DEPARTMENT OF MECHANICAL ENGINEERING

Open Electives offering to the students of other Departments

For

V, VI & VII 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

Open Elective Courses under V20 Regulations

(For 2020 – 2021 Admitted Batch)

S.No.	Category	Course Code	Course Title	Hours per week			
				L	T	P	C
1.	Open Elective	V20MEOE1	Basic Mechanical Engineering	3	0	0	3
2.		V20MEOE2	Green Engineering Systems				
3.		V20MEOE3	Computational Fluid Dynamics				
4.		V20MEOE4	Rapid Prototyping				
5.		V20MEOE5	Computer Aided Design				
6.		V20MEOE6	Mechatronics				

Courses offered in OPEN ELECTIVES V, VI & VII Semester B.Tech., under V20 Regulations to the students of the other departments

Semester	V	L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEOE1
Name of the Course	Basic Mechanical Engineering **Open Elective**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Discuss different types of materials, their properties and testing with applications.	K2
CO2	Interpret concepts of thermodynamics, Refrigeration, air conditioning and working of IC engines and air conditioners.	K2
CO3	Illustrate different manufacturing, joining, machining processes and machines with applications.	K2
CO4	Explain concepts of force, power transmission and power plants.	K2
CO5	Discuss the classification and working of pumps, turbines and gas turbines.	K2

UNIT – I

ENGINEERING MATERIALS AND PROCESSES:

ENGINEERING MATERIALS: Ferrous metals (Mild steel, Cast iron and its types, Stainless steel, High carbon steel), Non ferrous metals and alloys (Copper, Zinc, Aluminium, Tin, Nickel and their alloys). Properties- Strength, Hardness, Toughness, Brittleness, Creep, Fatigue, Stiffness, Ductility, Malleability, Elasticity, Plasticity, Specific gravity, Viscosity, Thermal conductivity, Specific heat, Corrosion resistance.

UNIT – II

THERMAL SCIENCE:

THERMODYNAMICS: System, Surroundings, Thermodynamic equilibrium, Property, State, Path, Process, Cyclic process, Work, Heat, Energy, Enthalpy, Entropy, Internal energy, Laws of thermodynamics (Description only), Scales of temperature.

IC ENGINES: Classification, Carnot, Otto, Diesel Cycles with P-V and T-S diagrams, 2 and 4 stroke C.I and S.I engines, working, Hybrid engines, Indicated power, Brake power, efficiencies.

REFRIGERATION AND AIRCONDITIONING: Refrigerant and its types with applications, Unit of refrigeration, COP, working of vapour compression refrigeration.

UNIT – III

MANUFACTURING SCIENCE: Basic description of manufacturing processes-Casting, Forging, Rolling, Extrusion, Hot and cold working processes with applications.

METAL JOINING PROCESSES: Basic description with sketches-Rivetting, Arc welding, Gas welding, Soldering and Brazing with applications.

UNIT – IV

FORCE AND POWER TRANSMISSION:

FORCE SYSTEM AND ANALYSIS: Concepts of- Laws of motion, Free body diagrams, Resultant force, Equilibrium, Friction, laws of friction, Stress, types of stress, Strain, Poisson's ratio, Elastic constants, Moment, Moment of inertia, centroid, Torque.

POWER TRANSMISSION: Description of working with sketches-Belt, Chain drives, Gear trains with applications, Single plate clutches. Basic concepts of hydraulic and pneumatic power transmission.

UNIT – V

PUMPS AND PRIME MOVERS:

PUMPS: Classification of pumps, Description and working of- Reciprocating and centrifugal pumps with applications, priming, Multistage pumps., Discharge and coefficient of discharge.

PRIME MOVERS: Classification of hydraulic turbines, steam turbines, description and working of Pelton wheel and governing. Types of gas turbines and working of gas turbines with applications.

TEXT BOOKS:

1. Thermal Engineering –Rajput RK, Laxmi publications.
2. Elements of Mechanical Engineering-Sadhu singh, S.chand publications.
3. Basic Mechanical Engineering –Pravin kumar, Pearson publications.
4. Elements of Mechanical Engineering-N.M. Bhatt and J.R.Mehta, Mahajan publishing house.

REFERENCE BOOKS:

1. Production Technology-P.C.Sharma
2. Thermal Engineering-PL Ballaney
3. Power Plant Engineering-Nagpal
4. Workshop Technology-Hajra choudhury

Semester	V	L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEOE2
Name of the Course	Green Engineering Systems **Open Elective**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Illustrate the concept of Solar Radiation, Collection, Storage and Applications	K2
CO2	Discuss the construction and working of wind energy and bio-energy conversion systems.	K2
CO3	Describe the construction and working of Geothermal and Ocean Energy conversion systems.	K2
CO4	Illustrate the principles of environmental impact of current manufacturing practices.	K2
CO5	Discuss the features and benefits of green building materials and its applications.	K2

UNIT – I

INTRODUCTION: SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, instruments for measuring solar radiation and sun shine, Flat plate and concentrating collectors.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different Storage methods, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

UNIT – II

WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, types of winds.

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, bio fuels, I.C. engine operation.

UNIT – III

GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy, potential in India.

OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

UNIT – IV

ENERGY EFFICIENT PROCESSES: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, zero waste manufacturing.

UNIT – V

GREEN BUILDINGS: Definition, features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste, Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings.

TEXT BOOKS:

1. Sukhatme S.P. and J.K.Nayak, Solar Energy – Principles of Thermal Collection and Storage,TMH.
2. Khan B.H., Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi, 2006.
3. Green Manufacturing Processes and Systems, Edited by J. Paulo Davim, Springer 2013.

REFERENCE BOOKS

1. Alternative Building Materials and Technologies / K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Ra.
2. Principles of Solar Energy / Frank Krieth & John F Kreider.
3. Non-Conventional Energy / Ashok V Desai /Wiley Eastern.
4. Renewable Energy Technologies /Ramesh & Kumar /Narosa
5. Renewable Energy Technologies/ G.D Roy

Semester	V	L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEOE3
Name of the Course	Computational Fluid Dynamics **Open Elective**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
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	Compare 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., 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 eat conduction, finite difference application in convective heat transfer, closure.

UNIT – IV

Finite differences, discretization, consistency, stability, and fundamentals of fluid flow modelling: 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 modelling, conservative property, the up wind scheme.

FINITEVOLUMEMETHOD: Approximation of surface integrals, volume integrals, interpolation and differentiation practices, upwind interpolation, linear interpolation and quadratic interpolation.

TEXTBOOKS:

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.

REFERENCEBOOKS:

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	V	L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEOE4
Name of the Course	Rapid Prototyping **Open Elective**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Understand virtual prototyping and testing of technology	K2
CO2	Construct CAD modelling for rapid prototyping	K3
CO3	Examine different types of process in rapid prototyping	K3
CO4	Explain Rapid Manufacturing errors	K2
CO5	Express the applications of rapid prototyping	K2

UNIT – I

Introduction: Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Classification of Rapid Manufacturing Processes: Additive, Subtractive, Formative, Generic RP process.

UNIT – II

CAD Modelling and Data Processing for RP: CAD model preparation, Data interfacing: formats (STL, SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP), conversation, validity checks, repair procedures; Part orientation and support generation, Support structure design, Model Slicing algorithms and contour data organization, direct and adaptive slicing, Tool path generation.

UNIT – III

RP Processes: Process Physics, Tooling, Process Analysis, Material and technological aspects, Applications, limitations and comparison of various rapid manufacturing processes. Photo polymerization (Stereo lithography (SL), Micro stereo lithography), Powder Bed Fusion (Selective laser Sintering (SLS), Electron Beam melting (EBM)), Extrusion-Based RP Systems (Fused Deposition Modelling (FDM)), 3D Printing, Sheet Lamination (Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC)), Beam Deposition (Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD)).

UNIT – IV

Errors in RP Processes: Pre-processing, processing, post-processing errors, Part building errors in SLA, SLS.

UNIT – V

Application of Rapid Prototyping and Technology: Functional models, pattern for investment and Vacuum casting, medical models, Art models, Engineering analysis models.

REFERENCE BOOKS:

1. Rapid Prototyping: Principles and Applications in Manufacturing. Chua C.K., Leong K.F., Chu S. L., World Scientific.
2. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing. Gibson, Ian, Rosen, David, Stucker, Brent, Pearson
3. Rapid Prototyping: Principles and Applications in Manufacturing. Noorani R, John Wiley & Sons.
4. Rapid Prototyping and Engineering applications: A tool box for prototype development. Liou W.L., Liou F. W., CRC Press
5. Rapid Prototyping: Theory and practice. Kamrani A. K., Nasr E. A., Springer

		L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEOE5
Name of the Course	Computer Aided Design **Open Elective**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Explain the basic fundamentals of CAD tools	K2
CO2	Find the characteristics of curves, Representation and continuity requirements	K3
CO3	Illustrate the Geometric Transformations and demonstrate various types of surfaces and Representation.	K3
CO4	Differentiate between the methods of representing Solid Modelling**.**	K4
CO5	Apply the local and global properties for product development	K3

UNIT – I

CAD Introduction: Need of machine design, use of computer, computer fundamentals, computer aided design process, CAD configuration, and CAD tools, positive and negative points of CAD, CAD and CAM integration.

UNIT – II

DESIGN OF CURVES: Fundamental of Curve Design, Parametric Space of a Curve, Representation, Parametric cubic curve, Blending functions, Truncation, extension, and subdivision, composite curve: continuity requirements .

UNIT – III

GEOMETRIC TRANSFORMATIONS: Translation, Rotation, Scaling Symmetry and Reflection, Homogeneous Transformations. Orthographic Projections, Axonometric Projections, Oblique Projections, Perspective Transformation.

DESIGN OF SURFACES: Fundamental of Surface Design, Parametric Space of a Surface, Representation of a Surface patch, sixteen point form, Four Curve Form, Plane.

UNIT – IV

SOLID MODELLING: Solid Modelling fundamentals, topology and geometry. Geometric Modelling Method, Constructive Solid Geometry (CSG), Boundary Representation (Brep), Introduction to Wireframe, surface and solid modelling techniques. Introduction CAD data exchange format IGES, STEP

UNIT – V

GEOMETRIC PROPERTIES: Local and global properties of a curve, Local and global properties of a surface, Global properties of complex solids, Relational properties, intersections. Applications in Product Development and other areas.

REFERENCE BOOKS:

1. Geometric Modeling: Michael E. Mortenson, Third Edition, Industrial Press Inc.2006.
2. Mathematical Elements of Computer Graphics, Rogers and Adams, McGraw Hill. 1994
3. CAD CAM Theory and Prectice: I. Zeid, Tata-McGraw Hill, 2006
4. Computer-Aided Engineering Design, B Sahay and ASaxena, Springer, 2005.
5. Differential Geometry of Curves and Surfaces, Thomas F. Banchoff and Stephen T. Lovett, Thomas Banchoff-Stephen Lovett, 2010.
6. Computational Geometry for Design and Manufacture, I.D. Faux and M.J. Pratt, John Wiley, 1980.
7. Lectures on Classical Differential Geometry, Dirk J. Struick, Addison Wesley, 1980.

		L	T	P	C	Course Code
Regulation	V20	3	0	0	3	V20MEOE6
Name of the Course	Mechatronics **Open Elective**					
Branch	Mechanical Engineering					

Course Outcomes:

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Understand the elements of Mechatronics & levels and explain various types of sensors , transducers and Mechatronics design process	K2
CO2	Sketch and explain various types of solid state devices like Diode, BJT, MOSFET, etc.,	K3
CO3	Illustrate and explain basic principles of Hydraulic, pneumatic, electro hydraulic, electro hydraulic servo actuating systems.	K3
CO4	Illustrate and explain microprocessors, microcontrollers and PLC	K3
CO5	Sketch and explain System interfacing and data acquisition systems.	K3

UNIT – I

MECHATRONICS SYSTEMS – elements & levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, advantages and disadvantages of mechatronics systems. Sensors and transducers, types, displacement,velocity, force, acceleration, liquid flow, liquid level, temperature and light sensors.

UNIT– II

SOLID STATE ELECTRONIC DEVICES - PN junction diode, BJT, FET, Analog signal conditioning, operational amplifiers, filters.

UNIT– III

HYDRAULIC AND PNEUMATIC ACTUATING SYSTEMS - Fluid systems, Hydraulic systems, and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic, electro-hydraulic servo systems.

UNIT– IV

DIGITAL ELECTRONICS AND SYSTEMS - Digital logic control, micro processors and micro controllers, programming, programmable logic controllers, PLCs versus computers, application of PLCs for control.

UNIT– V

SYSTEM AND INTERFACING AND DATA ACQUISITION – Data Acquisition Systems, Analog to Digital and Digital to Analog conversions; Digital Signal Processing.

TEXT BOOKS:

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram/WILEY India Edition

REFERENCE BOOKS:

1. Mechatronics /Smaili A, Mrad F/ Oxford Higher Education, Oxford University Press
2. Mechatronics Source Book / Newton C Braga/Thomson Publications, Chennai.
3. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
4. Mechatronics System Design / Devdas shetty/Richard/Thomson.
5. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
6. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition / W. Bolton / Pearson, 2012
7. Mechatronics – Principles and Application / Godfrey C. Onwubolu/Elsevier, Indian print