IV YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	MT701PC	Automobile Engineering	3	0	0	3
2		Professional Elective – II	3	0	0	3
3		Professional Elective – III	3	0	0	3
4		Professional Elective - IV	3	0	0	3
4		Open Elective - II	3	0	0	3
5	MT702PC	Industrial Oriented Mini Project/ Summer Internship	0	0	0	2*
6	MT703PC	Seminar	0	0	2	1
7	MT704PC	Project Stage - I	0	0	6	3
		Total Credits	**15**	**0**	**8**	**21**

IV YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1		Professional Elective – V	3	0	0	3
2		Professional Elective – VI	3	0	0	3
3		Open Elective - III	3	0	0	3
4	MT801PC	Project Stage -II	0	0	14	7
		Total Credits	**9**	**0**	**14**	**16**

***MC - Environmental Science – Should be Registered by Lateral Entry Students Only.**
***MC – Satisfactory/Unsatisfactory**

Note: Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

Professional Elective - I

MT611PE	Analog and Digital IC Applications
ME611PE	Unconventional Machining Processes
MT613PE	Total Quality Management

Professional Elective – II

MT711PE	Operations Research
MT712PE	Computer Organization
MT713PE	Advanced Data Structures

Professional Elective – III

ME721PE	Power Plant Engineering
MT722PE	Product Design & Assembly Automation
ME723PE	Renewable Energy Sources

Professional Elective – IV

ME731PE	Computational Fluid Dynamics
MT732PE	Advanced Kinematics and Dynamics of Machinery
MT733PE	Flexible Manufacturing Systems

Professional Elective – V

MT811PE	MEMS Design
MT812PE	Production Planning and Control
MT813PE	Concurrent Engineering

Professional Elective – VI

MT821PE	Automation in Manufacturing
MT822PE	MATLAB Applications
MT823PE	Mathematical Modeling and Simulation

MT701PC/ME722PE: AUTOMOBILE ENGINEERING (PC)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

UNIT - I

Introduction: Layout of automobile – introduction chassis and body components. Types of Automobile engines. – Power unit – Introduction to engine lubrication – engine servicing

Fuel System: S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump – filters – carburetor – types – air filters – petrol injection. Introduction to MPFI and GDI Systems.

C.I. Engines: Requirements of diesel injection systems, types of injection systems, DI Systems IDI systems. Fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps. Introduction to CRDI and TDI Systems.

UNIT - II

Cooling System: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporative cooling – pressure sealed cooling – antifreeze solutions.

Ignition System: Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser, and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

Electrical System: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT - III

Transmission System: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, fluid fly wheel – gear boxes, types, sliding mesh, constant mesh, synchro mesh gear boxes, epicyclic gear box, over drive torque converter. Propeller shaft – Hotch – Kiss drive, Torque tube drive, universal joint, differential rear axles – types – wheels and tyres.

Suspension System: Objects of suspension systems – rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

UNIT - IV

Braking System: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes.

Steering System: Steering geometry – camber, castor, king pin rake, combined angle toein, center point steering. Types of steering mechanism – Ackerman steering mechanism, Davis steering mechanism, steering gears – types, steering linkages.

UNIT - V

Emissions from Automobiles – Pollution standards National and international – Pollution Control – Techniques – Multipoint fuel injection for SI Engines. Common rail diesel injection Energy alternatives – Solar, Photo-voltaic, hydrogen, Biomass, alcohols, LPG, CNG, liquid Fuels, and gaseous fuels, Hydrogen as a fuel for IC Engines. - Their merits and demerits. Standard Vehicle maintenance practice.

TEXT BOOKS:

1. Automobile Engineering / William H Crouse
2. A Text Book Automobile Engineering–Manzoor, Nawazish Mehdi & Yosuf Ali, Frontline Publications.

REFERENCE BOOKS:

1. A Text Book of Automobile Engineering by R K Rajput. Laxmi Publications.
2. Automotive Mechanics / Heitner
3. Automotive Engineering / Newton Steeds & Garrett
4. Automotive Engines / Srinivasan
5. A Text Book of Automobile Engineering by Khalil U Siddiqui New Age International

MT711PE: OPERATIONS RESEARCH (PE – II)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

UNIT - I

Development-definition-characteristics and phases-Types of models-Operations Research models-applications.

Allocation: Linear Programming Problem Formulation-Graphical solution- Simplex method-Artificial variable techniques: Two-phase method, Big-M method.

UNIT - II

Transportation problem - Formulation-Optimal solution, unbalanced transportation problem-Degeneracy.

Assignment problem- Formulation-Optimal solution - Variants of Assignment problem- Travelling salesman problem.

UNIT - III

Sequencing- Introduction-Flow-Shop sequencing- n jobs through two machines – n jobs through three machines- Job shop sequencing-two jobs through 'm' machines

Replacement: Introduction- Replacement of items that deteriorate with time- when money value is not counted and counted- Replacement of items that fail completely- Group Replacement.

UNIT - IV

Theory of Games: Introduction- Terminology- Solution of games with saddle points and without saddle points. 2 x 2 games- dominance principle- m x 2 & 2 x n games- Graphical method.

Inventory: Introduction- Single item, Deterministic models- purchase inventory models with one price break and multiple price breaks- Stochastic models _ Demand may be discrete variable or continuous variable- single period model and no setup cost.

UNIT - V

Waiting lines: Introduction- Terminology- Single channel- Poisson arrivals and Exponential service times with infinite population.

Dynamic Programming: Introduction- Terminology, Bellman's principle of optimality- Applications of Dynamic programming- shortest path problem- linear programming problem.

TEXT BOOKS:

1. Operations Research/ J. K. Sharma4e./ Mac Milan
2. Introduction to OR/ Hillier & Libemann/TMH

REFERENCE BOOKS:

1. Introduction to OR/Taha/PHI
2. Operations Research/NVS Raju/SMS Education/3rd Revised Edition
3. Operations Research /A.M. Natarajan, P. Balasubramaniam, A. Tamilarasi/Pearson Education.
4. Operations Research/ Wagner/ PHI Publications.
5. Operations Research/M.V. Durga Prasad, K. Vijaya Kumar Reddy, J. Suresh Kumar/Cengage Learning.

MT712PE: COMPUTER ORGANIZATION (PE - II)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- To understand basic components of computers.
- To explore the I/O organizations in depth.
- To explore the memory organization.
- To understand the basic chip design and organization of 8086 with assembly language programming.

Course Outcome:

- After this course students understand in a better way the I/O and memory organization in depth. They should be in a position to write assembly language programs for various applications.

UNIT- I

Basic Computer Organization - Functions of CPU, I/O Units, Memory Instruction: Instruction Formats - One address, two addresses, zero addresses and three addresses and comparison; addressing modes with numeric examples: Program Control - Status bit conditions, conditional branch instructions, Program Interrupts: Types of Interrupts.

UNIT- II

Input-Output Organizations - I/O Interface, I/O Bus and Interface modules: I/O Vs memory Bus, Isolated Vs Memory-Mapped I/O, Asynchronous data Transfer-Storbe Control, Hand Shaking: Asynchronous Serial transfer- Asynchronous Communication interface, Modes of transfer programmed I/O, Interrupt Initiated I/O, DMA; DMA Controller, DMA Transfer, IOP-CPU-IOP Communication, Intel* IOP.

UNIT - III

Memory Organizations: Memory hierarchy, Main Memory, RAM, ROM Chips, Memory Address Map, Memory Connection to CPU, associate memory, Cache Memory, Data Cache, Instruction cache, Miss and Hit ratio, Access time associative, set associative, mapping, waiting into cache, Introduction to virtual memory.

UNIT- IV

8086 CPU Pin Diagram- Special functions of general purpose registers. Segment register, concept of pipelining, 8086 Flag register, Addressing modes of 8086.

UNIT- V

8086-Instruction formats: assembly Language Programs involving branch & Call instructions, sorting, evaluation of arithmetic expressions.

TEXT BOOKS:

1. Computer System Architecture: Moris Mano (UNIT - 1, 2, 3).
2. Advanced Micro Processor and Peripherals - Hall/ A K Ray (UNIT - 4, 5).

REFERENCE BOOKS:

1. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
2. Structured Computer Organization and Design - Andrew S. Tanenbaum, 4th Edition PHI/Pearson.
3. Fundamentals or Computer Organization and Design - Sivaraama Dandamudi Springer Int. Edition.

4. Computer Architecture a quantitive approach, Jhon L. Hennessy and David A. Patterson, Fourth Edition Elsevier.
5. Computer Architecture: Fundamentals and principles of Computer Design, Joseph D. Dumas II, BS Publication

MT713PE: ADVANCED DATA STRUCTURES (PE - II)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- To understand the basic concepts such as Abstract Data Types, Linear, and Non-Linear Data structures.
- To understand the notations used to analyze the Performance of algorithms.
- To understand the behaviour of data structures such as stacks, queues, trees, hash tables, search trees, Graphs and their representations.
- To choose the appropriate data structure for a specified application.
- To understand and analyze various searching and sorting algorithms.
- To write programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables, search trees.

Course Outcomes:

- Learn how to use data structure concepts for realistic problems.
- Ability to identify appropriate data structure for solving computing problems in respective language.
- Ability to solve problems independently and think critically.

UNIT – I

Basic concepts- Algorithm Specification-Introduction, Recursive algorithms, Data Abstraction Performance analysis- time complexity and space complexity, Asymptotic Notation-Big O, Omega, and Theta notations, Introduction to Linear and Non-Linear data structures. Singly Linked Lists-Operations-Insertion, Deletion, Concatenating singly linked lists, circularly linked lists-Operations for Circularly linked lists, Doubly Linked Lists- Operations Insertion, Deletion. Representation of single, two dimensional arrays, sparse matrices-array and linked representations.

UNIT – II

Stack ADT, definition, operations, array and linked implementations in C, applications-infix to postfix conversion, Postfix expression evaluation, recursion implementation, Queue ADT, definition and operations, array and linked Implementations in C, Circular queues -Insertion and deletion operations, Deque (Double ended queue) ADT, array and linked implementations in C.

UNIT – III

Trees – Terminology, Representation of Trees, Binary tree ADT, Properties of Binary Trees, Binary Tree Representations-array and linked representations, Binary Tree traversals, threaded binary trees, Max Priority Queue ADT-implementation-Max Heap-Definition, Insertion into a Max Heap, Deletion from a Max Heap. Graphs – Introduction, Definition, Terminology, Graph ADT, Graph Representations Adjacency matrix, Adjacency lists, Graph traversals – DFS and BFS.

UNIT – IV

Searching – Linear Search, Binary Search, Static Hashing-Introduction, hash tables, hash functions, Overflow Handling. Sorting-Insertion Sort, Selection Sort, Radix Sort, Quick sort, Heap Sort, Comparison of Sorting methods.

UNIT – V

Search Trees-Binary Search Trees, Definition, Operations- Searching, Insertion and Deletion, AVL Trees-Definition and Examples, Insertion into an AVL Tree, B-Trees, Definition, BTree of order m, operations-Insertion and Searching, Introduction to Red-Black and Splay Trees (Elementary treatment-

only Definitions and Examples), Comparison of Search Trees. Pattern matching algorithm- The Knuth-Morris-Pratt algorithm, Tries (examples only).

TEXT BOOKS:

1. Fundamentals of Data structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson-Freed, Universities Press.
2. Data structures A Programming Approach with C, D. S. Kushwaha and A.K. Misra, PHI.

REFERENCE BOOKS:

1. Data structures: A Pseudo code Approach with C, 2nd edition, R. F. Gilberg And B. A. Forouzan, Cengage Learning.
2. Data structures and Algorithm Analysis in C, 2nd edition, M. A. Weiss, Pearson.
3. Data Structures using C, A.M. Tanenbaum, Y. Langsam, M. J. Augenstein, Pearson.
4. Data structures and Program Design in C, 2nd edition, R. Kruse, C. L. Tondo and B. Leung, Pearson.
5. Data Structures and Algorithms made easy in JAVA, 2nd Edition, Narsimha Karumanchi, Career Monk Publications.
6. Data Structures using C, R. Thareja, Oxford University Press.
7. Data Structures, S. Lipscutz, Schaum's Outlines, TMH.
8. Data structures using C, A. K. Sharma, 2nd edition, Pearson.
9. Data Structures using C & C++, R. Shukla, Wiley India.
10. Classic Data Structures, D. Samanta, 2nd edition, PHI.
11. Advanced Data structures, Peter Brass, Cambridge.

ME721PE: POWER PLANT ENGINEERING (PE - III)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Pre-Requisites: None

Course Objective: The goal of this course is to become prepared for professional engineering design of conventional and alternative power-generation plants. The learning objectives include

- Analysis and preliminary design of the major systems of conventional fossil-fuel steam-cycle power plants.
- A working knowledge of the basic design principles of nuclear, gas turbine, combined cycle, hydro, wind, geothermal, solar, and alternate power plants.
- Awareness of the economic, environmental, and regulatory issues related to power generation.

Course Outcomes: At the end of the course students are able to:

- Understand the concept of Rankine cycle.
- Understand working of boilers including water tube, fire tube and high-pressure boilers and determine efficiencies.
- Analyze the flow of steam through nozzles
- Evaluate the performance of condensers and steam turbines
- Evaluate the performance of gas turbines

UNIT – I

Introduction to the Sources of Energy – Resources and Development of Power in India.

Steam Power Plant: Plant Layout, Working of different Circuits, Fuel and handling equipments, types of coals, coal handling, choice of handling equipment, coal storage, Ash handling systems.

Combustion Process: Properties of coal – overfeed and underfeed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment.

UNIT – II

Internal Combustion Engine Plant: Diesel Power Plant: Introduction – IC Engines, types, construction– Plant layout with auxiliaries – fuel supply system, air starting equipment, lubrication and cooling system – super charging.

Gas Turbine Plant: Introduction – classification - construction – Layout with auxiliaries – Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison.

UNIT – III

Hydro Electric Power Plant: Water power – Hydrological cycle / flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways.

Hydro Projects and Plant: Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

UNIT – IV

Nuclear Power Station: Nuclear fuel – breeding and fertile materials – Nuclear reactor – reactor operation. **Types of Reactors:** Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

UNIT – V

Power Plant Economics and Environmental Considerations: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, load duration curve.

Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control.

TEXT BOOKS:

1. Power Plant Engineering/ P. K. Nag / Mc Graw Hill
2. Power Plant Engineering / Hegde / Pearson.

REFERENCES BOOKS:

1. Power Plant Engineering / Gupta / PHI
2. Power Plant Engineering / A K Raja / New age

MT722PE: PRODUCT DESIGN AND ASSEMBLY AUTOMATION (PE - III)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

UNIT - I

Automatic feeding and Orienting Devices: Vibrator feeders, Mechanics of vibratory Conveying, Load sensitivity, solutions to load sensitivity, spiral elevators balanced feeders, Types of oriental systems, effect of active orienting devices on feed rate natural resting aspects of parts for automatic handling, out-of-bowl tooling, Reciprocating - tube hopper feeder

UNIT - II

Automatic Assembly Transfer Systems: Assembly machines classification, Continuous transfer, intermittent transfer, indexing mechanisms, and operator paced free - transfer machine, choice of assemble method, advantages and disadvantages of automation.

UNIT- III

Product design for High speed Automatic Assembly and Robot Assembly: Introduction, design of parts for: high speed, feeding and orienting, example, additional feeding difficulties, high speed automatic insertion, example, anlysis of an assembly, general rules for product design for automation, product design for robot assembly.

UNIT-IV

Design for Manual Assembly: General design guidelines for manual assembly, development of the systematic DFA methodologv, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time. Parts requiring two hands for manipulation, effect of symmetry, effect of chamfer design, on insertion operations, estimation of insertion time, reducing disk assembly problems.

UNIT-V

Performance and Economics of Assembly Systems: Indexing machines-effects of parts quality on down time and production time, free transfer machines- performance of free transfer machine comparison of indexing and free transfer machines.

TEXT BOOKS:

1. Geoffrey Boothroyd, "Assembly Automation and Product Design", Marcel Dekker Inc., NY, 1992.
2. Geoffrey Boothroyd, Peter Dewhurst, Winston Knight, “Product design for Manufacture and assembly”, 2e, CRC Press.

REFERENCE BOOKS:

1. A.K. Chitale, RC Gupta, “Product design and manufacturing”, PHI
2. Geoffrey Boothroyd,” Hand Book of Product Design” Marcel and Dekken, N.Y. 1990.
3. A Delbainbre “Computer Aided Assembly London, 1992.

ME723PE: RENEWABLE ENERGY SOURCES (PE - III)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

- To explain the concepts of Non-renewable and renewable energy systems
- To outline utilization of renewable energy sources for both domestic and industrial applications
- To analyse the environmental and cost economics of renewable energy sources in comparison with fossil fuels.

Course Outcomes:

- Understanding of renewable energy sources
- Knowledge of working principle of various energy systems
- Capability to carry out basic design of renewable energy systems

UNIT- I

Global and National Energy Scenario: Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO_2 reduction potential of renewable energy- concept of Hybrid systems.

UNIT- II

Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

UNIT- III

Wind Energy: Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy – Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

UNIT- IV

Biogas: Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.

UNIT-V

Ocean Energy: Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

1. **Small hydro Power Plant:** Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.
2. **Geothermal Energy**: Geothermal power plants, various types, hot springs and steam ejection.

TEXT BOOKS:

1. Renewable Energy Sources / Twidell, J.W. and Weir, A./ EFN Spon Ltd., 1986.
2. Non-Conventional Energy Sources / G.D Rai/ Khanna Publishers

REFERENCE BOOKS:

1. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi, 2012
2. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K, 1996.

ME731PE: COMPUTATIONAL FLUID DYNAMICS (Professional Elective – IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

Pre-requisite: Heat Transfer and Fluid Mechanics

Course Objective: To apply the principles of Heat Transfer and Fluid Mechanics to formulate governing equations for physical problems and to solve those using different numerical techniques

Course Outcomes: At the end of the course, the student should be able to:

- Differentiate between different types of Partial Differential Equations and to know and understand appropriate numerical techniques.
- Solve the simple heat transfer and fluid flow problems using different numerical techniques, viz., FDM.
- Understand and to appreciate the need for validation of numerical solution.

UNIT - I:

Basic Aspects of the Governing Equations – Physical Boundary Conditions – Methods of solutions of Physical Problems – Need for Computational Fluid Dynamics – Different numerical/CFD techniques – FDM, FEM, FVM etc., - Main working principle - CFD as a research and design tool – Applications in various branches of Engineering.

Mathematical behavior of Partial Differential Equations (Governing Equations): Classification of linear/ quasi linear PDE – Examples - Physical Processes: Wave Equations and Equations of Heat Transfer and Fluid Flow – Mathematical Behavior - General characteristics – Its significance in understanding the physical and numerical aspects of the PDE – One way and Two Way variables – Well posed problems – Initial and Boundary Conditions.

Solution of Simultaneous Algebraic Equations: Direct Method – Gauss Elimination – LU Decomposition – Pivoting – Treatment of Banded Matrices – Thomas Algorithm.

Iterative Method: Gauss Seidel and Jordan Methods - Stability Criterion.

UNIT - II:

Finite Difference Method: Basic aspects of Discretization – Finite Difference formulae for first order and second order terms – Solution of physical problems with Elliptic type of Governing Equations for different boundary conditions - Numerical treatment of 1D and 2D problems in heat conduction, beams etc., - Solutions –Treatment of Curvelinear coordinates – Singularities – Finite Difference Discretization – Solution of 1D heat conduction problems in Heat conduction in curve linear coordinates.

UNIT - III:

FDM: Solution of physical problems with Parabolic type of Governing Equations – Initial Condition – Explicit, implicit and semi implicit methods – Types of errors – Stability and Consistency – Von Neumann Stability criterion– Solution of simple physical problems in 1D and 2D – Transient Heat conduction problems- ADI scheme - Simple Hyperbolic type PDE - First order and Second order wave equations – Discretization using Explicit method - Stability criterion – Courant Number – CFL Condition - Its significance - Treatment of simple problems.

UNIT - IV:

Finite Difference Solution of Unsteady Inviscid Flows: Lax – Wendroff Technique – Disadvantages – Maccormack's Technique.

Fluid Flow Equations – Finite Difference Solutions of 2D Viscous Incompressible flow problems – Vorticity and Stream Function Formulation – Finite Difference treatment of Lid Driven Cavity Problem -

Application to Cylindrical Coordinates with example of flow over infinitely long cylinder and sphere – Obtaining Elliptic Equations.

UNIT - V:

Finite Difference Applications in Fluid flow problems: Fundamentals of fluid Flow modeling using Burger's Equation – Discretization using FTCS method with respect to Upwind Scheme and Transport Property – Upwind Scheme and Artificial Viscosity.

Solutions of Navier Stokes Equations for Incompressible Fluid Flows: Staggered Grid – Marker and Cell (MAC) Formulation – Numerical Stability Considerations – Pressure correction method - SIMPLE Algorithm.

TEXT BOOKS:

1. Computational Fluid Dynamics: The basics with applications/ John D Anderson/McGraw Hill Publications
2. Numerical Heat Transfer and Fluid Flow/ S.V. Patankar/ Mc Graw Hill

REFERENCE BOOKS:

1. Computational Fluid Flow and Heat Transfer / K Muralidharan and T Sudarajan/ Narosa Publishers.
2. Computational Methods for Fluid Dynamics / Firziger & Peric/ Springer

MT732PE: ADVANCED KINEMATICS AND DYNAMICS OF MACHINERY (PE - IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

UNIT - I:
Geometry of motion-Grublers Criterion for plain and spatial mechanisms- Grashoff's law for planar and spatial mechanisms, Kutn batch criterion for planar and spatial mechanisms velocity and acceleration analysis, use of computers in analysis. Velocity and accelerations analysis of complex mechanisms.

UNIT - II:
Coupler curves, Robert's chebychev spacing method. Cognate linkages. Path curvature- polodes- euler savery equation – bobiller and hartman's construction- equivalent mechanisms.
Space mechanisms and mobility equations: positional problems. Vector analysis of velocity and accelerations

UNIT - III:
Theorem of angular velocities and accelerations- computer aided analysis.
Static force analysis of plane and spatial mechanisms: Inertia forces and torques. Dynamics force analysis, application of computer animation and simulation of motion studies.

UNIT - IV:
Dynamic motion analysis: Quinn's energy distribution method, the equivalent mass and force method. The rate of change of energy method, dynamic motion simulation.

UNIT - V:
Synthesis of linkages: Two position synthesis, properties of rolopole, chebychev spacing. Optimization of the transmission angles. The overlay method; three-position synthesis; point position reduction; synthesis of dwell mechanisms.
Codes/Tables: no table/codebooks required for examination

TEXT BOOKS:
1. Kinematics and dynamics and design of machinery, Waldron, Wiley publishers.
2. Shigley: J.E. Kinematic Analysis of mechanisms, McGraw 11.

REFERENCE BOOKS:
1. Hirschcom: J. K. Kincibcs and Dynamics of Plane Mechanisms McGraw Hill.
2. Holewenko, A.R. Dynamics of machinery, John Wiley & Sons.

MT733PE: FLEXIBLE MANUFACTURING SYSTEMS (PE - IV)

B.Tech. IV Year I Sem.

L	T	P	C
3	0	0	3

UNIT - I

Introduction: Types of production, characteristics, applications, need for FMS, where to apply FMS technology. Components of FMS, FMS layout configurations, planning the FMS, FMS's Work- stations. Flexible Manufacturing Cell: Characteristics, Flexible Machining systems, achieving flexibility in machining systems, Machine cell design, quantitative techniques

UNIT - II

Group Technology (GT) —Part classification and coding systems: Part families, Optiz system, structure, MULTICODE, differences between Optiz and MULTICODE systems, relative benefits. GT-production flow analysis: Composite part concept, numerical problems for pads clustering. advantages of GT in manufacturing and design.

UNIT - III

Material Handling systems, Automatic Guided vehicle systems, Automated storage and retrieval systems and Computer control systems.

UNIT - IV

Implementing FMS: FMS Layout configurations, Quantitative Analysis methods
for FMS, Applications and benefits of FMS, problems in implementing EMS.

UNIT - V

Computer Aided Process planning: Importance, generative and retrieval
systems, advantages and disadvantages, Generation of route sheets, selection of optimal machining parameters, methods.
Computer aided quality control and testing: Coordinate measuring machines, over view, contact and non-contact inspection principles, Part programming coordinate measuring machines, In-cycle gauging

TEXT BOOKS:

1. Automation, Production systems and Computer Integrated Manufacturing System — Mikell P. Groover
2. The design and operation of FMS -Or. Paul Ranky Nort —Holland Publishers

REFERENCE BOOKS:

1. Flexible Manufacturing systems in practice by Joseph talvage and roger G. Hannarn, Marcel Dekker Inc., New York
2. Hand book of FMS-Nand Jha.K.
3. FMS and control of machine tools – V. Ratmirov, MIR publications
4. Flexible Manufacturing — David J. Parrish

MT811PE: MEMS DESIGN (PE - V)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

UNIT - I

Introduction, Integrated Circuits, MEMs, Micro sensors, Micro actuators, Microelectronics, Fabrication, micromachining, Mechanical MEMS, Thermal MEMs, MOEMS, Magnetic MEMEs, RF MEMS, Micro fluid systems, Bio and thermo-devices, Nanotechnology, Modeling, Simulation.

Micromachining: Introduction, Photolithography, Structural and sacrificial materials, other lithography methods, Thin film deposition, impurity doping, etching, Problems with bulk Micro Machining, Surface Machining, Bulks.

UNIT - II

System Modeling and properties of Material: Introduction, Need for modeling, system types, basic Model elements in mechanical systems, Electrical system, Fluid system and Thermal systems, Translational pure mechanical system with spring, damper and mass –Rotational pure mechanical system with spring, damper and mass –Rotational pure mechanical system with spring, damper and mass.

Passive Components and systems: Introduction, system-on-a-chip, passive electronic systems, passive mechanical systems.

UNIT - III

Mechanical Sensors and Actuators: Introduction, Principles of sensing and actuation, Beam and cantilever, Micro plates, captive Effects, Piezo Electric Material as sensing and actuating elements, strain measurement, pressure measurements, flow measurement using integrated paddle cantilever structure.

Thermal sensors and actuators: Introduction, Thermal energy basics and heat transfer process, Thermistors, Thermo devices, Thermocouple, Micro machined thermocouple probe, Peltier effect heat pumps, Thermal flow sensors, Microhot plate gas sensors, shape memory Alloys, U-shaped horizontal and vertical Electrothermal Actuators, Thermally activated MEMEs relay.

UNIT - IV

Micro-Opto-Electromechanical systems: Introduction, fundamental principle of MOEMs Technology, Review on properties of light, Light Modulators, beam Splitters, Microlense, Micro mirrors, digital micromirror device, light detectors, grating light valve, optical switch, waveguide and tuning, shear Stress measurement, Magnetic Sensors and actuators.

UNIT - V

Radiofrequency MEMS: Introductions, Review of RF –based communication systems, RF MEMs, MEMs Inductors, varactors, tuners/filter, resonator, clarification of Tuner, filter, resonators, MEMS switches, phase shifter, Micro fluidic systems, Introduction, Applications.

TEXT BOOKS:

1. MEMS, Nitaigour Premchand Mahalik, TMH.
2. MEMS & Micro Systems design and Manufacture, Tai-ran HSU, TMH, 2006.

REFERENCE BOOKS:

1. Mechatronics Systems Fundamentals-Rolf Isermann-Springer International Edition.
2. The science and engineering of Micro Electronic Fabrication, 2nd ed. By. S.A. Cambell, Published by Oxford University Press (2001).
3. Fundamentals of Micro Fabrication: The science of Miniaturization, 2nd Edition by M.J. Madou, published by CRC Press (2002).

4. Introductory MEMS: Fabrication and application by Adams, Thomas M. Layton Richard A., 1st Edition 2010 IBNL 978-0-387-09510-3, Springer.
5. Microsystems Design, Stephen D.Senturia, Springer International Edition.

MT812PE: PRODUCTION PLANNING AND CONTROL (PE - V)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives: Understand the importance of Production planning & control. Learning way of carrying out various functions so as to produce right product, right quantity at right time with minimum cost.

Course Outcomes: At the end of the course, the student will be able to understand production systems and their characteristics. Evaluate MRP and JIT systems against traditional inventory control systems. Understand basics of variability and its role in the performance of a production system. Analyze aggregate planning strategies. Apply forecasting and scheduling techniques to production systems. Understand theory of constraints for effective management of production systems.

UNIT – I

Introduction: Definition – Objectives of Production Planning and Control – Functions of production planning and control - Types of production systems - Organization of production planning and control department.

Forecasting – Definition- uses of forecast- factors affecting the forecast- types of forecasting- their uses - general principle of forecasting. Forecasting techniques- quantitative and qualitative techniques. Measures of forecasting errors.

UNIT – II

Inventory management – Functions of inventories – relevant inventory costs – ABC analysis – VED analysis – Basic EOQ model- Inventory control systems –continuous review systems and periodic review systems, MRP I, MRP II, ERP, JIT Systems - Basic Treatment only. **Aggregate planning –** Definition – aggregate-planning strategies – aggregate planning methods – transportation model.

UNIT – III

Line Balancing: Terminology, Methods of Line Balancing, RPW method, Largest Candidate method and Heuristic method.

Routing – Definition – Routing procedure – Factors affecting routing procedure, Route Sheet.

UNIT – IV

Scheduling –Definition – Scheduling Policies – types of scheduling methods – differences with loading – flow shop scheduling **–** job shop scheduling, line of balance (LOB) – objectives - steps involved.

UNIT – V

Dispatching: Definition – activities of dispatcher – dispatching procedures – various forms used in dispatching.

Follow up: definition – types of follow up – expediting – definition – expediting procedures-Applications of computers in planning and control.

TEXT BOOKS:

1. Operations management – Heizer- Pearson.
2. Production and Operations Management / Ajay K Garg / Mc Graw Hill.

REFERENCE BOOKS:

1. Production Planning and Control - Text & cases/ SK Mukhopadhyaya /PHI.
2. Production Planning and Control - Jain & Jain – Khanna publications
3. Production and operations Management/ R. Panner Selvam/PHI

4. Operations Management /Chase/ PHI
5. Production and Operations Management (Theory and Practice)/ Diparkar Kumar Bhattacharyya/ University Press.
6. Operations Management/S.N. Chary/TMH.

MT813PE: CONCURRENT ENGINEERING (PE - V)

B.Tech. IV Year II Sem.

L	T	P	C
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UNIT - I

Introduction: Development of concurrent engineering. The mean and activity concepts and principles, Examples.

Concurrent Engineering Tools and Technologies: Changes in to technologies, Tasks, Talents and times into well managed resources Product Developments.

UNIT - II

Research in engineering design and manufacturing: Theory applications using the concurrent Engineering concepts and Principles.

Simultaneous design all related processes of a product.

UNIT - III

The mission and vision of C.E: Computer optimized manufacturing (COM). The next generation of computer integrated manufacturing (CIM).

Global competitiveness and development of high-quality product. Offline reliability.

UNIT - IV

Managing the concurrent Engineering: Contemporary Issues a modern Tools and methods Use of computers and decision making. Reengineering Concepts.

UNIT - V

Automated Quality control Application OF CMM, Basic concepts, Zero defect, 6 sigma concept, Tolerancing, Examples, DFMA, Rapid Prototyping.

TEXT BOOK:

1. Concurrent engineering: Tools and Technologies for Mechanic systems Design- Edward J. Haug.

REFERENCE BOOKS:

1. Research in engineering Design: Theory, Applications and concurrent engineering: Vol. 7 No. 1, 1995.
2. Managing concurrent Engineering – Jon Turino.

ME712PE/MT821PE: AUTOMATION IN MANUFACTURING (PE - VI)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

UNIT - I

Introduction: Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools. Mechanical feeding and too changing and machine tool control transfer the automaton.

UNIT - II

Automated flow lines: Methods or work part transport transfer Mechanical buffer storage control function, design and fabrication consideration.

Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage, partial automation, implementation of automated flow lines.

UNIT - III

Assembly system and line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT - IV

Automated material handling: Types of equipment, functions, analysis and design of material handling systems conveyor systems, automated guided vehicle systems.

Automated storage systems, Automated storage and retrieval systems; work in process storage, interfacing handling and storage with manufacturing.

UNIT - V

Fundamentals of Industrial controls: Review of control theory, logic controls, sensors and actuators, Data communication and LAN in Manufacturing.

Business process Re-engineering: Introduction to BPE logistics, ERP, Software configuration of BPE.

TEXT BOOK:

1. Automation, Production Systems and Computer Integrated Manufacturing: M.P. Groover 3e./PE/PHI, 2009.

REFERENCE BOOKS:

1. Computer Aided Manufacturing, Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang, Pearson, 2009.
2. Automation by W. Buekinsham.

MT822PE: MATLAB APPLICATIONS (PE - VI)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

UNIT - I

Starting with MATLAB: Command Window, Arithmetic Operations, Display Formats, Built-In Functions, Variables, Useful Commands, Script Files, Examples of MATALAB Applications.

UNIT - II:

Arrays and Mathematical Operations: One and two-dimensional Array, zero's ones and, eye Commands, Array Addressing, Vector Matrix, Strings and Strings as Variables. Addition, Subtraction, Multiplication and Array Division, Built-in MATH Functions, Generation of Random Numbers, Script File operations Examples

UNIT - III:

Programming in MATLAB: Plot, line, hold on and hold off Commands, Formatting a Plot, Polar Plots. Relational and Logical Operators, Conditional Statements, Nested Loops and Nested Conditional Statements, User-Defined Functions and Function Files, Comparison between Script Files and Function Files, Anonymous and Inline Functions, Function Functions, Sub-functions. Nested Functions, Examples.

UNIT - IV:

Polynomials, Curve Fitting, and Interpolation: Polynomials, Value of Polynomial, Roots of Polynomial, Addition, Multiplication, Derivatives and Division of Polynomials, Curve Fitting Curve Fitting with Polynomials, The polyfit Function.

UNIT - V:

Applications in Numerical Analysis: One variable, Integration, Ordinary Differential Equations, Mesh, surface, special graphs, view commands, symbolic objects and expressions, algebraic equation, differentiation, integration, Examples

TEXT BOOKS:

1. MATLAB An Introduction with Applications, 4h Edition, Amos Gilat, WILEY Publishers.
2. MATLAB Programming for Engineers, 4th Edition, Stephen J. Chapman, Cengage Publishers.

REFERENCE BOOKS:

1. Essential-MATLAB for Engineers and Scientists, 4th Edition, Brian H. Hahan and Daniel T. Valentine, Elsevier Publications.
2. MATLAB-A practical Introduction to programming and problem solving, 2nd Edition, Stormy Attaway, Elsevier BH.

MT823PE: MATHEMATICAL MODELING AND SIMULATION (PE - VI)

B.Tech. IV Year II Sem.

L	T	P	C
3	0	0	3

UNIT - I:

Art of Modeling, Types of models, mathematical models - solution methods analytical, Numerical and Heuristic. L.P.P. - Formulation - Graphical 1 Method, simplex method, dual simplex method and application Transportation models - Assignment models, Integer programming, Non- linear programming

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UNIT – II:

Deterministic Inventory models General Inventory model, Static E.O.Q. Models, Dynamic Inventory model, Probabilistic Inventory models, continuous Review models, single period model and multiple period model Selective Inventory control - ABC, VED, FSN Analysis. Inventory systems - Fixed order quantity system, two bin system, periodic review systems, Optional Replenishment system and MRP

UNIT - III:

Queuing Theory - Basic Structure of Queuing Models, Role of Exponential Distribution, Birth-and-Death Process, Queuing Models Based on the Birth- and- Death Process, Queuing Models involving Non-exponential Distributions, Priority-Discipline Queuing Models and Queuing Networks. Applications of Queuing Theory - Decision Making, Formulation of Waiting Cost Function and Decision Models

UNIT- IV:

CPM and PERT Network Representation, Critical path calculation, construction of Time schedule. Simulation Introduction, General principles, Random-Number Generation, Random-Variate Generation, Simulation Software.

UNIT-V:

Input modeling, verification and validation of simulation models, Output Analysis for a single model, Comparison and Evaluation of Alternative System Designs, Simulation of Computer Systems.

TEXT BOOKS:

1. Introduction to Operations Research, Frederick S Hiller and Gerald J Lieberman, 7 Edition, Tata McGraw Hill, 2001 (Chapters 17 and 18 for Unit-lll).
2. Discrete-Event System Simulation, Jerry Banks, John S Carson II, Barry L. Nelson and David M. Nicol, 3' edition, PHI/Pearson Education (Chapters 1.3,4,7 and 8 for Unit-IV; Chapters 9,10,11,12 and 14 for Unit-V).
3. Operations Research - An Introduction, 7th edition, Prentice-Hall of India. 1999 (Chapter 1 to 5 for Unit-I and Chapters 11 and 16 for Unit II, Section 6.7 for Unit-IV).

REFERENCE BOOKS:

1. Operation Research -S.K.Jain and D. M. Mehta, Galgotia.
2. Introductory Operations Research: Theory & Applications, Kasana, Springer.
3. Applied Simulation Modelling - Seila, Ceric and Tadikamalla.
4. Simulation Modeling and Analysis - Averil M Law-TMH.
5. Operation Research-An Introduction 7th Edition, Prentice Hall of India, 1999 (Chapter 1 to 5 for Unit-I and Chapters 11 and 16 for Unit II, Section 6,7 for Unit - IV).