications), Design of elded andriveted joints subjectedto axial andeccentricloading Introduction andclassificationsof shaftscouplings, design ofrigid flange couling	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Designof MachineElements	V. B. Bhandari		McGrawHill education.
2.	MachineDesign	P.H.Black		TMH.
3.	MechanicalEngg.Design,	Shigley		TMH.
4.	DesignDatabook	B.D. Shiwalkar		CentralTechnopublications

ReferenceBooks

S.N	Title	Authors	Edition	Publisher
1.	Handbookof MachineDesign	Shigley& Mischke		McGrawHill education.
2.	MechanicalEngineeringHandbookVol 1 & 2,	Kent,John		Willey & Sons.
3	Designof MachineElements,	B.D. Shiwalkar		CentralTechnopublications

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22MED 3P	Design of MachineElementsLab	-	-	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.	• 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 V-belt drive
4	Design of roller chain drive
5	Design and selection of spur gear drive.
6	Design and selection of worm-worm gear drive.
7	Design of Clutch
8	Design of structural riveted joint subjected to eccentric loading
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. Shivalkar		Central Techno publications
2.	Handbook of Machine Design	Shiley & Mischke		McGraw Hill education.
3	Design of Machine Elements	Shama & Purohit		PHI.

Reference Books

S.N	Title	Authors	Eidtion	Publisher
1.	Design Data HandBook	Mahadevan		CBS publishers
2.	Machine Tool Design Data Book			CMTI
3	Handbook of Machine Design	Shiley & Mischke		McGraw Hill education.
4	Mechanical Engineering Handbook,	Kent, John	Vol 1 & 2	Willey & Sons.

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22ME504T	Operation Research and Industrial Engineering	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
1. To develop mathematical models to identify one or P R U H ³ R S W L P D O ´ 2. Application of methods of Industrial engineering method modification and improvement of product and use of various quality concepts	• Apply quantitativeapproach to problem solving in real life industrial situations • Apply project management and allocation model for time and cost optimization. • Plan applicationof work study and ergonomicsprinciples for productivity improvement in industry • Develop demand analysis model and maintenance management strategy for industry. • Interpret Quality Management system and quality controtools for application in industry

Unit I	[8Hrs]
Introduction to Operation research, characteristics, phases & methodology of O.R., LinearProgramming: Introduction, Linear programming problem formulation, LPP solution by GraphicalMethod, SimplexMethod.	
Unit II	**[8Hrs]**
Project Management, Network analysis, CPM, PERT, Concept of Crashing. Assignment Model Introduction, Variants of Assignment Problems(Unbalanced)	
Unit III	**[8Hrs]**
Productivity, Types of productivity, factors affecting productivity. Work study and methods study: Definitions, objectives, steps method study, processchart, Work measurement: Objectives, definition, stop watch study, work sampling, PMTs, Ergonomics, Principlesof motioneconomy	
Unit IV	**[8Hrs]**
Forecasting: Need for forecasting, Qualitative methods of forecasting, time series analysis, least square method, moving av method, Maintenance: Objectives, Types of maintenance, preventive, predictive, break down maintenance.	
Unit V	**[8Hrs]**
Quality, quality fodesign, quality of conformance, Quality Control: Definition, function, objective, characteristics., process co charts, Qualitycost, Acceptancesampling, OC curves, samplingplans, ISO seriesof standards, BIS 14000. , QualityCircle, ust in Time (JIT), Kaizen, Poka Yoke. Qualitycircles, Six sigma	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	OperationResearch	D.S. Hira & P. Gupta,	1995	S. Chand
2.	WorkStudy	George Kanawaty	1992	InternationalLabourOrganisation
3.	StatisticalQualitycontrol	M.Mahajan	1999	DhanpatRaiand Co.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	OperationResearch	J. K. Sharma,	2009	MacmilanPublishers
2.	Motion& Time study	R.M. Barnes	1991	ohn Wiley.

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22ME505T(i)	Professional Elective - I : Refrigeration and Air conditioning	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
1. To introduce the basic concept of refrigeration a air conditioning and to further carry out th engineering analysis. 2. To make student aware of the conventional an new refrigeration systems, cryogenics, conditioning with psychometric, heat lo calculations, design of air conditioning system transmission and distribution of conditioned air. 3. 7 R H Q K D Q F H bow environmental impact of refrigerants and alternative refrigerants.	• Describe and analyze air cycle refrigeration and aircr refrigeration. • Describe and analyze vapour compression system and se appropriate refrigerant in the light of contemporary issues of ozone depletion and global warming. • Describe and analyze multipressure vapor compression syste and other non-conventional refrigeration systems. • Describe and analyze the basic air-conditioning processes and the application for achieving thermal comfort for better health and wo productivity. • Describe and analyze transmission and distribution of air thro ducts and related systems.

Unit I	[7Hrs]
Air cycle refrigeration: The Reversed Carnot Cycle, Gas as a Refrigerantin Reversed Carnot Cycle, Limitationsof Reversed CarnotCycle, ReversedBraytonor oule or Bell-ColemanCycle, Applicationto AircraftRefrigeration	
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 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 Conditioningof 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, Duct Design, Processing, Transmission and Distribution o Air in Clean Rooms, Air Locks, Air Curtains and Air Showers	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Refrigerationand Airconditioning	C.P. Arora	3rd Edition,2017	Tata McGrawHill,
2.	A textbookof Refrigerationand Air Conditioning	Khurmi R.S., Gupta, J. K	2006	EurasiaPublishinghousing (P) Ltd, New Delhi

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	A coursein Refrigerationand Air conditioning	Arora, S. C., Domkundwar,S	2018	DhanpatRai (P) Ltd., New Delhi

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22ME505T(ii)	Professional Elective-I: Production & Operation Management	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
The students are expected to undsetrand concepts of production and operatio management in an organization an expose toanalytical methods.	● Classify various operations managemetnetchniques and be able to select and apply suitable processes for an engineering product. ● Infer various produtc& process design and analysis, and be able to select and apply suitable processes for new Product Development ● DescribevariousFactorsInfluencingPlantLocation ● llustrate the Application of various planning techniques like capacity,Facility,material requirement and aggregate ● Illustrate the Applicationof IntegratedMaterialsManagementtechniques

Unit I [8Hrs]

INTRODUCTION TO PRODUCTION AND OPERATIONS MANAGEMENT

Introduction, scope of production and operations management , Classification of Production System: ob shop production, Batc production, Mass production, Continuous production, Production: Relationship with Other Functions, various types Production management: concept, scope ,objective, Operating system: concept, Operations Management concept scope Objectives , activities production and operations management functions:, Difference between Production and Op Management

Unit II [7Hrs]

PRODUCT & PROCESS DESIGN AND ANALYSIS

New product Design reason to design the new product, Product life cycle (Characteristics of Phases in Product Life cycle (PLC),Aspects of Product Design and Analysis, Product design (development) process , factors that affect a product design of product Design ,Product analysis,Process design, selection and Classification of Process ,process planning and Design, Steps in Process Planning, Process Design , Value Analysis/Value Engineering

Unit III [7Hrs]

PLANT LOCATION & PLANT LAYOUT

Plant Location: Factors Influencing Plant Location ,Plant layout, objectives , Classification of Layout- Advantages and Limitations of Product Layout- Objectives- Work Flow patterns- Factors Influencing Plant Layout- REL(Relationship) Chart-

Unit IV [7Hrs]

PRODUCTION PLANNING MANAGEMENT

Capacity and Facity 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 ,IT and Lean manufacturing, Aggregate production planning

Unit V [7Hrs]

MATERIALS MANAGEMENT

Materials Management: Planning Definition, Objectives primary & secondary , scope ,flow , purpose ,principle ,function of MM , Components of Integrated Materials Management: Stores Management- Incoming Materials Control- Inventory Control Inventory Model ABC Analysis XY Analysis

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Productionand Operations 0 D Q D	Panneerselvam		PHI.
2.	Productionand OperationsManagement,	AjayK Garg,		TMH.
3.	ProductionOperationsManagement,	Prof.L.C. hamb:	18 th	EverestPublishingHouse.

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Productionand OperationsManagement,	Dipak Kumar Bhattacharyya,		UniversitiesPress.
2.	OperationsManagement:Theoryand Practice	B. Mahadevan,		Pearson.

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22ME505T(i i)	Professional Elective I: Design Thinking	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
• Learndesignthinkingconcepts andprinciples • Use design thinking methods in every stage of the problem • Learnthe differentphasesof designthinking • Apply various methods in design thinkingto different problems	• Definekey conceptsof designthinking • Practicedesignthinkingin all stagesof problemsolving • Applydesignthinkingapproachto real worldproblems

Unit I	[7Hrs]
INTRODUCTION: Why Design? - Four Questions,Ten Tools - PrinciplesofDesignThinking- The processof Design Thinking- How to plan a Design Thinkingproject.	
Unit II	**[7Hrs]**
UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM: Search fielddetermination- Problemclarification- Understandingof the problem Problem analysis Reformulationof the problem - ObservationPhase - Empatheticdesign - Tips forobserving- 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 creativeprocessandcreativeprinciples- Creativitytechniques- Evaluation of ideas- PrototypePhase - LeanStartupMethodforPrototypeDevelopment- Visualizationand presentationtechniques.	
Unit IV	**[7Hrs]**
TESTING AND IMPLEMENTATION:Test Phase - Tips for interviews- Tips forsurveys- Kano Model - Desirability Testing- How to conductworkshops- Requirementsforthe space - Materialrequirements- AgilityforDesignThinking.	
Unit V	**[7Hrs]**
FUTURE:DesignThinkingmeets the corporation The New Social Contract Design Activism Designingtomorrow.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	HandbookofDesignThinking- Tips& Tools for how to design thinking	ChristianMueller-Rosenberg	2021	IndependentlyPublished
2.	ChangebyDesign:How DesignThinking TransformsOrganizationsandInspires Innovation	Tim Brown	2019	HarperCollins

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	DesignThinkingfor StrategicInnovation	IdrisMootee	2021	Wiley

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23ME561O	Open Elective-I : Automobile Engineering	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
1. To enable students to understand the basic concepts automobileand itscomponents. It includeisnformation o different chassis, frame, power plant, clu gear box, transmission system, brakes, steering systems, whe tyres,suspensionsystemsand electricalsystemsusedin automobile. 2. To enable students to study Electrivcehicles, Hybrid vehicles, Fuel cell vehicles Alternative energy sourc Body and Safety Considerations and Moder Developments in Automobiles.	• Classify and identify the main components of Chassis and frames. Explain construction and working of fuel supply systems, cooling systems and lubri systems used in automobile. • Illustrate the functionsof differenttypesof automobileclutchesand gear boxes.Select clutch and gear box for particular application. Explain the working of transmi system, its components such as propeller shaft, drives, differential and axles. • Describethe working of different brakes, steering systems suspension systems itscomponents. • Explain the functions of automobile electrical system like battery, lighting circuit, wiper, panel board instrument, ignition system and automobile conditioning. Compare classify wheels and tyres of an automobile • Express the need and functional requirements of Electric and hybrid vehicles latest trendsinAutomobilesuch as importanceofsafetyconsiderationsin automobiles, the recenttechnologicaldevelopmentand automotivesafety.

Unit I	[8Hrs]
Introduction to Automobile: Chassis and Frame: Layout of chassis & its main components. Types of frames, conven Frames and unitized chassis, articulated, rigid vehicles, prime movers, Power Plant: Constructional features of different types 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 clsuitncghl,e and multiplate clutch, fluid clutch Gear Box: Necessity of transmission, principle, types of transmission, sliding mesh, constant synchromesh, transfer gear box, gear selector mechanism, lubrication and control. Torque converter, semi automatic and automatic transmission Propellershaft,drives,differentialand axles.	
Unit III	**[7Hrs]**
Brakes, Steering systems and Suspension system: Brakes:Need & types,mechanical,hydraulic& pneumaticbrakes,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 s Suspension systems: Functionof springand shock absorber, conventionaland Independentsuspensionsystem, Telescopic shockabsorber,linkedsuspensionsystems,rubber,plastic,hydroand pneumaticsuspensionsystem	
Unit IV	**[7Hrs]**
Electrical systems, Wheels and Tyres: AutomobileBattery, lighting circuit, horn, side indicator, wiper and panel bo instruments. Battery, magneto and electronic ignition systems. Automobile air conditioning.Wheels and Tyres: Types of wheels, wheel dimensions,tyre, desirabletyre properties,typesof tyres, comparisonof radialand bias-ply tyres, tyre constructionf,actor affectingtyre life, precautionsregardingthe tyresand wheelbalancing.	
Unit V	**[7Hrs]**
Electric vehicles, Hybrid vehicles and Fuel cell vehicles. Alternative energy sources, CNG, LPG, biodiesel, ethanol and hydrogenfuels inautomobiles.Body and Safety Considerations and Modern Developments in Automobiles: Requirementsof automobilebody, safety considerations,crash worthiness.Recent advances in automobilessuch as ABS, electronicpower steering, Activesuspension,collisionavoidance,intelligentlighting,navigationaids and electronicbrake distributionsystem.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	AutomobileEngineeringVol I and II	Kripal Singh		StandardPublications
2.	AutomobileEngineering	R. K. Rajput		LaxmiPublications(P) Ltd.
3.	AutomobileEngineering	G.B.S. Narang		Khanna Publishers

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	MotorVehicle	Newton& Steeds		Life & SonsLimited
2.	AutomotiveMechanics	oseph Heitner		McGrawHill pub. Co
3.	AutomotiveEngineers	W.H. Crouse		McGrawHill pub. Co

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22H104	Foundational Humanities Elective-Development of Societies	2	-	-	-	Audit		

Course Objectives	Course Outcomes
Thiscoursewillprovidea naturallinkbetweenengineeringand humanities.	At the end of the course,students willbe able to: ● developa largerviewof socialstructures andsystems. ● understandthe politicalsystems and their comparative study. ● Aware themselvesof various economicsystems and sustainable development. ● understand the interaction of political and economic strategies. ● apply learnt conceptsand generate and evaluatemodels of development in current context.

Unit I Social Development	**[5Hrs]**
1. Conceptsbehindthe originof Family,Clan and Society 2. DifferentSocialSystems 3. RelationbetweenHumanbeingand Society 4. Comparative studieson differentmodelsof SocialStructuresand theirevolution	
Unit II Political Development	**[4Hrs]**
1. Ideas of PoliticalSystemsas learntfromHistory 2. Differentmodelsof Governingsystemand theircomparativestudy	
Unit III Economic Development I	**[4Hrs]**
1. Birthof Capitalism,Socialism,Marxism	
Unit IV Economic Development II	**[7Hrs]**
1. Conceptof developmentin pre-British,Britishand postBritishperiod- Barter,ajmani 2. E. F. Schumacher'sidea of development,Buddhisteconomics.Gandhianidea of development.Swaraj and Decentralization	
Unit V Economic Development III	**[4Hrs]**
1. EconomicDevelopment 2. Idea of developmentin currentcontext.	

Reference Books

S.N	Title	Authors	Edition	Publisher
1	FunctionalEnglishforTechnicalStudent	Dr. Pratibha Mahato and Dora Thompson	2020	Himalaya Publishing House
2.	CommunicationSkillsforEngineer	C. Muralikrishna and Sunita Mishra	2022	Pearson
3.	EffectiveTechnicalCommunication	BarunK Mitra	1	OxfordUniversityPress
4.	BasicBusinessCommunication	Lesikar,R. &Flately	9	Tata McGrawHill

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22AS502T	English for Engineers	2	-	-	2	15	35	50

Course Objectives	Course Outcomes
To provide students with the skills and knowledge of communication in a business environment.	At the end of the course, students will be able to: 1. develop an understandingof basic grammar conceptsand their applications. 2. prepare and equipthemselvesforcompetitiveexams 3. deliver effective presentations in a professional environme tackle group discussions and face interviews. 4. acquirehands-on experiencein writingbusinessletters 5. display written communication in line wditifhferent workplace requirements.

Unit I:Functional Grammar	[6Hrs]
1. Subject-Verb Agreement 2. Preposition,Pronounand Articles 3. Tenses 4. Direct Indirect Speech 5. Transformation of sentences Simple, Complex, Compound and Degrees of comparison 6. Activeand Passive Voice	
Unit II : English for Competitive Exams	**[5Hrs]**
1. Sentenceimprovementand construction 2. Paragraphordering 3. One wordsubstitution 4. VerbalAnalogies 5. Idioms	
Unit III : Verbal Ability	**[4Hrs]**
1. ReadingComprehension 2. Listeningto Conversation(formaland Informal)and Announcements. 3. IntegratedWriting Read, and listento a short excerptand writea response. 4. Speaking Podcast,GroupDiscussion,Presentationsand Mock Interviews	
Unit IV : Formal Correspondence	**[4Hrs]**
1. Describing,summarizing,comparing graphsor illustrations 2. Basicpatternsof BusinessLetterWriting 3. Approachesto writing Direct,Indirectand persuasivestyles. 4. Coverletter,Resume, Applications.	
Unit V : Communication at Workplace	**[5Hrs]**
1. Draftingemailsand reports 2. Circularand notices. 3. Meetingetiquetteand recordingMinutesof the Meeting 4. Writinga Press Release	

Reference Books

S.N	Title	Authors	Edition	Publisher
1	FunctionalEnglishforTechnicalStudent	Dr. Pratibha Mahato and Dora Thompson	2020	Himalaya Publishing House
2.	CommunicationSkillsforEngineer	C. Muralikrishna and Sunita Mishra	2022	Pearson
3.	EffectiveTechnicalCommunication	BarunK Mitra	1	OxfordUniversityPress
4.	BasicBusinessCommunication	Lesikar,R. &Flately	9	Tata McGrawHill

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22ME506P	Technical Skill Development-II	-	-	2	1	50	-	50

Course Objectives	Course Outcomes
• To demonstrate the basic understandingof design process • To prepare analytical models of basic engineering structures. • To effectivelyanalyze and interpretthe outcomesof analytical evaluations using modern tools.	• Performdesignevaluationof simpleengineeringstructures. • Propose methods for analytical evaluation of basic engineeri problems and develop its solution. • Evaluateand interpretthe outcomeof analyticalevaluation.

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	Calculatethe deflectionin a cantileverbeam whenit is subjectedto a pointload
2	Calculatethe stressresponseof the cantilever beam
3	Create points,lines,surfaces
4	Create Closedvolumeusingsurfaces
5	Definethickness,materialpropertiesusingHypermesh
6	Discretizationof surfacesandassigningthicknessand materialpropertyto it.
7	Define Forceas a vectorand fixingdiscretizedsurfaces
8	Performlinearstaticanalysisusingoptistruct
9	Evaluateand interpretthe outcomeof linearstaticanalysis

Text Books

S.N	Title	Authors	Edition	Publisher
1.	DesignData formachineelements	B.D.Shiwalkar		Denett
2.	Fundamentalsof strengthof materials	P. N. Chandramouli		PHI Learning

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Appliedmechanicsand strengthof materials	R.S.K urmi		S. Chand/Eurasia Publishingco. Pvt. Ltd.

FIFTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
22ME507P	Career Development- III	2	-	-	0	15	35	50

Course Objectives	Course Outcomes
This course is aimed to maek the students conversant with the preparation needed f placement in core and IT industry. The design course will make students to understand the sh cut tricks and techniques of problem solving reasoning ability.	• 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 a simplify it using best possible method. • To analyze and solve questions on cubes and dice and able to construct Venn diagram. • To understandand select correct alternativefor verbaland non-verbal questions based on classification, analogy, imagesand coding-decoding. • To examine the given situationin questionsbased on logicalthinking, binary logic,data sufficiency and conclude the correct answer.

Unit I	**[4 Hrs]**
Bloodrelations,problemson directionsense,operatorbasedquestions.	
Unit II	**[4 Hrs]**
Analyticalreasoningi.e. linear seating arrangement, circularseating arrangement, selection, order sequence, network and distribution.	
Unit III	**[6 Hrs]**
Cubesand dice, questionson Venn diagram.	
Unit IV	**[6 Hrs]**
Classification, Analogy i.e. number analogy, letter analogy, word analogy &verbal analogy, number and letter serie questions, coding-decoding, Logical sequence of words, Non verbal reasoning i.e. mirror image, water image, paper fo problems and paper cutting problems.	
Unit V	**[6 Hrs]**
Logical thinkingi.e. statement & conclusions,statement & assumption,cause & effect, matching definitionsetc., binarylogic, questions on data sufficiency, puzzles.	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	A Modernapproachto Verbal& Non Verbal Reasoning	R.S.Agrawal		S.Chandand CompanyPvt. Ltd
2.	ReasoningVerbaland Non Verbal	K.P. Singh		Viva PublishersPvt. Ltd

Reference Books

S.N	Title	Authors	Edition	Publisher
1.	Verbal& NonverbalReasoning	Rajesh K mar Thakur		PrabhatPublishers