DEPARTMENT OF MECHANICAL ENGINEERING

COURSE STRUCTURE AND SYLLABUS

For

VII & VIII Semesters (V18 Regulation)

B.Tech. MECHANICAL ENGINEERING

(Applicable for batches admitted from 2018-2019)

DEPARTMENT OF MECHANICAL ENGINEERING (Accredited by NBA)

SRI VASAVI ENGINEERING COLLEGE (Autonomous)

PEDATADEPALLI, TADEPALLIGUDEM – 534 101

Sri Vasavi Engineering College (Autonomous)

(Sponsored by Sri Vasavi Educational Society)

(Approved by AICTE, New Delhi & Permanently affiliated to JNTUK, Kakinada)
(Accredited by NBA & NAAC with 'A' Grade, Recognized by UGC Under Section 2(f) & 12(B))

Pedatadepalli, Tadepalligudem, W.G.Dt, A.P-534101

DEPARTMENT OF MECHANICAL ENGINEERING

Course Structure of Mechanical Engineering - V18 Regulation
(For 2018 – 2019 Admitted Batch)

IV B.Tech

VII Semester						
S.No.	**Course Code**	**Course**	**L**	**T**	**P**	**Credits**
1	**V18MET20**	Automation in manufacturing	3	0	0	3
2	**V18MET21**	Operation Research	3	0	0	3
3		Professional Elective – II	3	0	0	3
4		Professional Elective – III	3	0	0	3
5		Open Elective – II	3	0	0	3
6	**V18MEL12**	Simulation Lab	0	0	3	1.5
7	**V18MEL13**	Production Drawing Lab	0	0	3	1.5
8	**V18MEL14**	Project Work –PART-A	0	0	9	3
			15	**0**	**15**	**21**

Contact hours: 30 Total Credits: 21

VIII Semester						
S.No.	**Course Code**	**Course**	**L**	**T**	**P**	**Credits**
	V18MET28	Automobile Engineering	3	0	0	3
1		Open Elective – III	3	0	0	3
2		Professional Elective - IV	3	0	0	3
3		Professional Elective –V	3	0	0	3
4	**V18MEL15**	Project Work – PART-B	0	0	18	9
			12	**0**	**18**	**21**

Contact hours : 30 Total Credits : 21

Open Elective –II **V18MEOE4-** Computer Aided Design **V18MEOE5-** Condition Monitoring & Machine learning	**Open Elective –III** **V18MEOE6-** Power Plant Engineering **V18MEOE7 -** Mechatronics

Professional Elective –II **V18MET22 -** Industrial Engineering and Management **V18MET23 -** Composite Materials **V18MET24 -** Refrigeration & Air Conditioning	**Professional Elective –III** **V18MET25 -**Total Quality Management **V18MET26 -** Finite Element Methods **V18MET27 -** Micro Electro Mechanical Systems (MEMS)
Professional Elective –IV **V18MET31 –** Process Planning & Cost Estimation **V18MET32 -** Non Destructive Evaluation **V18MET33 -** Industrial Hydraulics and Pneumatics	**Professional Elective –V** **V18MET34 -** Computational Fluid Dynamics **V18MET35-** Production Planning and Control **V18MET36 -** Energy Conservation and Management

Syllabi for the courses offered in VII semester B. Tech under V18 Regulation for the Academic Year 2021-2022

VII Semester

Semester	VII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET20
Name of the Course	Automation in Manufacturing					
Branch	Mechanical Engineering					

Course Outcomes:

After successful completion of the course, the student will be able to

CO1	Understand the basic types, levels, strategies of automation.	K2
CO2	Identify the basic components and their functions of automated production line system.	K2
CO3	Differentiate various automated assembly systems.	K4
CO4	Compute various storage system and transportation requirements of automated systems.	K3
CO5	Apply appropriate process control strategy to an automated system.	K3
CO6	Illustrate the concepts of CIM..	K3

UNIT – I

INTRODUCTION : Facilities — Manual work systems, worker-machine systems and automated systems. Manufacturing support systems, Automation in Production systems — Automated Manufacturing systems, Computerized manufacturing support systems, Manual labour in Production systems, Automation principles and strategies.

UNIT – II

AUTOMATED PRODUCTION LINES : Fundamentals- System configurations, work part transfer mechanisms, Storage buffers, and Control of the production line. Applications — Machining systems and System Design Considerations. Analysis of Transfer lines — Transfer lines with No internal parts storage, Transfer lines with internal storage buffers.

UNIT – III

AUTOMATED ASSEMBLY SYSTEMS : System configurations, Parts delivery at workstations, and applications, quantitative analysis of assembly systems-Parts Delivery System at Workstations, Multi-Station Assembly Machines, Single Station Assembly Machines, Partial Automation.

UNIT – IV

AUTOMATED MATERIAL TRANSPORT & STORAGE SYSTEMS : Automated Material Transport & Storage systems: Automated Guided Vehicle (AGV) Systems, Types and applications, Vehicle Guidance Technology, Vehicle Management and Vehicle safety. Automated Storage/Retrieval Systems (ASRS) and Carousel Storage Systems.

UNIT – V

AUTOMATED INSPECTION SYSTEMS : Quality in Design and manufacturing, inspection principles and strategies, automated inspection, contact Vison-contact, CMM. Manufacturing support systems. Quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.

UNIT – VI

COMPUTER INTEGRATED MANUFACTURING : The Scope of CAD/CAM and CIM, Computerized elements of a CIM System, Components of CIM, Database for CIM, Planning , Scheduling and Analysis of CIM Systems.

TEXT BOOKS:

1. Nagrath and Mittel, "Robotics and Control", Tata McGraw-Hill, 2003.
2. Mikell P Groover, " Automation, production Systems and Computer Integrated Manufacturing," 3rd Edition, Prentice Hall Inc., New Delhi, 2007.
3. Nanua Singh, "System Approach to Computer Integrated Manufacturing," Wiley & Sons Inc.,
4. CAD CAM: Principles, Practice and Manufacturing Management by Chris Mc Mohan, JimmieBrowne, Pearson edu. (LPE).
5. Automation by Buckinghsm W, Haper& Row Publishers, New York, 1961
6. Automation for Productivity by Luke H.D, John Wiley & Sons, New York, 1972.

REFERENCE BOOKS:

1. P. Radhakrishnan, S, Subrarnanyan and V, Raju, 'CAD/CAM/CIM', New Age International (P) Ltd., New Delhi, 2009.
2. S.R.Deb and Sankha Deb, 'Robotics Technology and Flexible Automation', Tata McGraw Hill,Seconcl Edition, New Delhi, 2010.
3. Peter Corke, 'Robotics, Vision and Control' Fundamental Algorithms in MATLAB', Springer, 2011.
4. Nicholas Odrey, MikellGroover, Roger Nagel, Ashish Dutta, 'Industrial Robotics (SIE): Technology, Programming and Applications', McGraw Hill, 2012.

WEB REFERENCES:

1. https://nptel_acinicourses/108/105/108105063/
2. https://www.automationmag.com/
3. https://www.springer.com/gp/book/9783319771786.
4. https://library.automationdirect.com/industrial-automation-top-10-trends/
5. https://nptel.ac.inicourses/112/102/112102011

Semester	VII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET21
Name of the Course	Operation Research					
Branch	Mechanical Engineering					

Course Outcomes:

After successful completion of the course, the student will be able to

CO1	Understand the formulating of LPP and solve LPP by Simplex methods, artificial variables techniques.	K2
CO2	Solve Transportation and assignment problems.	K3
CO3	Explain the concept of Sequencing and replacement of item.	K2
CO4	Understand the concept of queues with single server, solution of games with and without saddle points.	K2
CO5	Apply the concept of inventory models in solving EOQ problems.	K3
CO6	Solve the issues of dynamic programming and simulation.	K3

UNIT – I

HISTORICAL OVERVIEW – Definition and scope– types of operation research models – applications.

LINEAR PROGRAMMING: Problem formulation – graphical solution – simplex method – artificial variables techniques - big-M method, two–phase method.

UNIT – II

TRANSPORTATION PROBLEM: Formulation – optimal solution, unbalanced transportation problem – degeneracy

ASSIGNMENT PROBLEM: Introduction, optimal solution, Traveling Salesman problem.

UNIT – III

SEQUENCING – Introduction – flow –shop sequencing – *n* jobs through two machines – *n* jobs through three 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 – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games -graphical method.

WAITING LINES: Introduction – single channel – poison arrivals – exponential service times – with infinite population and finite population models

UNIT – V

INVENTORY : Introduction – single item – deterministic models – purchase inventory models with one price break– shortages are not allowed – stochastic models – demand may be discrete variable or continuous variable – instantaneous production. Instantaneous demand and continuous demand and no set up cost.

UNIT – VI

DYNAMIC PROGRAMMING: Introduction – Bellman's principle of optimality – applications of dynamic programming- capital budgeting problem – shortest path problem .

SIMULATION: Definition – types of simulation models – phases of simulation– applications of simulation – inventory and queuing problems – advantages and disadvantages – simulation languages.

TEXT BOOKS:

1. Operations Research / S.D.Sharma-Kedarnath
2. Operations Research by R. Pannerselvam; Publisher: Prentice Hall International.

REFERENCES:

1. Introduction to O.R/Hiller & Libermann (TMH).
2. Operations Research / A.M.Natarajan, P. Balasubramani, A. Tamilarasi / Pearson Education.
3. Operations Research: Methods & Problems / Maurice Saseini, Arhur Yaspan & Lawrence Friedman.

Semester	VII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET22
Name of the Course	**Industrial Engineering and Management** Professional Elective –II					
Branch	**Mechanical Engineering**					

Course Outcomes:

After successful completion of the course, the student will be able to

CO1	Design and conduct experiments, analyze, interpret data and synthesize valid conclusions	K4
CO2	Design a system, component, or process, and synthesize solutions to achieve desired needs	K4
CO3	Use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for public health and safety, cultural, societal, and environmental constraints	K3
CO4	Examine effectively within multi-disciplinary teams and understand the fundamental precepts of effective project management	K3
CO5	Understand quality and quality management	K2
CO6	Understand concepts on recourse management	K2

UNIT – I

INTRODUCTION: Definition of industrial engineering (I.E), development, applications, role of an industrial engineer, differences between production management and industrial engineering, quantitative tools of IE and productivity measurement. concepts of management, importance, functions of management, scientific management, Taylor's principles, theory X and theory Y, Fayol's principles of management.

UNIT – II

PLANT LAYOUT: Factors governing plant location, types of production layouts, advantages and disadvantages of process layout and product layout, applications, quantitative techniques for optimal design of layouts, plant maintenance, preventive and breakdown maintenance.

UNIT – III

WORK STUDY: Importance, types of production, applications, work study, method study and time study, work sampling, PMTS, micro-motion study, rating techniques, MTM, work factor system, principles of Ergonomics, flow process charts, string diagrams and Therbligs

UNIT – IV

STATISTICAL QUALITY CONTROL: Quality control, Queuing assurance and its importance, SQC, attribute sampling inspection with single and double sampling, Control charts – and R – charts and *S* charts and their applications, numerical examples.

UNIT – V

TOTAL QUALITY MANAGEMENT: zero defect concept, quality circles, implementation, applications, ISO quality systems. six sigma – definition, basic concepts

VALUE ANALYSIS: Value engineering, implementation procedure, enterprise resource planning and supply chain management.

UNIT – VI

RESOURCE MANAGEMENT: Concept of human resource management, personnel management and industrial relations, functions of personnel management, Job-evaluation, its importance and types, merit rating, quantitative methods, wage incentive plans, types.

PROJECT MANAGEMENT (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (simple problems).

TEXT BOOKS:

1. Industrial Engineering and management / O.P Khanna/Khanna Publishers.

2. Industrial Engineering and Production Management/Martand Telsang/S.Chand & Company Ltd. New Delhi

REFERENCE BOOKS:

1. Industrial Management / Bhattacharya DK/Vikas publishers
2. Operations Management / J.G Monks/McGrawHill Publishers.
3. Industrial Engineering and Management Science/T.R. Banga,S.C.Sharma, N. K. Agarwal/Khanna Publishers
4. Principles of Management /Koontz O' Donnel/McGraw Hill Publishers.
5. Statistical Quality Control /Gupta/Khanna Publishers
6. Industrial Engineering and Management /NVS Raju/Cengage Publishers

Semester	VII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET23
Name of the Course	**Composite Materials** Professional Elective –II					
Branch	**Mechanical Engineering**					

Course Outcomes:

After Successful completion of this course the student will be able to

CO1	Explain the required properties, reinforcements and uses of various composites.	K2
CO2	Explain how common fibers are produced and how the properties of the fibers are related to the internal structure and the interfaces obtained.	K2
CO3	Illustrate the processing techniques for polymer matrix, ceramic matrix and metal matrix composites and list out their properties and applications	K3
CO4	Analyze different ceramic composite materials	K4
CO5	Examine the processing of ceramic matrix composites	K3
CO6	Evaluate mechanical properties of composite materials	K5

UNIT-I

Introduction, Classification of Composite materials based on structure and matrix and reinforcements, Advantages and applications of composites, Functional requirements of reinforcement and matrix materials. Difference between composites and metals &alloys, Properties of composites in comparison with standard materials

UNIT-II

TYPES OF REINFORCEMENTS AND THEIR PROPERTIES: Glass, Carbon, Boron, Aramid, Al_2O_3 and SiC fibers. Nature and manufacture of glass, carbon and aramid fibers, Comparison of fibers. Role of interfaces: Wettability and Bonding, the interface in Composites, Interactions and Types of bonding at the Interface.

UNIT-III

Fabrication of Polymeric Matrix Composites, Structure and properties of Polymeric Matrix Composites, Interface in Polymeric Matrix Composites, Applications,Recycling of PMCs

UNIT-IV

FABRICATION OF METAL MATRIX COMPOSITES (MMC): Solid state fabrication, Liquid state fabrication and In-situ fabrication techniques. Interface in Metal Matrix Composites. Mechanical bonding, Chemical bonding and Interfaces in In-situ Composites. MMC: Properties and Applications.

UNIT -V

FABRICATION OF CERAMIC MATRIX COMPOSITES (CMC): Processing of CMCs: Cold Pressing and Sintering, Hot Pressing, Reaction Bonding Processes, Infiltration, Sol–Gel process. Interface in CMCs. Properties of CMCs, Applications of CMCs.

UNIT -VI

MECHANICAL TESTING OF COMPOSITES AND THEIR CONSTITUENTS: Measurement of Constituent Material Properties Fiber Tests, Neat Resin Matrix Tests, Constituent Volume Fraction Measurement. Measurement of Basic Composite Properties: Tensile Tests, Compressive Tests, Shear Tests, Flexure Tests, Fiber/Matrix Interface Tests.

TEXT BOOKS:

1. Composite Materials – Science & Engineering, K.K. Chawla, Springer-Verlag, New York, 1987.
2. Principles of Composite Material Mechanics, Ronald F. Gibson
3. An Introduction to Composite Materials, Hull, Cambridge, 2nd Edt.1997.

REFERENCE BOOKS:

1. Composites, Engineered Materials Handbook, Vol.1, ASM International, Ohio, 1988.
2. Structure and Properties of Composites, Materials Science and Technology, Vol. 13, VCH, Weinheim, Germany, 1993
3. Composite Materials: Engineering and Science, F.L. Matthews and R.D. Rawlings, Chapman & Hall, London, 1994.

Semester	VII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET24
Name of the Course	**Refrigeration & Air Conditioning** Professional Elective –II					
Branch	**Mechanical Engineering**					

Course Outcomes:

After successful completion of the course, the student will be able to

CO1	Apply the concept of refrigeration to various systems.	K3
CO2	Employ the methods to improve performance of vapor compression systems.	K3
CO3	Identify eco-friendly refrigerants and understanding various VCR System Components.	K2
CO4	Describe vapour absorption systems.	K2
CO5	Analyze cooling and heating loads in an air conditioning system.	K4
CO6	Explain various air conditioning systems.	K2

UNIT – I

INTRODUCTION TO REFRIGERATION: Necessity and applications – Unit of refrigeration and C.O.P. –Mechanical refrigeration – Types of ideal cycles of refrigeration.

Air refrigeration: Bell Coleman cycle - Open and Dense air systems – Refrigeration needs of Air crafts- Refrigeration systems used in air crafts and Problems.

UNIT – II

VAPOUR COMPRESSION REFRIGERATION: Working principle and essential components of the plant –simple vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – Effect of sub cooling and super heating – Cycle analysis – Actual cycle influence of various parameters on system performance – Use of p-h charts – Problems.

UNIT – III

Refrigerants – Classification – Desirable properties of an ideal refrigerant – Common refrigerants used – Nomenclature of refrigerants .

VCR System Components: Compressors – General classification – comparison – Advantages and Disadvantages. Condensers – Classification – Working Principles. Evaporators – Classification – Working Principles. Expansion devices – Types – Working Principles.

UNIT – IV

VAPOR ABSORPTION SYSTEM: Calculation of maximum COP – description and working of Water-Ammonia Systems, Water-Lithium Bromide System. Principle of operation three fluid absorption system, salient features.

UNIT – V

INTRODUCTION TO AIR CONDITIONING: Psychometric properties & Processes – Characterization of sensible and latent heat loads — Need for ventilation, Consideration of infiltration – Load concepts of RSHF, GSHF- Problems, concept of ESHF and ADP temperature.

Requirements of industrial air conditioning, Air conditioning load calculations.

UNIT – VI

AIR CONDITIONING SYSTEMS: Classification of equipment, Components related to Air- Conditioning Systems- filters, grills and registers, fans and blowers.

TEXT BOOKS:

1. A Course in Refrigeration and Air conditioning , SC Arora & Domkundwar, Dhanpatrai
2. Refrigeration and Air Conditioning , CP Arora, TMH.
3. Refrigeration and Air Conditioning / Manohar Prasad / New Age

REFERENCE BOOKS:

1. Principles of Refrigeration /Dossat / Pearson Education.
2. Basic Refrigeration and Air-Conditioning / Ananthanarayanan / TMH
3. Stoecker, W. F., and Jones, J. W., Refrigeration and Air-Conditioning, McGraw - Hill, New Delhi.
4. Data Book: Refrigerant and Psychrometric Properties - Tables and Charts [SI Units], MathurM. L., and Mehta F. S., Jain Brothers.

Semester	VII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET25
Name of the Course	**Total Quality Management** Professional Elective –III					
Branch	**Mechanical Engineering**					

Course Outcomes:

After the completion of this course, the students will be able to

CO1	Understand the importance of significance of quality & to understand the concept of Quality.	K2
CO2	Develop quality improvement teams & to implement Quality Implementation Programs.	K3
CO3	Identify requirements of quality improvement programs & bench marketing	K2
CO4	Apply the tools and techniques of quality management to manufacturing and services processes.	K3
CO5	Apply the concepts of comprehensive quality management and the challenges of putting them into practice.	K3
CO6	Apply the quality management methods for analysing and solving problems of organization.	K3

UNIT – I

INTRODUCTION: The concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs, Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT – II

CUSTOMER FOCUS AND SATISFACTION: The importance of customer satisfaction and loyalty-Crating satisfied customers, Understanding the customer needs, Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships. .

UNIT – III

BENCH MARKETING: Evolution of Bench Marketing, meaning of Bench marketing, benefits of bench marketing, the bench marketing process, pitfalls of bench marketing.

UNIT – IV

ORGANIZING FOR TQM: The systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organizing, Quality Circles. Productivity, Quality and Reengineering:

UNIT – V

THE COST OF QUALITY: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost Information, Accounting Systems and Quality Management.

UNIT – VI

QUALITY MANAGEMENT SYSTEM (QMS): Introduction to QMS. Universal Standards of Quality: ISO around the world, The ISO9001 ANSI/ASQCQ-Series Standards, benefits of ISO9001 certification, the third party audit, Documentation ISO9001 and services, the cost of certification implementing the system.

TEXT BOOKS:

1. Total Quality Management / Joel E.Ross/Taylor and Franscis Limited
2. Total Quality Management/P.N.Mukherjee/PHI
3. Total Quality Management Paperback / R Kesavan, C Elanchezhian, B Vijaya Ramnath / I K International Publishing House

REFERENCE BOOKS:

1. Beyond TQM / Robert L.Flood
2. Statistical Quality Control / E.L. Grant / McGraw Hill.
3. Total Quality Management- A Practical Approach/H. Lal
4. Quality Management/Kanishka Bedi/Oxford University Press/2011
5. Total Engineering Quality Management/Sunil Sharma/Macmillan

Semester	VII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET26
Name of the Course	**Finite Element Methods** Professional Elective – III					
Branch	**Mechanical Engineering**					

Course Outcomes:

After the completion of this course, the students will be able to

CO1	Use the concepts of variational methods and weighted residual methods in FEM.	K3
CO2	Use Finite Element Formulation for solving the problems.	K3
CO3	Solve the problems of Truss elements by FEM.	K3
CO4	Solve the problems of Beam s elements by FEM.	K3
CO5	Use FEM to solve 2D CST problems.	K3
CO6	Analyze finite element method for problems involving dynamics and heat transfer.	K4

UNIT-I

INTRODUCTION TO FINITE ELEMENT METHOD: stress and equilibrium, strain – displacement relations, stress-strain relations, plane stress and plane strain conditions, variational and weighted residual methods, the concept of potential energy, one-dimensional problems.

UNIT – II

FINITE ELEMENT FORMULATION: Discretization of the domain, element shapes, discretization procedures, assembly of stiffness matrix, bandwidth, node numbering, mesh generation, interpolation functions, convergence requirements, Treatment of Boundary conditions, Derivation of element stiffness matrix for Bar elements and problems

UNIT – III

ANALYSIS OF TRUSSES: Finite element modelling, coordinates and shape functions, assembly of global stiffness matrix and load vector, finite element equations, treatment of boundary conditions, stress, strain and support reaction calculations.

UNIT – IV

ANALYSIS OF BEAMS: Derivation of Element stiffness matrix for beam element, derivation of load vector for concentrated and UDL, Problems on Cantilever, simply supported beams with point and uniformly distributed loads.

UNIT-V

CST AND AXISYMMETRIC ELEMENTS: Finite element modelling of two-dimensional stress analysis with constant strain triangles and treatment of boundary conditions, formulation of axisymmetric problems,

HIGHER ORDER AND ISOPARAMETRIC ELEMENTS: One dimensional quadratic and cubic elements in natural coordinates, two dimensional four noded isoparametric elements, numerical integration.

UNIT – VI

STEADY STATE HEAT TRANSFER ANALYSIS: one dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of a uniform shaft subjected to torsion.

DYNAMIC ANALYSIS: Formulation of finite element model, element consistent and lumped mass matrices, evaluation of eigen values and eigen vectors, free vibration analysis.

TEXT BOOKS:

1. The Finite Element Methods in Engineering / S. S Rao / Pergamon.

REFERENCE BOOKS:

1. Finite Element Method with applications in Engineering / YM Desai, Eldho& Shah /Pearson publishers
2. An introduction to Finite Element Method / JN Reddy / McGraw Hill
3. The Finite Element Method for Engineers – Kenneth H. Huebner, Donald L. Dewhirst, Douglas E. Smithand Ted G. Byrom / John Wiley &Sons (ASIA) Pte Ltd.
4. Finite Element Analysis/ P.Seshu
5. Finite Element Methods: Basic Concepts and Applications ByChennakesava R. Alavala
6. Finite Element Analysis: for students & Practicing Engineers / G.LakshmiNarasaiah / BSP Books Pvt. Ltd.

Semester	VII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET27
Name of the Course	**Micro Electro Mechanical Systems (MEMS)** Professional Elective – III					
Branch	**Mechanical Engineering**					

Course Outcomes:

After successful completion of the course, the student will be able to

CO1	Understand about the basics of MEMS, Methods of Micro machining.	K2
CO2	Interpret various Mechanical sensors & Actuators	K3
CO3	Illustrate the working principles of various Thermal sensors and Actuators & its applications.	K3
CO4	Differentiate between different types of MOEMS devices	K2
CO5	Illustrate and explain various Magnetic sensors and Actuators & its applications	K3
CO6	Illustrate and explain various micro-fluidic devices & its applications	K3

UNIT – I

INTRODUCTION: Definition of MEMS, MEMS history and development, micro machining, lithography principles & methods, structural and sacrificial materials, thin film deposition, impurity doping, etching, surface micro machining, wafer bonding, LIGA.

UNIT – II

MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitive, piezo electric, strain, pressure, flow, pressure measurement by micro phone, MEMS gyroscopes, shear mode piezo actuator, gripping piezo actuator, Inchworm technology.

UNIT – III

THERMAL SENSORS AND ACTUATORS: Thermal energy basics and heat transfer processes, thermisters, thermo devices, thermo couple, micro machined thermo couple probe, micro hot plate gas sensors, MEMS thermo vessels, pyro electricity, shape memory alloys (SMA).

UNIT – IV

MICRO-OPTO-ELECTRO MECHANICAL SYSTEMS: Principle of MOEMS technology, properties of light, light modulators, beam splitter, micro lens, micro mirrors, digital micro mirror device (DMD), light detectors, grating light valve (GLV), optical switch.

UNIT – V

MAGNETIC SENSORS AND ACTUATORS: Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive sensor, more on hall effect, magneto diodes, magneto transistor, MEMS magnetic sensor, pressure sensor utilizing MOKE, mag MEMS actuators, by directional micro actuator.

UNIT – VI

MICRO FLUIDIC SYSTEMS: Applications, considerations on micro scale fluid, fluid actuation methods, dielectro phoresis (DEP), electro wetting, electro thermal flow, thermo capillary effect, electro osmosis flow, opto electro wetting (OEW), micro fluid dispenser, micro needle, micro pumps.

TEXT BOOKS:

1. MEMS, Nitaigour Premchand Mahalik, TMH Publishing co.

REFERENCE BOOKS:

1. Foundation of MEMS, Chang Liu, Prentice Hall Ltd.
2. MEMS and NEMS, Sergey Edwrd Lyshevski, CRC Press, Indian Edition.
3. MEMS and Micro Systems: Design and Manufacture, Tai-Ran Hsu, TMH Publishers.
4. Introductory MEMS, Thomas M Adams, Richard A Layton, Springer International Publishers.

Semester	VII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18CSTOE05
Name of the Course	**Artificial Intelligence** Open Elective – II					
Branch	**Mechanical Engineering**					

Course Outcomes:

After successful completion of the course, the student will be able to

CO1	Illustrate the concept of intelligent systems and current trends in AI.	K2
CO2	Apply Problem solving, Problem reduction and Game Playing techniques in AI.	K3
CO3	Illustrate the Logic concepts in AI.	K2
CO4	Explain the Knowledge representation techniques in AI.	K2
CO5	Describe Expert systems and their applications.	K2
CO6	Illustrate Uncertainty Measures.	K2

UNIT – I

INTRODUCTION TO ARTIFICIAL INTELLIGENCE: Introduction, history, intelligent systems, foundationsof AI, applications, tic-tac-toe game playing, current trends in AI

UNIT – II

PROBLEM SOLVING: STATE-SPACE SEARCH AND CONTROL STRATEGIES: Introduction, General Problem Solving, Characteristics of problem, Exhaustive searches, Heuristic search techniques, Iterative deepeninga*, constraint satisfaction

PROBLEM REDUCTION AND GAME PLAYING: Introduction, problem reduction, game playing, alpha betapruning, two-player perfect information games

UNIT – III

LOGIC CONCEPTS: Introduction, Propositional Calculus, Proportional Logic, Natural Deduction system, Axiomatic system, Semantic tableau system in proportional logic, Resolution Refutation in Propositional logic, Predicate Logic

UNIT – IV

KNOWLEDGE REPRESENTATION: Introduction, approaches to Knowledge representation, Knowledge representation using Semantic Networks, Extended Semantic Networks for KR, Knowledge representation using Frames

UNIT – V

EXPERT SYSTEMS AND APPLICATIONS: Introduction phases in building Expert Systems, Expert System versus Traditional Systems, Rule-based Expert Systems, Blackboard systems, Truth maintenance systems, applications of Expert Systems.

UNIT – VI

UNCERTAINTY MEASURE: Probability theory- Introduction, Probability Theory, Bayesian Belief networks, Certainty Factor Theory, Dempster-Shafer theory

TEXT BOOK:

1. Artificial Intelligence, Saroj Kaushik, 1st Edition, Cengage Learning.

REFERENCE BOOKS:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivashankar B Nair, 3rd Edition, Tata McGraw Hill Education Private Limited., 2009
2. Artificial Intelligence- A modern Approach, 3rd Edition, Stuart Russel, Peter Norvig, Pearson Education.

Semester	VII	L	T	P	C	Course Code
Regulation	V18	0	0	3	1.5	V18MEL12
Name of the Course	Simulation Lab					
Branch	Mechanical Engineering					

Course Outcomes:

After successful completion of the course, the student will be able to

CO1	Apply the tools like ANSYS or FLUENT in solving real time problems and day to day problems.	K3
CO2	Develop drawings for various components.	K3
CO3	Practice programming on CNC Machines.	K3

List of experiments:

1. **DRAFTING:** Development of part drawings for various components in the form of orthographic and isometric representation of dimensioning and tolerances scanning and plotting. study of script, DXE and IGES files.

2. **PART MODELING:** Generation of various 3D models through protrusion, revolve, shell sweep. creation of various features. study of parent child relation. feature based and boolean based modelling surface and assembly modelling. study of various standard translators. Design simple components.

3. a) Determinationofdeflectionandstressesin2Dand3Dtrussesandbeams.
   b) Determination of deflections component and principal and Von-mises stresses in plane stress, plane strain and Axisymmetric components.
   c) Determination of stresses in 3D and shell structures (at least one example in each case)
   d) Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
   e) Steady state heat transfer Analysis of plane and Axisymmetriccomponents.

4. a) Study of various post processors used in NC Machines.
   b) Machining of simple components on NC lathe and Mill by transferring NC Code / from a CAM package. Through RS 232.
   c) Practice on CNC Sinutrain Turning
   d) Practice on CNC Sinutrain Milling
   e) CNC programming forturned components using FANUC Controller
   f) CNC programming for milled components using FANUC Controller
   g) Automated CNC Tool path & G-Code generation using

   Pro/E/MasterCAM**Packages to be provided to cater to drafting, modeling & analysis from the following:**CATIA, Pro-E, I-DEAS, ANSYS, NISA, CAEFEM, Gibbs CAM, Master CAM etc.

Semester	VII	L	T	P	C	Course Code
Regulation	V18	0	0	3	1.5	V18MEL13
Name of the Course	Production Drawing Lab					
Branch	Mechanical Engineering					

Course Outcomes:

After successful completion of the course, the student will be able to

CO1	Recognise the need of limits, fits and tolerances, and apply the same on part drawings for manufacturing.	K2
CO2	Illusttrate the Geometric Dimensioning and tolerancing, able to apply GD&T to a part drawing.	K3
CO3	Indicate various surface roughness symbols on part drawings for manufacturing.	K2
CO4	Assess the raw material requirements, final cost of the component and heat treatment process.	K3
CO5	Develop skill to produce detailed drawings from assembly drawings.	K3
CO6	Construct press tools, die-casting dies and jigs and fixtures using computer aided design software.	K3

PART-A

LIMITS, FITS AND TOLERANCES: Types of fits, exercises involving selection and interpretation of fits and estimation of limits from tables.

GEOMETRIC DIMENSIONING AND TOLERANCING: Introduction to GD&T ,terminology & basic rules, features and material conditions, maximum material condition, least material condition, regardless of feature's size, datums, datum reference frame, **form tolerances, orientation tolerances, profile tolerances, runout tolerances.**

ADDING GD&T TO A DRAWING/DESIGN – size, location, orientation & form, choosing datums, indication of form and position tolerances on drawings, preparation of bill of material

SURFACE ROUGHNESS AND ITS INDICATIONS: Definition, types of surface roughness indication-Surface roughness obtained from various manufacturing process, recommended surface roughness on mechanical components, heat treatment and surface treatment symbols used on drawings.

PART-B

Drawing of parts from assembly of stuffing box, piercing and blanking die, Die casting die, Box jig, machining fixture with indication of size, tolerance, roughness, form and position tolerances using Computer aided design software.

TEXT BOOKS:

1. Production and Drawing – K.L. Narayana& P. Kannaiah/New Age Publication
2. Tool Engineering & Design_G.R.Nagpal/Khannapublishers,1st edition, Khanna Publishers, 2009
3. MachineDrawingwithAutoCAD-PohitandGhosh,1st edition, Pearso, 2017
4. Geometric dimensioning and tolerancing- James D. Meadows/B.S Publications.

REFERENCE BOOKS:

1. MachineDrawingbyNagpal,1st edition, khanna publishers,2009
2. Machinedrawing,AjeetSingh,2nd edition,TMH,2016
3. Engineering Metrology, R.K. Jain, Khanna Publications.

VIII Semester

Semester	VIII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET28
Name of the Course	Automobile Engineering					
Branch	Mechanical Engineering					

Course Outcomes:

After successful completion of the course, the student will be able to

CO1	Understand various components in four wheel automobile.	K2
CO2	Differentiate between different types of transmission systems used in automobile.	K4
CO3	Examine steering geometry and steering systems used in automobile.	K3
CO4	Interpret suspension, breaking and electrical systems in automobile.	K3
CO5	Understand various safety systems used in automobile.	K2
CO6	Practice engine service for different components in automobile.	K3

UNIT – I

INTRODUCTION: Components of four wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4 wheel drive – types of automobile engines, engine construction, turbo charging and super charging – engine lubrication, splash and pressure lubrication systems, oil filters, oil pumps – crank case ventilation – engine service, reboring, decarbonisation, Nitriding of crank shaft.

UNIT – II

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, construct mesh, synchromesh gear boxes, epicyclic gear box, over drive torque converter. propeller shaft – Hotch – Kiss drive, Torquetube drive, universal joint, differential rear axles – types – wheels and tyres.

UNIT – III

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 – IV

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

BRAKING SYSTEM: Mechanical brake system, hydraulic brake system, master cylinder, wheel cylinder tandem master cylinder requirement of brake fluid, pneumatic and vacuum brakes.

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 – V

ENGINE SPECIFICATION AND SAFETY SYSTEMS: Introduction- engine specifications with regard to power, speed, torque, no. of cylinders and arrangement, lubrication and cooling etc.

Safety: Introduction, safety systems - seat belt, air bags, bumper, anti lock brake system (ABS), wind shield, suspension sensors, traction control, mirrors, central locking and electric windows, speed control.

UNIT – VI

ENGINE SERVICE: Introduction, service details of engine cylinder head, valves and valve mechanism, piston connecting rod assembly, cylinder block, crank shaft and main bearings, engine reassembly-precautions.

TEXT BOOKS:

1. Automotive Mechanics – Vol. 1 & Vol. 2 / Kirpal Singh/standard publishers
2. Automobile Engineering / William Crouse/TMH Distributors
3. Automobile Engineering/P.S Gill/S.K. Kataria & Sons/New Delhi.

REFERENCE BOOKS:

1. Automotive Engines Theory and Servicing/James D. Halderman and Chase D. Mitchell Jr.,/ Pearson education inc.
2. Automotive Engineering / K Newton, W.Steeds & TK Garrett/SAE
3. Automotive Mechanics: Principles and Practices/ Joseph Heitner/Van Nostrand Reinhold
4. Automobile Engineering / C Srinivasan / Mc Graw Hill

Semester	VIII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET31
Name of the Course	**Process Planning & Cost Estimation** Professional Elective – IV					
Branch	**Mechanical Engineering**					

Course Outcomes:

After successful completion of the course, the student will be able to

CO1	Understand the basic concepts of production, steps involved in types of process planning.	K2
CO2	Calculate the process parameters for various production processes.	K3
CO3	Prepare the types of estimates.	K3
CO4	Calculate depreciation cost and explain about different costs.	K3
CO5	Estimate production cost in forging, welding and foundry.	K2
CO6	Determine the machining time of different machining operations.	K4

UNIT – I

INTRODUCTION: Types of production, standardization, simplification, product design and selection-process planning-methods, selection and analysis-steps involved in manual and computer aided process planning-Break even analysis.

UNIT – II

PROCESS PLANNING ACTIVITIES: Calculation of process parameters for various production processes-Selection of jigs & fixtures-Selection quality assurance methods-Set of documents for process planning.

UNIT – III

ESTIMATION AND COSTING: Aim and objective of cost estimation – Functions of estimation – Costing – Importance and aims of costing – Difference between costing and estimation. Types of estimates – Estimation procedure.

UNIT – IV

COST ELEMENTS: Material cost – Determination of material cost, labour cost, Expenses — Analysis of overhead expenses – Factory expenses, Administrative expenses – Selling and Distributing expenses – Allocation of over head expenses. Cost of product – Illustrative examples Depreciation: Depreciation – Causes of Depreciation – Methods of Depreciation calculation.

UNIT – V

ESTIMATION OF PRODUCTION COST : Estimation in forging shop – Losses in forging – forging cost – Illustrative examples. Estimation in welding shop – Gas cutting – Electric welding - Illustrative examples. Estimation in foundry shop – Estimation of pattern cost and casting cost - Illustrative examples.

UNIT – VI

MACHINING TIME ESTIMATION: Estimation of Machining Time for Lathe operations – Estimation of Machining Time for Drilling, Boring, Shaping, Planning, Milling and Grinding operations - Illustrative examples.

TEXT BOOKS:

1. M.Adithian and B.S. Pabla, Estimation and Costing, Konark publishers Pvt. Ltd., 1989.
2. A.K.Chitale and R.C.Gupta, Product Design and Manufacturing, Prentice Hall Pvt. Ltd.., 2005

REFERENCE BOOKS :

1. Namua Singh, System Approach to computer integrated Design and Manufacturing, John Wiley & Sons,Inc.,1996.
2. Joseph G Monks, Operation Management, Theory & Problems, McGraw Hill Book Company, 1987.
3. T.R.Banga and S.C.Sharma, Estimations and Costing, Khanna Publishers,1988.
4. G.B.S.Narang and V.Kumar, Production and Costing, Khanna Publishers, 1995.
5. Sinha B.P – Mechanical estimating & costing – Tata McGrawhill publishing co.,1995

Semester	VIII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET32
Name of the Course	**Non Destructive Evaluation** Professional Elective – IV					
Branch	**Mechanical Engineering**					

Course Outcomes:

After Successful completion of this course the student will be able to

CO1	Examine the Radiograpic test method	K3
CO2	Examine the Radiograpic test method	K3
CO3	Understand the Radiograpic test method	K2
CO4	Understand the Radiograpic test method	K2
CO5	Examine the Radiograpic test method	K3
CO6	Apply knowledge of non destructive testing methods for the products of railways, automobiles, aircrafts, chemical industries etc.	K3

UNIT – I

Introduction to non-destructive testing, Radiographic test, Sources of X and Gamma Rays and their interaction with Matter, Radiographic equipment, Radiographic Techniques, Safety Aspects of Industrial Radiography.

UNIT – II

ULTRASONIC TEST: Principle of Wave Propagation, Reflection, Refraction, Diffraction, Mode Conversion and Attenuation, Sound Field, Piezo-electric Effect, Ultrasonic Transducers and their Characteristics, Ultrasonic Equipment and Variables Affecting Ultrasonic Test, Ultrasonic Testing, Interpretations and Guidelines for Acceptance, Rejection, Effectiveness and Limitations of Ultrasonic Testing.

UNIT – III

LIQUID PENETRANT TEST: Liquid Penetrant Test, Basic Concepts, Liquid Penetrant System, Test Procedure, Effectiveness and Limitations of Liquid Penetrant Testing.

EDDY CURRENT TEST: Principle of Eddy Current, Eddy Current Test System, Applications of Eddy Current Testing Effectiveness of Eddy Current Testing.

UNIT – IV

MAGNETIC PARTICLE TEST: Magnetic Materials, Magnetization of Materials, Demagnetization of Materials,Principle of Magnetic Particle Test, Magnetic Particle Test Equipment, Magnetic Particle Test Procedure, Standardization and Calibration, Interpretation and Evaluation, Effective Applications and Limitations of the Magnetic Particle Test.

UNIT – V

INFRARED AND THERMAL TESTING: Introduction and fundamentals to infrared and thermal testing, Heat transfer –Active and passive techniques, Lock in and pulse thermography, Contact and non contact thermal inspection methods, Heat sensitive paints and papers, thermally quenched phosphors liquid crystals, techniques for applying liquid crystals, other temperature sensitive coatings, Inspection methods, Infrared radiation and infrared detectors, thermo mechanical behavior of materials, IR imaging in aerospace applications,electronic components, Honey comb and sandwich structures–Case studies.

UNIT – VI

INDUSTRIAL APPLICATIONS OF NDE: Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions.

TEXT BOOKS:

1. Non destructive test and evaluation of Materials/J Prasad, GCK Nair/TMH Publishers
2. Ultrasonic testing of materials/ H Krautkramer/Springer
3. Non destructive testing/Warren, J Mc Gonnagle / Godan and Breach Science publishers
4. Nondestructive evaluation of materials by infrared thermography / X. P. V. Maldague, Springer-Verlag, 1st edition, (1993)

REFERENCE BOOKS:

1. Ultrasonic inspection training for NDT/ E. A. Gingel/Prometheus Press,
2. ASTM Standards, Vol 3.01, Metals and alloys
3. Non-destructive, Hand Book – R. Hamchand

Semester	VIII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET33
Name of the Course	**Industrial Hydraulics and Pneumatics** Professional Elective – IV					
Branch	**Mechanical Engineering**					

Course Outcomes:

After Successful completion of this course the student will be able to

CO1	Understand the fundamentals of Fluid Power Systems	K2
CO2	Develop general concepts associated with Hydraulic actuators and cylinders.	K3
CO3	Identify Hydraulic elements in the design of circuits	K2
CO4	Illustrate various accumulators & intensifiers	K3
CO5	Develop the operation of pnuematics circuits andcomponents typically used in industry.	K3
CO6	Examine the applications of Industrial Hydraulics and Pneumatics.	K3

UNIT – I

FUNDAMENTALS OF FLUID POWER SYSTEMS-INTRODUCTION – types advantages, disadvantages & applications-fluid characteristics-terminologies used in fluid power-hydraulic symbols-hydraulic systems and components-sources- pumping theory-gear, vane & piston pumps.

UNIT-II

FLUID POWER ACTUATORS : Introduction-hydraulic actuators-hydraulic cylinders-types, construction, specifications and special types. hydraulic motors- working principle-selection criteria for various types-hydraulic motors in circuits- formulae-numerical problems

UNIT-III

HYDRAULIC ELEMENTS IN THE DESIGN OF CIRCUITS- Introduction-control elements- direction control valve-check valve-pressure control valve-relief valve- throttle valve-temperature & pressure compensation-locations of flow controlvalve

UNIT-IV

ACCUMULATORS & INTENSIFIERS-types, size &function of accumulators- application & circuits of accumulators- intensifiers-circuit & applications.

UNIT-V

PNEUMATIC SYSTEMS-INTRODUCTION-symbols used-concepts & components- comparison-types & specifications of compressors-arrangement of a complete pneumatic system-compressed air behaviour-understandingpneumatic circuits-direction control valves

UNIT-VI

APPLICATIONS- Servo systems-introduction-closed loop, hydro-mechanical and electro hydraulic – conventional and proportional valves-characteristics of proportional and servo valves- PLC applications in fluid power – selected pneumatic / electro pneumatic circuit problems – failure and trouble shooting in fluid power systems.

TEXT BOOKS:

1. Introduction to Hydraulics and Pneumatics by S. Ilango and V.Soundararajan, PHI , New Delhi
2. Applied hydraulics and pneumatics-T. Sunder Selwyn & R.Jayendiran, Anuradha Publications.

REFERENCE BOOKS:

1. Oil Hydraulic Systems, S.R .Majumdar, McGrawHill Companies
2. Pneumatic Systems: Principles and Maintenance, Majumdar,McGrawHill

Semester	VIII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET34
Name of the Course	**Computational Fluid Dynamics** Professional Elective – V					
Branch	**Mechanical Engineering**					

Course Outcomes:

After Successful completion of this course the student will be able to

CO1	Apply techniques in the numerical solution of fluid equations	K3
CO2	Apply numerical modeling and its role in the field of heat transfer and fluid flow.	K3
CO3	Develop methodologies used in CFD	K3
CO4	Comapre various discretization methods and solving methodologies.	K4
CO5	Apply skills in the actual implementation of CFD methods (e.g. boundary conditions, different numerical schemes etc.	K3
CO6	Apply the finite element methods in the application of CFD analysis to real life engineering designs.	K3

UNIT – I

ELEMENTARY DETAILS IN NUMERICAL TECHNIQUES: Number system and errors, representation of integers, fractions, floating point arithmetic, loss of significance and error propagation, condition and instability, computational methods for error estimation, convergence of sequences.

UNIT – II

APPLIED NUMERICAL METHODS: Solution of a system of simultaneous linear algebraic equations, iterative schemes of matrix inversion, direct methods for matrix inversion, direct methods for banded matrices.

EQUATIONS GOVERNING FLUID FLOW AND HEAT TRANSFER: Introduction, conservation of mass, Newton's second law of motion, expanded forms of navier-stokes equations, conservation of energy principle, special forms of the navier-stokes equations.

UNIT – III

Steady flow, dimensionless form of momentum and energy equations, stokes equation, conservative body force fields, stream function - vorticity formulation. Finite difference applications in heat conduction and convention – heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction, finite difference application in convective heat transfer, closure.

UNIT – IV

Finite differences, discretization, consistency, stability, and fundamentals of fluid flow modeling: introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods.

UNIT – V

Introduction to first order wave equation, stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme

UNIT – VI

FINITE VOLUME METHOD: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TEXT BOOKS:

1. Numerical heat transfer and fluid flow / Suhas V. Patankar- Butter-worth Publishers.
2. Computational fluid dynamics - Basics with applications - John. D. Anderson / McGraw Hill.

REFERENCE BOOKS:

1. Computational Fluid Flow and Heat Transfer/ Niyogi, Pearson Publications.
2. Fundamentals of Computational Fluid Dynamics – Tapan K. Sengupta / Universities Press.
3. Computational fluid dynamics, 3rd edition/Wendt/Springer publishers

Semester	VIII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET35
Name of the Course	**Production Planning and Control** Professional Elective – V					
Branch	**Mechanical Engineering**					

Course Outcomes:

After Successful completion of this course the student will be able to

CO1	Generalise structure, elements and functions of Production planning and Control.	K2
CO2	Apply the principles of different forecasting methods.	K3
CO3	Analyze principles of different inventory control systems.	K4
CO4	Generalise Routing, its procedure, factors affecting Routing procedure.	K2
CO5	Explain Scheduling methods, Planning and controlling aspects.	K2
CO6	Understand Dispatching procedure, types of follow up, applications of computers in production planning and control.	K2

UNIT – I

Introduction: Definition – objectives and functions of production planning and control – elements of production control – types of production – organization of production planning and control department – internal organization of department.

UNIT – II

Forecasting– importance of forecasting – types of forecasting, their uses – general principles of forecasting – forecasting techniques – qualitative methods and quantitive methods.

UNIT – III

Inventory management– functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems.

Introduction to MRP I, MRP II, ERP, JIT systems.

UNIT – IV

Routing– definition – routing procedure –route sheets – bill of material – factors affecting routing procedure, schedule –definition – difference with loading.

UNIT – V

Scheduling policies– techniques, standard scheduling methods. Line Balancing, aggregate planning, chase planning, expediting.

UNIT – VI

Dispatching– activities of dispatcher – dispatching procedure – follow up – definition – reasons for existence of functions – applications of computers in production planning and control.

TEXT BOOKS:

1. Elements of Production Planning and Control / Samuel Eilon.
2. Manufacturing, Planning and Control, Partik Jonsson Stig-Arne Mattsson, Tata Mc Graw Hill

Semester	VIII	L	T	P	C	Course Code
Regulation	V18	3	0	0	3	V18MET36
Name of the Course	**Energy Conservation and Management** Professional Elective – V					
Branch	**Mechanical Engineering**					

Course Outcomes:

After Successful completion of this course the student will be able to

CO1	Understand the principles of Energy.	K2
CO2	Evaluate thermal Performance.	K5
CO3	Illustrate Energy Conservation Program.	K3
CO4	Predict the Energy Conservation Options	K2
CO5	Recognise the Strategies for Electricity and Management	K2
CO6	Express the Importance and Role of Energy Management	K2

UNIT-I

Energy scenario, Principles of energy conservation, Energy consumption pattern, Resource availability.

UNIT-II

Calculation of thermal performance, calculation of heat loss – heat gain, estimation of annual heating & cooling load factors that influence thermal performance, analysis of existing buildings.

UNIT-III

Organizing for energy conservation program, the energy audit and energy information system, technology for energy conservation, co-generation of process, steam & electricity, computer controlled energy.

UNIT-IV

Commercial options in waste heat recovery equipment, cases of energy studies, energy conservation opportunity, Energy conservation in I. C. Engine.

UNIT-V

Strategies for electricity and management, setting up an energy management programme, electricity saving technique by category of end use, Electrical end use in industries, energy & power management in industry, energy management strategies for industry, demand management.

UNIT-VI

Importance and role of energy management, Energy economics, Payback period, Internal rate of return, life cycle costing.

TEXT BOOKS:

1. Hamies, Energy Auditing and Conservation, Methods, Measurements, Management and Case Study, Hemisphere,
   Washington, 1980
2. W.F.Kenny, Energy Conservation in Process Industry.
3. Trivedi, P.R, Jolka K.R., Energy Management, Commonwealth Publication, New Delhi, 1997.
4. C.B.Smith, Energy Management Principles, Pergamon Press, New York, 1981.

REFERENCE BOOKS:

1. W.C. Turner, Energy Management, Hand Book.
2. Kreith, Economics of Solar Energy and Conservation Systems, Vol -3.
3. Witte, Larry C, Industrial Energy Management and Utilization, Hemisphere Publishers, Washinton, 1988.