Scheme of Examination - SECOND SEMESTER

Sr No	Course Code	Course Title	Hours per Week			Credits	Maximum Marks		
			L	T	P		Continual Assessment	End Sem Examination	Total
1	24CAD201T	Advance Finite Element Method	3	-	-	3	30	70	100
2	24CAD201P	Advance Finite Element Method Lab	-	-	4	2	50	50	100
3	24CAD202T	Computer Aided Tool Design	3	-		3	30	70	100
4	24CAD202P	Computer Aided Tool Design Lab	-	-	4	2	50	50	100
5	24CAD203T	Product Design and Development	3	-	-	3	30	70	100
6	24CAD204T	Professional Elective-III	3	-	-	3	30	70	100
7	24CAD205T	Professional Elective - IV	3	-	-	3	30	70	100
8	24CAD206P	Technical Seminar & Research paper Writing/ IPR/ Quantative Methods/ Design of Experiments/	-	-	2	-	-	-	-
Total			**15**	**0**	**10**	**19**	**250**	**450**	**700**

24CAD204T	Professional Elective - III		24CAD205T	Professional Elective - IV
24CAD204T(i)	Design of Material Handling Systems		24CAD205T(i)	Manufacturing system Integration and management
24CAD204T(ii)	Design for Manufacturing and Assembly		24CAD205T(ii)	Modelling and Simulation
24CAD204T(iii)	Additive Manufacturing		24CAD205T(iii)	Agile Manufacturing

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

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD201P	Advance Finite Element Methods Lab	-	-	4	2	50	50	100

Course Objectives	Course Outcomes
• To teach the fundamentals of finite element method with emphasize on the underlying theory, assumption, and modeling issues. • To provide hands-on experience for using finite element software for modeling & analyzing stresses, strains, deformations, natural frequencies, modal shapes, etc. for machine/structural components. • To enable understanding of design evolution cycle through process of design validation	• Model finite element problems using commercial software and understand the fundamental use of finite element preprocessor, solver and post-processor. • Demonstrate the ability to evaluate and interpret Finite Element Analysis Results for the design and evaluation of 1D and 2D finite element formulations. • Understand the Finite Element Modeling aspects of the Frequency response problem for solving engineering design problems.

- **Minimum eight experiments to be performed from the list (**Minimum Six Practical on the standard CAE packages like HYPERWORKS, ANSYS, NASTRAN, ABAQUS, or any other relevant software or freeware.

Expt. No.	Title of the experiment
1	Static structural analysis of Axially loaded bar with 1-D finite elements using standard FEA package.
2	Static structural analysis of bar under the influence of self-weight using 1-D finite elements using standard FEA package.
3	Static structural analysis of bar under applied torque using 1-D finite elements using standard FEA package.
4	Static structural analysis of 1D truss using standard FEA package.
5	Static structural analysis with 2-D Plane stress element using standard FEA package.
6	Static structural analysis with 2-D Plane strain element using standard FEA package.
7	Static structural analysis of a beam under transverse loading using standard FEA package.
8	Dynamic structural analysis to determine natural frequency and mode shapes, using standard FEA package.
9	Thermal analysis to estimate nodal temperatures using standard FEApackage.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Introduction to Finite Elements in Engineering	Chandrupatla T. R. and Belegunda A. D		Prentice Hall.
2	First Course in the Finite Element Method	Daryl Logan		Cengage Learning

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Finite Element Procedures	Bathe K. J		Prentice-Hall of India
2	Finite Element Analysis, Theory, and Practice	Fagan M. J.		Pearson Education Limited

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD201T	Advance Finite Element Method	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
The objective of the course is to teach the fundamentals of finite element method with emphasize on the underlying theory, assumption, and modeling issues as well as providing hands-on experience using finite element software for modeling & analyzing stresses, strains, deformations, natural frequencies, modal shapes, etc. for machine/structural components.	• Identify the application of fundamentals of solid mechanics for evaluation of structural problems for evaluation of Point load, body force, traction and torsional loads. • Study the application and formulation of the basic finite elements for static and truss, beam and bars subjected to plane stress and plane strain behavior. • Formulate mathematical models for the solution of common engineering problems using finite element methods i.e, formulation of simple & complex problems using finite elements and to develop the ability to generate the governing finite element equations for systems regulated by partial differential equations. • Identify the significance and difference between the formulation and application of thermal engineering problems using1D & 2D finite elements. • Formulate dynamic problems to study and evaluate structural response under free vibration.

Unit I	**[8Hrs]**
Introduction to FEM, basic concepts, historical back ground, applications of FEM, general description, comparison of FEM with other methods, vibrational approach, Glerkin's Methods. Coordinates, basic element shapes, interpolation function, Virtual energy principle, Rayleigh – Ritz method, properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain-displacement relations.	
Unit II	**[8Hrs]**
1-D STRUCTURAL PROBLEMS: Axial bar element–stiffness matrix, load vector, temperature effects, Quadratic shape functions and problems. Plane Trusses and Axi-symmetric Truss elements, and problems Beam bending problem, Hermite shape functions–stiffness matrix– Load vector.	
Unit III	**[8Hrs]**
2-D PROBLEMS: CST, LST, force terms, Stiffness matrix and load vectors, boundary conditions, Iso-parametric elements–quadrilateral element, shape functions–Numerical Integration. Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements. 3-DPROBLEMS: Tetrahedran element–Jacobian matrix–Stiffness matrix.	
Unit IV	**[8Hrs]**
SCALAR FIELD PROBLEMS:1-D Heat conduction-Slabs–fins-2-D heat conduction problems –Introduction to Torsional problems.	
Unit V	**[8Hrs]**
Dynamic considerations, Dynamic equations–consistent mass matrix– Eigen Values, Eigen vector, natural frequencies–mode shapes–modal analysis	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Introduction to Finite Elements in Engineering	Chandrupatla T. R. and Belegunda A. D		Prentice Hall.
2	First Course in the Finite Element Method	Daryl Logan		Cengage Learning

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Finite Element Procedures	Bathe K. J		Prentice-Hall of India
2	Finite Element Analysis, Theory, and Practice	Fagan M. J.		Pearson Education Limited

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD202P	Computer Aided Tool Design Lab	-	-	4	2	50	50	100

Course Objectives	Course Outcomes
This course deals with various types of cutting tools, the mechanics of metal cutting, design of gauges, design of metal cutting tools and also to understand various press working operations along with die design for sheet metal working, basics of forging dies and design of jigs and fixtures.	• Design single and multi-point cutting tools. • Design various press working cutting operation dies for given sheet metal parts. • Design various forging dies and design machine forging dies. • Design simple, blow and injection molds for plastic parts. • Design jigs and fixtures by considering principles of location and clamping.

- **Minimum eight experiments to be performed from the list**

Expt. No.	Title of the experiment
1	**Design of single point cutting tool(SPCT):** Theory of metal cutting, Tool geometry and nomenclature, One numerical on SPCT and boring tool
2	**Design of Press Working Cutting Operation Dies (Blanking and Piercing):** Analytical design (finalization of all dimensions), Preparation of 3-D model of complete Die Block using CAD software., 3-D assembly model, 2-D drafting model showing assembly views, exploded views, BOM and balloons, 2-D detailing of assembly parts.
3	**Design Press Working (Bending Forming & Drawing dies):** Analytical design (finalization of all dimensions), Preparation of 3-D model of complete Die Block using CAD software., 3-D assembly model, 2-D drafting model showing assembly views, exploded views, BOM and balloons.
4	**Design of Forging Dies:** Analytical design (finalization of all dimensions), Preparation of 3-D model of complete using CAD software, 3-D assembly model, 2-D drafting model showing assembly views, exploded views, BOM and balloons, 2-D detailing of assembly parts.
5	**Design of Blow Mould:** Analytical design (finalization of all dimensions), Preparation of 3-D model of complete using CAD software, 2-D detailing of mould.
6	**Design of Drill Jig:** Problem statement and analysis of requirements, Development of initial ideas (Locating and clamping devices, jig body etc.), Final Design of jig using 3-D modeling CAD software's: 3-D assembly model, 2-D drafting model showing assembly views, exploded views, BOM and balloons, 2-D detailing of assembly parts.
7	**Design of Fixtures:** Problem statement and analysis of requirements., Development of initial ideas(Locating and clamping devices, jig body etc.), Final Design of fixture using 3-D modeling CAD software's: 3-D assembly model, 2-D drafting model showing assembly views, exploded views, BOM and balloons, 2-D detailing of assembly parts.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Production Engineering	P. C. Sharma		S. Chand Publication
2	Tool Design	Donaldson		Tata McGraw Hill, New Delhi

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Manual of Jigs and Fixtures Design	Henrickson		Industrial Press Inc., New York

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD202T	Computer Aided Tool Design	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
i) To create complete understanding about design of cutting tools used in metal removal processes. ii) To make students understand different types of press working operations and their die design. iii) To make students well versed with principles and design of jigs and fixtures. iv) To provide knowledge about forging die design and mold design.	• Perform analysis of forces on cutting tools in metal removal process and Design single and multi-point cutting tools. • Design various press working cutting operation dies for given sheet metal parts, also will be able to suggest heat treatment cycle for these dies. • Understand terminologies and design considerations related to press working bending, forming and drawing dies. • Explain and classify various forging dies and design machine forging dies. • Design simple, blow and injection molds for plastic parts. • Design jigs and fixtures by considering principles of location and clamping.

Unit I	**[8Hrs]**
Design of single point & multi-point cutting tools: Design of single Point Cutting Tool: Form tools- Introduction, Types, design of form tools. Design of multi-point cutting tools: Drills-Introduction, Types, Geometry, Design of drill, Milling cutters-Introduction, Types, Geometry, and Design of milling cutters.	
Unit II	**[8Hrs]**
Press working (Cutting operation dies): Introduction, Press working operations, construction and working of metal cutting dies e.g. simple die, compound die, progressive die, combination die. Design of heat treatment cycle for press tools, Principle of metal cutting, press tonnage capacity, cutting forces, method of reducing cutting forces. Blanking & Piercing die design– Simple, compound & progressive dies.	
Unit III	**[8Hrs]**
Press Working (Bending Forming & Drawing dies): Bending dies: Bending terminology, types of bending operation, blank development, spring back and its prevention, bending force and design of bending dies. Forming dies: Introduction, types of forming dies – Solid form dies, pad type form dies, curling dies, embossing dies, coining dies and its design. Drawing dies: Metal flow in drawing operation, factors affecting metal flow, calculation of number of draws, development of blank, drawingforce,blankholdingforceanddesignofvarioustypesofdrawingdies i.e. single action draw die, double action draw die and invert eddies.	
Unit IV	**[8Hrs]**
Forging Die Design & Mold Design: Introduction, Classification of forging dies, Single impression dies, Multiple Impression dies and Forging design factors. Preliminary forging operation-fullering, edging, bending, drawing, flattering, blacking finishing, cutoff. Die design for machine forging in closed & open die forging, materials of forging dies. **Mould Design**: Design of Simple Blow Moulds for Articles such as bottles, cans Design of simple two plate injection moulds, Mould Materials.	
Unit V	**[8Hrs]**
Design of jigs &fixture:- Introduction, general principles for design of jigs and fixtures, principle of location, principle for clamping, clamping devices, types of jig bushes, material and heat treatment, design of drill jig. Design of Milling Fixtures and lathe fixtures.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Production Engineering	P. C. Sharma		S. Chand Publication
2	Tool Design	Donaldson		Tata McGraw Hill, New Delhi

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Manual of Jigs and Fixtures Design	Henrickson		Industrial Press Inc., New York

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD203T	Product Design and Development	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
The primary objective of this course is to make students well conversant with Product Development (New or existing) and various aspects involved in it.	• Understand the importance of product design and development • Select material, manufacturing process for development of product • Apply principals for DFM, DFA, DFX concurrent engineering for Generation of product • Understand and apply product development cycle.

Unit I	**[8Hrs]**
Importance of product design, types of design, product definition, product specification, Phases of product development: conceptual, embodiment and detailed design, product and technology development cycle, concept generation and evaluation methods.	
Unit II	**[8Hrs]**
Material selection – Importance, classification, material performance characteristic, Selection criteria, Ashby Material selection chart Process selection–Importance, types of manufacturing processes and their classification, sources of information, selection criteria, Material and Process selection Methods-Expert systems, Computer Database Approach, Performance indices, decision matrix, AHP and fuzzy approach, introduction to material and process selection software.	
Unit III	**[8Hrs]**
Benchmarking – DFM, DFA, DFX, Early supplier involvement, robust design, QFD and concurrent engineering. Mathematics of Time Value of Money, Cost Comparison, Depreciation, Taxes, Inflation, Profitability of Investment and Investment Decision Analysis Sensitivity Analysis. Methods of Cost Estimates.	
Unit IV	**[8Hrs]**
Industrial Engineering Approach, Parametric Approach, Introduction to Assembly Modeling, Top-Down and Bottom-Up Approaches of AM, Mating Conditions, Representation Schemes, Generations of Assembly Sequences.	
Unit V	**[8Hrs]**
Product Development Cycle and Importance of Prototyping, Types of Prototypes, Principle and Advantages & Different Type of Generative Manufacturing Process, Viz, Stereo lithography, FDM, SLS etc. Factors Concerning to RP: Consideration for Adoptions, Advantages, Accuracy and Economic Considerations	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Engineering Design	Dieter George E	2000	McGraw Hill Pub. Company
2	Product Design and Development	Ulrich Karl T. and Eppinger Steven D	2005	McGraw Hill Pub. Company

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Product Design & Manufacturing	Chitale, Gupta	2nd Ed 2002	Prentice Hall of India

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD204T(i)	PE-III Design of Material Handling Systems	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
The overall objective of this course is to understand and learn about various industrial mechanical handling devices starting from their basic design for any desired condition and its safety analysis with its theoretical knowledge.	• To understand the importance of material handling systems, basic principles, Functions and classifications • To perform selection, feasibility analysis and economic analysis of material handling system for particular application. • To design elements of hoisting systems and bucket elevator to understand working and constructional details of various conveying systems and design belt conveyor system. • To design various types of factory cranes and its structures.

Unit I	**[8Hrs]**
Elements of Material Handling System:- Importance, terminology, objectives and benefits of better Material Handling; Principles and features of Material Handling System; Interrelationships between material handling and Plant layout, physical facilities and other organizational functions; Classification of Material Handling equipment's.	
Unit II	**[8Hrs]**
Selection of Material Handling Equipments:- Factors affecting for selection; Material Handling equation; choices of Material Handling equipment; general analysis procedures; basic analytical techniques; The unit load concept; selection of suitable types of systems for applications; activity cost data and economic analysis for design of component so Material Handling Systems; functions and parameters affecting service; packing and storage of materials.	
Unit III	**[8Hrs]**
Design of hoisting elements: Welded and roller chains- Hemp and wire ropes - Design of ropes, pulleys, pulley systems, sprockets and drums, Load handling attachments. Design of forged hooks and eyehooks – crane grabs - lifting magnets - Grabbing attachments – Design of arresting gear-Brakes: shoe, band and cone types. Design of bucket Elevator: Introduction, Types of Bucket Elevator, Design of Bucket Elevator- loading and bucket arrangements, Cage elevators, shaft way, guides, counter weights.	
Unit IV	**[8Hrs]**
Conveyor Design: Introduction to apron conveyors, Pneumatic conveyors, Belt Conveyors, Screw conveyors and vibratory conveyors, Escalators and their applications, Design of Belt conveyor-Belt selection procedure and calculation of drop energy, Idler design.	
Unit V	**[8Hrs]**
Design of Cranes: Hand-propelled and electrically driven E.O.T overhead Traveling cranes; Traveling mechanisms of cantilever and monorail cranes; design considerations for structures of rotary cranes with fixed radius; fixed post and overhead traveling cranes; Stability of stationary rotary and traveling rotary cranes.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Material Handling Equipments	N. Rudenko		Peace Publishers
2	Material Handling System Design	James M. Apple		John-Willey and Sons Publication

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Bulk Solid Handling	C. R. Cock and J. Mason		Leonard Hill Publication Co. Ltd
2	Material Handling Hand Book	Kulwiac R. A.,		John Wiley Publication

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD204T(ii)	PE-III Design for Manufacturing and Assembly	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
To make students conversant with concepts of product development cycle considering design, manufacturing and assembly aspects.	• Understand the concept of product development cycle. • Select suitable engineering material and suggest shape of product. • Suggest suitable product design considering manufacturing process. • Suggest suitable product design considering the process of assembly. • Include reliability and optimization aspect in product design.

Unit I	**[8Hrs]**
Introduction Need Identification and Problem Definition, Concept Generation and Evaluation, Embodiment Design, Selection of Materials and Shapes.	
Unit II	**[8Hrs]**
Properties of Engineering Materials, Selection of Materials–I, Selection of Materials–II, Case Studies–I, Selection of Shapes, Co-Selection of Materials and Shapes, Case Studies–II.	
Unit III	**[8Hrs]**
Selection of Manufacturing Processes, Review of Manufacturing Processes, Design for Casting, Design for Bulk Deformation Processes, Design for Sheet Metal Forming Processes, Design for Machining, Design for Powder Metallurgy, Design for Polymer Processing, Co-selection of Materials and Processes, Case-Studies– III	
Unit IV	**[8Hrs]**
Design for Assembly, Review of Assembly Processes, Design for Welding–I, Design for Welding–II, Design for Brazing and Soldering, Design for Adhesive Bonding, Design for Joining of Polymers, Design for Heat Treatment, Case-Studies -IV	
Unit V	**[8Hrs]**
Design for Reliability, Failure Mode and Effect Analysis and Quality, Design for Quality, Design for Reliability, Approach to Robust Design, Design for Optimization.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Materials and Design-the art and science of material selection in product design	M F Ashby and K Johnson		Butterworth-Heinemann
2	Engineering Design-a materials and processing approach	G Dieter		McGraw Hill, NY

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Engineering Optimization: theory and practice	S S Rao	1996	John Wiley, NY
2	Product design for manufacture and assembly	G Boothroyd, P Dewhurst and W Knight	1994	John Wiley, NY: Marcel Dekkar

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD204T(iii)	PE-III Additive Manufacturing	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
1. Use commercial software for digitizing free-form geometry. 2. Create the design of an object suitable for additive manufacturing processes. 3. Compare traditional versus next generation manufacturing. 4. Define and apply criterion for selecting appropriate additive manufacturing process for any given application.	• Explain the evolution of additive manufacturing (AM) and its importance in digital manufacturing. Also, create AM process chain for product. • To create and pre-process a model for additive manufacturing. • Understand explain liquid based and solid based additive manufacturing processes • Understand and explain powder based additive manufacturing process. • Explain 3-dimensional printing and post process the additive manufactured parts.

Unit I **[8Hrs]**

Introduction: Need - Development of Additive Manufacturing (AM) systems, Distinction between AM & CNC machining, AM process chain: Conceptualization, 3D Scanning & the Scanning Process, CAD, conversion to STL, Transfer to AM, STL file manipulation, Machine setup, build, removal and cleanup, post-processing. Impact of AM on Product Development - Virtual Prototyping – Rapid Tooling–Rapid Prototyping (RP) to AM-Classification of AM processes, Benefits and Applications.

Unit II **[8Hrs]**

Reverse engineering and CAD modeling: Basic concepts-Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements. Introduction to Geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM –Case studies.

Unit III **[8Hrs]**

Liquid based and Solid based additive manufacturing systems: Stereo lithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, Recoating issues, materials, advantages, limitations and applications. Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and applications. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications –Case studies.

Unit IV **[8Hrs]**

Powder based additive manufacturing systems: Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS-powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications–Case Studies.

Unit V **[8Hrs]**

Other Additive Manufacturing systems: Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Post processing of AM parts: Support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, property enhancements using non-thermal and thermal techniques.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing	Gibson, I., Rosen, D.W. and Stucker, B	2010	Springer
2	Rapid Prototyping: Principles &Applications	Chua Chee Kai, Leong Kah Fai	2003	World Scientific

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Rapid prototyping	Gebhardt, A	2003	Hanser Gardener Publications
2	Rapid Prototyping and Engineering applications : A tool box for prototype development	Liou, L.W. and Liou, F.W	2011	CRC Press

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

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD205T(i)	PE-IV Manufacturing System Integration and Management	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
Develop an understanding of Manufacturing Systems: manufacturing Planning, Computer integrated Production management Systems, Manufacturing Resources Planning (MRP III) and JIT concept with Simulation: Need of simulation, Simulation languages and Package	• Identify components of Manufacturing System, classification, manufacturing progress function. Single station manufacturing cells: Single station manned workstations, automated cells, analysis of single station cells. • Get acquainted With Manufacturing Planning, softwares, CAPP, And Group Technology. • Get acquainted With Various Computer integrated Production management Systems (CAQC,SFC) • Get acquainted With Manufacturing Resources Planning (MRP III), JIT concept • Get acquainted with simulation, Simulation languages & Packages, methodology. Types Even Scheduling Approach (ESA), Activity scanning Approach (ASA), Process Interaction Approach (PIA)

Unit I **[8Hrs]**

Introduction to Manufacturing Systems: components of Manufacturing System, classification, manufacturing progress function. single station manufacturing cells: Single station manned workstations, Automated cells, Applications, analysis of single station cells.

Unit II **[8Hrs]**

Manufacturing Planning: Automated process planning: Process planning, general methodology of group technology, part identification and coding, Retrieval & Generative CAPP systems. Introduction to process planning software.

Unit III **[8Hrs]**

Computer integrated Production management Systems Aggregate Production Planning and Master Production Schedule, Material Requirement Planning, Capacity Planning, Manufacturing system control: Computerized statistical process control, Shop floor control, Shop floor data collection techniques, CAQC, Bill of materials. Business functions: Purchase orders receiving, Inventory management, financial control, Job costing, Sales & Marking applications

Unit IV **[8Hrs]**

Manufacturing Resources Planning (MRPIII): Framework Of MRPII System, Elements Of MRPII. Value Added Focus, Source of waste, JIT principles, The Meaning of JIT, Small Lot Production, Setup Time Reduction, Pull Production: Production Control Systems, Pull And Push System, Process Improvement, Necessary Conditions For Pull Production Systems, How To Achieve Pull Production, Mechanisms For Signal, To Pull or Production, Kanban, lean production, Agile manufacturing.

Unit V **[8Hrs]**

Simulation: Need of simulation, Simulation languages & Packages, Simulation methodology. Types of simulation approaches- Even Scheduling Approach (ESA), Activity scanning Approach (ASA), Process Interaction Approach (PIA), interfacing requirements for integrating manufacturing systems.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Group Technology in Engineering Industry	Bubidge, J. L	1979	Mechanical Engineering Pub, London
2	G. T. Planning and Operation, in the Automated Factory- Handbook: Technology and Management	Askin, R. G. and Vakharia, A. J	NY1991	cleland, D. I. And Bidananda, B (Eds), TAB Book

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Competitive Manufacturing Management	Nicholes John M.	Intl edition	McGraw Hill

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD205T(ii)	PE-IV Modeling and Simulation	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
To provide students with basic principles of discrete- event simulation which leads to develop and analyze computer simulation models of existing and proposed manufacturing, service and business systems.	• Define the basics of simulation modeling and replicating the practical situations in organizations. • Generate random numbers and random variants using different techniques. • Analysis of Simulation models using input analyzer, and output analyzer • Students will learn to simulate the models for the purpose of optimum control by using software

Unit I **[8Hrs]**

Introduction to simulation as a tool, Areas of application, System model, Components of system, System environment, Types of system model, Steps in a simulation study. Discrete event system simulation, Event scheduling, Time advance mechanism, List processing – basic properties and operations, Dynamic allocation, linked lines. Characteristics of queuing systems, Transient and steady-state behaviour, Long run performance measures, Infinite-population steady-state models, Finite-population models.

Unit II **[8Hrs]**

Properties and generation of random numbers, Testing of generated random numbers. Random Variate Generation : Exponential, Uniform, Weibull, Triangular, Empirical, Discrete distributions, Direct transformation for normal distribution, Convolution method ,Acceptance-rejection technique

Unit III **[8Hrs]**

Analysis of simulation data: data collection, identifying distributions, Parameter estimation, Goodness of-fit tests, Multivariate and time series input models.

Unit IV **[8Hrs]**

Model building, Verification, Validation process, Verification of simulation models, Calibration and validation of models: Validation of assumptions, Input-output transformations, Validation of input output using historical data and turning test. Estimation of absolute performance.

Unit V **[8Hrs]**

Optimization and Design of Systems: Summary of gradient based techniques: Nontraditional Optimization techniques, genetic Algorithm (GA)- coding, GA operations elitism, Application using MATLAB: Simulated Annealing Neural Network Modeling of Systems only with Input-output Database: Neurons, architecture of neural networks, knowledge representation, learning algorithm. Multi-layer feed forward network and its back propagation learning algorithm, Application to complex engineering systems and strategy for optimum output. Modeling Based on Expert Knowledge: Fuzzy sets, Membership functions, Fuzzy Inference systems, Expert Knowledge and Fuzzy Models, Design of Fuzzy Controllers, Simulation of Engineering Systems: Monte-Carlo simulation, Simulation of continuous and discrete processes with suitable Examples from engineering problems

Text Books

S.N	Title	Authors	Edition	Publisher
1	Discrete-Event System Simulation	J. Banks		PHI
2	Simulation Modeling and Analysis	S. Law		McGraw Hill Publishing Co

Reference Books

S.N	Title	Authors	Edition	Publisher
1	System Simulation	J. Gordon		PHI
2	Simulation Modeling & Analysis	A. M. Law & W. D. Keltron		McGraw Hill International series
	Automation, Production Systems and Computer Integrated Manufacturing	Mikell P. Groover		PHI

SECOND SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24CAD205T(iii)	PE-IV Agile Manufacturing	3	-	-	3	30	70	100

Course Objectives	Course Outcomes
1. To impart knowledge of Agile Manufacturing, its need and strategies. 2. To make students conversant in process development in agile manufacturing/ enterprise. Integrating Product/Process development.	• Understand conceptual frame work of agile manufacturing environment. • Get insight into Enterprise design process, apply interdisciplinary design concepts. • Apply IT/ES concepts in agile manufacturing and supply chain. • Understand and explain computer control of agile Manufacturing. • Suggest enhance technology for machine tool and system.

Unit I **[8Hrs]**

Agile Manufacturing: Definition, business need, conceptual frame work, characteristics, generic features. Four Core concepts: Strategy driven approach-integrating organization, people technology, interdisciplinary design methodology.

Unit II **[8Hrs]**

Developing Agile Manufacturing: Enterprise design, System concepts as the basic manufacturing theory-joint technical & Organizational design and a model for the design of agile manufacturing enterprise. Enterprise design process insights into design processes, what is interdisciplinary design, main issues, simple design example. Integration of Product /Process Development: Principles, Robust design approach, Approaches to enhance ability in manufacturing, Role of QFD, Managing people in Agile organization, Approaches.

Unit III **[8Hrs]**

Application of IT/ES Concepts In Agile Manufacturing: Strategies, Management of complexities and information. flow, approaches, applications of multimedia to improve agility in manufacturing, system concepts. Agile Supply Chain Management: Principles, IT/ES concepts in supply chain management, enterprise integration and management in agile manufacturing, concepts, Agility, Adaptability and learners– comparison of concepts.

Unit IV **[8Hrs]**

Computer Control of Agile Manufacturing: CAPP for Agile Manufacturing, Aggregate capacity planning and production line design / redesign in Agile manufacturing, Cellular manufacturing, concepts, and examples. Corporate Knowledge Management In Agile Manufacturing: Strategies, strategic options in Agile manufacturing, Role of standards.

Unit V **[8Hrs]**

Design of Skill & Knowledge: Enhancing technology for Machine tool system, Resumption of design requirement geometry, definition, methods, decision support for selection of cutting parameters, design enhancements, parametric approach only.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Agile Manufacturing- Forging Mew Frontiers'	Poul T Kidd	1994	Amagow Co. UK
2	Agile Manufacturing	A Gunasekharan		Elsevier Press, India

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Levine Transitions to Agile Manufacturing	Joseph C Moutigomery and Lawrence	1996	Milwaukee. Wisconsin, USA
2	Agile Development for Mass Customization	David M Anderson and B Joseph Pine,	1997	Irwin Professional Publishing, Chicago, USA,.