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 AND SYLLABUS

For

VII & VIII Semesters (V20 Regulation)

B.Tech. MECHANICAL ENGINEERING

(Applicable for batches admitted from 2020-2021)

DEPARTMENT OF MECHANICAL ENGINEERING (Accredited by NBA)

SRI VASAVI ENGINEERING COLLEGE (Autonomous)

PEDATADEPALLI, TADEPALLIGUDEM – 534 101

DEPARTMENT OF MECHANICAL ENGINEERING

Course structure under V20 Regulations

(For 2020 – 2021 Admitted Batch)

VII SEMESTER							
S. No	**Category**	**Course Code**	**Course Title**	**Hours per week**			
				L	**T**	**P**	**C**
1	Professional Elective courses		Professional Elective III	3	0	0	3
2	Professional Elective courses		Professional Elective IV	3	0	0	3
3	Professional Elective courses		Professional Elective V	3	0	0	3
4	Open Elective Course/Job oriented elective		Open Elective / Job Oriented Elective Course – III	3	0	0	3
5	Open Elective Course/Job oriented elective		Open Elective / Job Oriented Elective Course – IV	3	0	0	3
6	***Humanities and Social Science Elective**		Universal Human Values	3	0	0	3
	Skill advanced course/ soft skill course*	V20SOC04	Certificate course offered by industries/Professional bodies/APSSDC or any other accredited bodies.	1	0	2	2
	Industrial/Research Internship (Mandatory) after third year (to be evaluated during VII semester			0	0	0	3
Total Credits				19	0	2	23

Total Contact Hours: 21 Total Credits: 23

VIII SEMESTER							
S. No	**Category**	**Course Code**	**Course Title**	**Hours per week**			
				L	**T**	**P**	**C**
1	Major Project	V20MEP01	Project Project work, seminar and internship in industry	0	0	0	12
	INTERNSHIP (6 MONTHS)						
Total Credits				0	0	0	12

Professional Electives:	
Professional Elective – III V20MEPE7 – Finite Element Methods V20MEPE8 – Tribology V20MEPE9 – Micro Electro Mechanical Systems	**Professional Elective – IV** V20MEPE10 – Automobile Engineering V20MEPE11 – Cryogenics V20MEPE12 – Design for Manufacturing & Assembly
Professional Elective – V V20MEPE13 – Power plant Engineering V20MEPE14 – Non Destructive Testing & Evaluation V20MEPE15 – Gas dynamics & Jet Propulsion	

Job Oriented Courses:
V20MEJO1 – CAD/CAM V20MEJO2 – Refrigeration and Air conditioning V20MEJO3 – Integration of AI & ML in Mechanical Engineering V20MEJO4 – Industrial Safety & Management V20MEJO5 – Industrial Hydraulics & Pneumatics V20MEJO6 – Automation in Manufacturing

Syllabi for the courses offered in VII semester B. Tech under V20 Regulation

VII Semester

Semester	VII	L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEPE7
Name of the Course	Finite Element Methods **Professional Elective – III**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
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 and Beam elements by FEM.	K3
CO4	Use FEM to solve 2D CST problems.	K3
CO5	Apply finite element method for problems involving dynamics and heat transfer.	K3

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.

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 – IV

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 node disoparametric elements, numerical integration.

UNIT-V

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	V20	3	0	0	3	V20MEPE8
Name of the Course	Tribology **Professional Elective – III**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Understand the fundamentals of tribology and associated parameters.	K2
CO2	Apply concepts of tribology for the performance analysis and design of components experiencing relative motion.	K3
CO3	Analyse the requirements and design hydrodynamic journal and plane slider bearings for a given application.	K4
CO4	Select proper bearing materials and lubricants for a given tribological application.	K3
CO5	Apply the principles of surface engineering for different applications of tribology.	K3

UNIT – I

Introduction to tribology: Friction, Wear and Lubrication, practical importance. Lubricants: Types and specific field of applications. Properties of lubricants, viscosity, its measurement, effect of temperature and pressure on viscosity, lubrication types, standard grades of lubricants, and selection of lubricants.

UNIT – II

Friction: Origin, friction theories, measurement methods, friction of metals and non-metals.

Wear: Classification and mechanisms of wear, delamination theory, debris analysis, testing methods and standards. Related case studies.

UNIT – III

Hydrodynamic journal bearings: Friction forces and power loss in a lightly loaded journal bearing, Petroff's equation, mechanism of pressure development in an oil film, and Reynold's equation in 2D. Introduction to idealized journal bearing, load carrying capacity, condition for equilibrium, Sommerfeld's number and it's significance; partial bearings, end leakages in journal bearing, numerical examples on full journal bearings only.

UNIT – IV

Plane slider bearings with fixed/pivoted shoe: Pressure distribution, Load carrying capacity, coefficient of friction, frictional resistance in a fixed/pivoted shoe bearing, center of pressure, numerical examples.

Hydrostatic Lubrication: Introduction to hydrostatic lubrication, hydrostatic step bearings, load carrying capacity and oil flow through the hydrostatic step bearing, numerical examples.

UNIT – V

Bearing Materials: Commonly used bearings materials, and properties of typical bearing materials. Advantages and disadvantages of bearing materials.

Introduction to Surface engineering: Concept and scope of surface engineering. Surface modification – transformation hardening, surface melting, thermo chemical processes. Surface Coating – plating, fusion processes, vapor phase processes. Selection of coating for wear and corrosion resistance.

TEXT BOOKS:

1."Introduction to Tribology", B. Bhushan, John Wiley & Sons, Inc., New York, 2002
2. "Engineering Tribology", Prasanta Sahoo, PHI Learning Private Ltd, New Delhi, 2011.
3."Engineering Tribology", J. A. Williams, Oxford Univ. Press, 2005.

REFERENCE BOOKS:

1. "Introduction to Tribology in bearings", B. C. Majumdar, Wheeler Publishing.
2. "Tribology, Friction and Wear of Engineering Material", I. M.Hutchings, Edward Arnold, London,1992.
3. "Engineering Tribology", G. W. Stachowiak and A. W. Batchelor, Butterworth-Heinemann,1992.
4. "Friction and Wear of Materials", Ernest Rabinowicz, John Wiley & sons,1995.
5. "Basic Lubrication Theory", A. Cameron, Ellis Hardwoods Ltd., UK.
6. "Handbook of tribology: materials, coatings and surface treatments", B.Bhushan, B.K. Gupta, McGraw-Hill,1997.

Semester	VII	L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEPE09
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:	Knowledge Level
CO1	Understand about the basics of MEMS, Methods of Micro machining.	K2
CO2	Interpret various Mechanical and Thermal sensors & Actuators	K3
CO3	Differentiate between different types of MOEMS devices	K2
CO4	Illustrate and explain various Magnetic sensors and Actuators & its applications	K3
CO5	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, surface micro machining, Bulk micro machining , wafer bonding, LIGA.

UNIT – II

MECHANICAL SENSORS AND ACTUATORS: Principles of sensing and actuation: beam and cantilever, capacitive, piezo electric, pressure, shear mode piezo actuator, gripping piezo actuator, Inchworm technology.

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

UNIT – III

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 – IV

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.

UNIT – V

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	V20	3	0	0	3	V20MEPE10
Name of the Course	Automobile Engineering **Professional Elective – IV**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
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 and Interpret suspension systems in automobile	K3
CO4	Interpret breaking and electrical systems in automobile.	K3
CO5	Use various safety systems used in automobile and 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, no. of cylinders and arrangement, 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 crankshaft.

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, 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.

UNIT – III

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

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.

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

SAFETYSYSTEMS: Introduction, safety systems - seatbelt, airbags, bumper, antilock brake system (ABS), wind shield, suspension sensors, traction control, mirrors, central locking and electric windows, speed control.

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Automotive Engines Theory and Servicing/James D. Halderman and Chase D. Mitchell Jr.,/ Pearson educationinc.
2. Automotive Engineering/K Newton,W.Steeds & TKGarrett/SAE
3. AutomotiveMechanics:PrinciplesandPractices/JosephHeitner/VanNostrandReinhold
4. Automobile Engineering/CSrinivasan/ McGrawHill

Semester	VII	L	T	P	C	Course Code
Regulation	V20	3	1	0	4	V20MEPE11
Name of the Course	Cryogenics **Professional Elective – IV**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Illustrate the basics for evolution of low temperature science, Understand properties of materials at cryogenic temperatures.	K3
CO2	Illustrate various liquefaction systems.	K3
CO3	Illustrate gas liquefaction systems.	K3
CO4	Illustrate Cryogenic Refrigeration systems.	K3
CO5	Illustrate Cryogenic fluid storage and transfer system.	K3

UNIT – I

Introduction to Cryogenic Systems, Historical development, Low Temperature properties of Engineering Materials, Mechanical properties- Thermal properties- Electric and magnetic properties – Cryogenic fluids and their properties.

Applications of Cryogenics: Applications in space, Food Processing, super conductivity, Electrical Power, Biology, Medicine, Electronics and Cutting Tool Industry. Low temperature properties of engineering materials.

UNIT – II

Liquefaction systems ideal system, Joule Thoms on expansion, Adiabatic expansion, Linde Hampson Cycle, Claude & Cascaded System, Magnetic Cooling, Stirling Cycle Cryo Coolers.

UNIT – III

Gas liquefaction systems: Introduction - Production of low temperatures - General Liquefaction systems - Liquefaction systems for Neon. Hydrogen and Helium – Critical components of Liquefaction systems.

UNIT –IV

Cryogenic Refrigeration systems: Ideal Refrigeration systems - Refrigeration using liquids and gases as refrigerant- Refrigerators using solids as working media.

UNIT – V

Cryogenic fluid storage and transfer systems: Cryogenic Storage vessels and Transportation, Thermal insulation and their performance at cryogenic temperatures, Super Insulations, Vacuum insulation, Powder insulation, Cryogenic fluid transfer systems.

TEXT BOOKS:

1.R.B.Scott,CryogenicEngineering,VanNostrandCo., 1959
2.RandalF.Barron,Cryogenicsystems,McGraw Hill,1986

REFERENCE BOOKS:

1. Klaus D.Timmerhaus and Thomas M.Flynn, Cryogenic Process Engineering, Plenum Press, New York, 1989.

Semester	VII	L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEPE12
Name of the Course	Design for Manufacturing and Assembly **Professional Elective – IV**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Explain how a design can be made suitable for various manufacturing and assembly processes.	K2
CO2	Express various factors influencing the manufacturability of components.	K2
CO3	Illustrate various metal casting, extrusion and sheet metal work.	K2
CO4	Apply different factors to joining processes.	K3
CO5	Explain various assembly systems and assembly lines.	K2

UNIT – I

Introduction to DFM, DFMA: How Does DFMA Work? Reasons for Not Implementing DFMA, What Are the Advantages of Applying DFMA During Product Design?, Typical DFMA Case Studies, Overall Impact of DFMA on Industry.

Design for Manual Assembly: General Design Guidelines for Manual Assembly, Development of the Systematic DFA Methodology, Assembly Efficiency, Effect of Part Symmetry, Thickness, Weight on Handling Time, Effects of Combinations of Factors, Application of the DFA Methodology.

UNIT – II

Machining processes: Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining – ease – redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT – III

Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

UNIT – IV

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints. Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

UNIT – V

Design for Assembly Automation: Fundamentals of automated assembly systems, System configurations, parts delivery system at workstations, various escapement and placement devices used in automated assembly systems, Quantitative analysis of Assembly systems, Multi station assembly systems, single station assembly lines.

TEXTBOOKS:

1. Design for manufacture, John cobert,AdissonWesley.1995
2. Design for Manufacture and assembly by Boothroyd,3rd edition CRC press
3. Design for manufacture, James Bralla, 2nd edition Mc Graw Hill

REFERENCES BOOK:

1. ASM Hand book Vol.20, Taylor & Francis 1997

Semester	VII	L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEPE13
Name of the Course	Power Plant Engineering **Professional Elective – V**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Explain the working and layout of steam power plant and the different systems comprising the plant.	K2
CO2	Describe the basic components and working principle of hydroelectric power plant.	K2
CO3	Explain the working principles, layouts of diesel power plant and gas turbine power plants.	K2
CO4	Describe the basic components and working principle of different reactors of nuclear power plant.	K2
CO5	Compute the power plant economics.	K3

UNIT – I

Introduction to the Sources of Energy.

Steam Power Plant: Plant layout, working of different circuits, coal handling equipment, ash handling systems, overfeed and underfeed fuel beds, types of stokers, dust collectors, cooling towers and feed water treatment.

UNIT – II

Hydro Electric Power Plant: Water power, hydrological cycle, hydrographs, classification of dams and spill ways.

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

UNIT – III

Diesel power Plant: IC Engines, types, 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 – IV

Nuclear Power Station: Nuclear fuel – breeding and fertile materials, nuclear reactor – reactor operation. Types of reactors and their operation - Pressurized water reactor, boiling water reactor, sodium-graphite reactor, fast breeder reactor. Radiation hazards and shielding, radioactive waste disposal.

UNIT – V

Power Plant Economics: 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.

TEXT BOOKS:

1. A course in Power Plant Engineering /Arora and Domkundwar/Dhanpatrai& Co.
2. Power Plant Engineering /P.C.Sharma / S.K.Kataria Pub

REFERENCE BOOKS:

1. Power Plant Engineering: P.K.Nag/ TMH.
2. Power station Engineering – M.M.Ei-Wakil / McGraw Hill.

Semester	VII	L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEPE14
Name of the Course	Non Destructive Testing and Evaluation **Professional Elective – V**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Identify the flaws in manufacturing process through radiographic inspection	K2
CO2	Explain the theory of wave propagation and inspect the components using ultrasonic test	K2
CO3	Identify various surface, subsurface flaws with LPT and ECT	K2
CO4	Explain the principle of magnetic particle test system, flaw detection and evolution	K2
CO5	Explain the industrial applications in railways, nuclear, aerospace	K2

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

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. Non destructive 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	VII	L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEPE15
Name of the Course	Gas Dynamics and Jet Propulsion **Professional Elective – V**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Understand the basic principles of Gas Dynamics.	K2
CO2	Apply governing equations of Isentropic Flow.	K3
CO3	Illustrate governing equations of Fanno Flow, Rayleigh Flow.	K3
CO4	Develop governing equations of Normal Shock.	K3
CO5	Examine jet engines, rocket engines and associated parameters.	K3

UNIT – I

Introduction to gas dynamics: control volume and system approaches acoustic waves and sonic velocity, mach number, classification of fluid flow based on mach number, mach cone, compressibility factor, general features of one dimensional flow of a compressible fluid, continuity and momentum equations for a control volume.

UNIT – II

Isentropic flow of an ideal gas: basic equation, stag nation enthalpy, temperature, pressure and density, acoustic speed, critical speed of sound, maximum fluid velocity, mach number M*, area ratio as function of mach number, dimensionless velocity, governing equations for isentropic flow of a perfect gas, critical flow area, stream thrust an dimpulse function.

Steady one dimensional is entropic flow with area change, effect of area change on flow parameters, chocking, convergent nozzle, performance of a nozzle under decreasing backpressure, De lavelnozzle, optimum area ratioeffect of back pressure, nozzle discharge coefficients, nozzle efficiencies.

UNIT – III

Simple frictional flow: adiabatic flow with friction in a constant area duct, governing equations, fanno line limiting conditions, effect of wall friction on flow properties in an Isothermal flow with friction in a constant are a duct, governing equations, limiting conditions.

Steady one dimensional flow with heat transfer in constant area duct, governing equations, Rayleigh line entropy change caused by heat transfer, conditions of maximum enthalpy and entropy.

UNIT – IV

Effect of heat transfer on flow parameters: Intersection of Fanno and Rayleigh lines, Shock waves in perfect gas, properties of flow across a normal shock, governing equations, Rankine Hugoniat equations, Prandtl's velocity relationship, converging diverging nozzle flow with shock thickness, shock strength.

UNIT – V

Propulsion: Air craft propulsion: types of jet engines, energy flow through jet engines, thrust, thrust power and propulsive efficiency, turbojet components - diffuser, compressor, combustion chamber, turbines, exhaust systems.

Performance of turbo propeller engines, ramjet and pulse jet, scram jet engines. Rocket propulsion-rocket engines, Basic theory of equations - thrust equation, effective jet velocity, specific impulse, rocket engine performance, solid and liquid propellant rockets, comparison of various propulsion systems.

TEXT BOOKS:

1. Compressible fluid flow/A.H.Shapiro/Ronald Press Co.,1953
2. Fundamentals of compressible flow with air craft and rocket propulsion / S.M.Yahya / New Age international Publishers
3. Fundamental of Gasdynamics-2nd edition/MJZucker/Wiley publishers

REFERENCE BOOKS:

1. Elements of gas dynamics/HW Liepman & ARoshko /Wiley
2. Air craft & Missile propulsion/MJ Zucrow/Wiley
3. Gas dynamics/M.J.Zucrow & Joe D.Holfman / Krieger Publishers

		L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEJO1
Name of the Course	CAD / CAM **Job Oriented Course**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Understand the basics of CAD/CAM and different representations of curves	K2
CO2	Identify the basic components to solve different surface models	K2
CO3	Interpret the functionality of numerical control systems to write the programming	K3
CO4	Illustrate part families and group technology models	K3
CO5	Apply appropriate process strategy to achieve FMS	K3

UNIT – I

Fundamentals of CAD/ CAM, Application of computers for Design and Manufacturing, Benefits of CAD/ CAM - Computer peripherals for CAD/ CAM, Design workstation, Graphic terminal, CAD/ CAM software- definition of system software and application software, CAD/ CAM database and structure.

Geometric Modeling: Wire frame modeling, wire frame entities, Interpolation and approximation of curves, Concept of parametric and non-parametric representation of curves, Curve fitting techniques, definitions of cubic spline, Bezier, and B-spline.

UNIT – II

Surface Modeling: Algebraic and geometric form, Parametric space of surface, Blending functions, parameterization of surface patch, Subdividing, Cylindrical surface, Ruled surface, Surface of revolution Spherical surface, Composite surface, Bezier surface. B-spline surface, Regenerative surface and pathological conditions.

Solid Modeling: Definition of cell composition and spatial occupancy enumeration, Sweep representation, Constructive solid geometry, Boundary representations.

UNIT – III

NC Control Production Systems: Numerical control, Elements of NC system, NC part programming: Methods of NC part programming, manual part programming, Computer assisted part programming, Post Processor, Computerized part program, SPPL (A Simple Programming Language). CNC, DNC and Adaptive Control Systems.

UNIT – IV

Group Technology: Part families, Parts classification and coding. Production flow analysis, Machine cell design. Computer aided process planning: Difficulties in traditional process planning, Computer aided process planning: retrieval type and generative type, Machinability data systems.

Computer Aided Manufacturing Resource Planning: Material resource planning, inputs to MRP, MRP output records, Benefits of MRP, Enterprise resource planning, Capacityrequirements planning

UNIT – V

Flexible Manufacturing System: F.M.S equipment, FMS layouts, Analysis methods for FMSbenefits of FMS.

Computer Aided Quality Control: Automated inspection- Off-line, On-line, contact, Non-contact; Coordinate measuring machines, Machine vision.

Computer Integrated Manufacturing: CIM system, Benefits of CIM

TEXT BOOKS:

1. CAD/CAM Concepts and Applications/ Alavala / PHI
2. CAD/CAM Principles and Applications/P.N. Rao/Mc Graw Hill
3. CAD/CAM/ GrooverM.P/ Pearson
4. CAD/CAM/CIM/Radha Krishnan and Subramanian/New Age

		L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEJO2
Name of the Course	Refrigeration and Air conditioning **Job Oriented Course**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
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	Analyze cooling and heating loads in an air conditioning system.	K4
CO5	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.

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.

UNIT – V

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.

		L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEJO3
Name of the Course	Integration of AI & ML in Mechanical Engineering **Job Oriented Course**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Apply ML models in design of mechanical materials	K3
CO2	Apply AI technologies for development of Robotics	K3
CO3	Apply AI to represent manufacturing problems	K3
CO4	Apply ML for engineering design	K3
CO5	Apply AI for thermal comfort systems	K3

UNIT – I

AI and ML in design of mechanical materials: Introduction – summary of ML models – data collection, generation and pre-processing – Applications – perspectives.

UNIT – II

Robotics and AI: Introduction – History – current state of the art – the seasons of AI and robotics – technologies and disciplines – limitations – weak and strong AI and robotics – the impact of government – major technological firms – programming languages – risks and fears

UNIT – III

Artificial intelligence in advanced manufacturing: Introduction to Artificial intelligence in advanced manufacturing – Evolution – Opportunities – Hierarchical approach to manufacturing systems – Manufacturing system optimization – AI for manufacturing applications of human robot collaboration – AI for condition based maintenance – AI for process monitoring, diagnostics and prognostics – AI for manufacturing process control – challenges and opportunities

UNIT – IV

Machine learning approach for engineering design: Introduction – model formation and use – Adaptive and interactive Modelling systems(AIMS) – Apply AIMS to engine design: engine design simulator, simulation and example generation – AIMS as support tool.

UNIT – V

AI for efficient thermal comfort systems: Introduction – thermal comfort: Air conditioning and personal thermal comfort system – AI for thermal comfort requirements – current applications and requirements of AI for thermal comfort in buildings – future directions for enabling autonomous personalized thermal comfort systems

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, 4th US ed. by Stuart Russell and Peter Norvig
2. Artificial Intelligence Saroj Kaushik. February 19, 2018

REFERENCE JOURNAL PUBLICATIONS:

1. Kai Guo, Zhenze Yang, Chi-Hua Yu and Markus J. Buehler, "Artificial intelligence and machine learning in design of mechanical materials", *Mater. Horiz.*, 2021, 8, 1153–1172 | 1153–1172.
2. Estifanos Tilahun Mihret, "Robotics and Artificial Intelligence", International Journal of Artificial Intelligence and Machine Learning Volume 10 • Issue 2 • July-December 2020, pp. 57-78.
3. Jorge F. Arinez, Qing Chang, Robert X. Gao, Chengying Xu and Jianjing Zhang, "Artificial Intelligence in Advanced Manufacturing: Current Status and Future Outlook", Journal of Manufacturing Science and Engineering · NOVEMBER 2020, Vol. 142 / 111003-1 to 16.
4. Sudhakar Yerramareddy, David K. Tcheng, Stephen C-Y. Lu, and Dennis N. Assanis, "Cmatjng and Using Models for Engineering Design", Article in IEEE Expert · June 1992, pp. 52-59.
5. Ali Ghahramani, Parson Galicia, David Lehrer, Zubin Varghese, Zhe Wang and Yogesh Pandit, "Artificial Intelligence for Efficient Thermal Comfort Systems: Requirements, Current Applications and Future Directions", Front. Built Environ. 6:49. Volume 6, Article 49, April 2020, pp. 1-16.

		L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEJO4
Name of the Course	Industrial Safety and Management **Job Oriented Course**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Understand the basic principles of Industrial Safety	K2
CO2	Discuss the principles of Directing for Safety	K2
CO3	Explain the principles of Safety Management	K2
CO4	Describe the role of Safety Committee	K2
CO5	Apply the knowledge for Accident Prevention	K3

UNIT – I

Henrichs Axioms Of Industrial Safety, Concepts Of Safety, Organization For Safety, Organization, Definition, Need & Principles Organizing For Health, and, Environmental, Activities, Organization Structure, Function & Responsibilities.

UNIT-II

Directing For Safety, Direction, Definition, Process, Principles and Techniques Leadership, Role, Function and, Attributes of a Leader.

UNIT-III

Safety Management System, Objectives of Health, Safety and Environment Policy, Responsibility for Implementation of HSE Policy.

UNIT-IV

Role of Occupier and Factory Manager, Factory Safety Committee, Structure and Functions and Working Tenure details etc.

UNIT-V

ACCIDENT PREVENTION :Definition : Incident, Accident, Injury , Dangerous occurrence ,Unsafe Act, Unsafe, Conditions, Hazards, Error, Oversight, Mistake ,Near Miss ,Electricity & Hazards ,Of Electricity, Explosives and Transportation Safety.

TEXT BOOKS:

1. Fundamentals of Industrial safety & health by K.U. Mistry.
2. Factories Act 1948.

		L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEJO5
Name of the Course	Industrial Hydraulics and Pneumatics **Job Oriented Course**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Identify the fundamentals of Fluid Power Systems found in industry today.	K2
CO2	Discuss various types of Fluid Power Actuators	K2
CO3	Illustrate various Hydraulic elements in the design of circuits	K3
CO4	Describe the operations of Accumulators & intensifiers typically used in industry.	K2
CO5	Illustrate various Pneumatic systems and their operations	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

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 control valve.

UNIT – IV

Accumulators & intensifiers-types, size & function of accumulators application & circuits of accumulators – intensifiers – circuit & applications. Design & drawing of hydraulic circuits-Introduction-case study & specifications-method of drawing a hydraulic circuit-hydraulic cylinder – quick return of a hydraulic cylinder.

UNIT –V

Pneumatic systems-Introduction-symbols used-concepts & components comparison- types & specifications of compressors-arrangement of a complete pneumatic system-compressed air behaviour- understanding pneumatic circuits-direction control valves. Electro pneumatics- Introduction-Pilot operated solenoid valve-electrical connections to solenoids-electro pneumatic circuit switches-relays-solenoids- P.E converter-concept of latching.

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, Mc Graw Hill.

Semester	VI	L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEJO6
Name of the Course	Automation in Manufacturing **Job Oriented Course**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Explain Automation and types of Automations in the industries.	K2
CO2	Examine different Automated flow lines in the Industries.	K3
CO3	Asses and perform one or more processing and/or assembly operations on a starting raw material, part, or set of parts.	K3
CO4	Produce a sequence of automated or mechanized assembly operations Flexible manufacturing system (FMS)—a highly automated machine cell that produces part.	K3
CO5	Interpret logic controls, sensor, actuators and software configuration	K2

UNIT – I

Introduction: Types and strategies of automation, pneumatic and hydraulic components circuits, Automation in machine tools, Mechanical Feeding and to changing and machine tool control transfer the automation

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 BOOKS:

1. Automation, production systems and computer integrated manufacturing/ Mikell. P Groover
2. CAD/CAM/CIM/ P. Radha Krishnan & S. Subrahamanyarn and Raju/New Age International Publishers
3. System Approach to Computer Integrated Design and Manufacturing/ Singh/John Wiley

REFERENCE BOOKS:

1. Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang/ Pearson
2. Manufacturing and Automation Technology / R Thomas Wright and Michael Berkeihiser / Good
Heart/Willcox Publishers