



# **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**

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## **DEPARTMENT OF MECHANICAL ENGINEERING**

### **COURSE STRUCTURE AND SYLLABUS**

**For**

**III & IV 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**



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

## DEPARTMENT OF MECHANICAL ENGINEERING

### Course Structure of Mechanical Engineering – V20 Regulation (For 2020 – 2021 Admitted Batch)

#### II B.Tech

III Semester						
S.No	Course Code	Course Title	Hours per week			C
			L	T	P	
1	V20MET03	Metallurgy and Material Science	3	0	0	3
2	V20MET04	Mechanics of Solids	3	0	0	3
3	V20MET05	Fluid Mechanics with Machine Learning	3	0	0	3
4	V20MET06	Thermodynamics	3	0	0	3
5	V20MBT51	Managerial Economics and Financial Analysis	3	0	0	3
6	V20MEL02	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
7	V20MEL03	Mechanics of Solids & Materials Engineering Lab	0	0	3	1.5
8	V20MEL04	Machine drawing	0	0	3	1.5
9	V20SOC01	Certificate course offered by industries/Professional bodies/APSSDC or any other accredited bodies.	1	0	2	2
10	V20ENT02	Professional Communication Skills – I	0	3	0	MNC
Total Credits			16	3	11	21.5

Total Contact Hours: 29

Total Credits: 21.5

IV Semester						
S.No	Course Code	Course Title	Hours per week			C
			L	T	P	
1	VI8MAT04	Probability and Statistics	3	0	0	3
2	V20MET07	Kinematics of Machinery	3	0	0	3
3	V20MET08	Manufacturing Science with Artificial Intelligence	3	0	0	3
4	V20MET09	Mechanical measurements and Metrology	3	0	0	3
5	V20MET10	Applied Thermodynamics	3	0	0	3
6	V20MEL05	Mechanical measurements and Metrology lab	0	0	3	1.5
7	V20MEL06	Manufacturing Process Lab	0	0	3	1.5
8	V20MEL07	Thermal Engineering Lab	0	0	3	1.5
9	V20SOC02	Certificate course offered by industries/Professional bodies/APSSDC or any other accredited bodies.	1	0	2	2
10	V20ENT03	Professional Communication Skills – II	0	4	0	MNC
	Total Credits		16	4	11	21.5

Total Contact Hours: 29

Total Credits: 21.5

**Syllabi for the courses offered in III semester B. Tech under V20 Regulation  
for the Academic Year 2020-2021**  
**III Semester**

<b>Semester</b>	<b>III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>V20MET03</b>
<b>Name of the Course</b>	<b>Metallurgy and Material Science</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Explain the types of bonds in solids and crystallization of Metals.	K2
CO2	Construct phase diagrams for the study of alloys and phase Transformation reactions.	K2
CO3	Use different ferrous and nonferrous metals based on properties for various applications	K3
CO4	Apply suitable heat treatment process to achieve desired properties of metals and alloys.	K3
CO5	Illustrate the properties and applications of composites and Ceramic materials and understand the concepts of powder metallurgy.	K2

**UNIT – I**

**INTRODUCTION TO METALLURGY AND MATERIAL SCIENCE:** Structure of Metals, Properties of metals, Types of Bonds in Solids, Crystal geometry – Space Lattices, Unit cells, Crystal Structure, Miller indices. Imperfections in crystals- Line defects, Point defects, Surface defects. Crystallization of metals, grain, grain boundaries and their properties. Constitution of alloys: Necessity of alloying, types of solid solutions, Hume Rotherys rules.

**UNIT – II**

**EQUILIBRIUM DIAGRAMS:** Experimental methods of construction of equilibrium diagrams, phase rule, Isomorphous alloy systems, Lever rule, eutectic systems, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, Study of important binary phase diagrams of Cu-Ni, Al- Si, and Fe-Fe<sub>3</sub>C.

**UNIT – III**

**FERROUS, NONFERROUS METALS AND THEIR ALLOYS:** Production of Iron and steel: Blast furnace, Cupola, Electric furnace and Induction furnace, Types of Cast irons- White, Grey, Malleable and Nodular Cast Irons, Properties and application of cast irons, Effect of alloying elements on structure and properties of steels, Properties and uses of Silicon and Hadfield Manganese steels, High speed steels and Stainless steel. Properties and uses of important non-ferrous metals like Cu, Al, Pb, Sn, Zn. Study of important non-ferrous alloys: Brass & Bronzes, Bearing alloys, Al alloys & Ti alloys.

#### **UNIT – IV**

**HEAT TREATMENT OF FERROUS AND NON-FERROUS ALLOYS:** Types of heat treatment processes, Annealing, normalizing, hardening, tempering, hardenability, surface - hardening methods, TTT diagrams, Age hardening treatment

#### **UNIT – V**

**ADVANCED MATERIALS:** Composites and its classification, methods of manufacturing of composites – stir casting method, hand layup process, filament winding process. Properties and applications of crystalline ceramics, shape memory alloys, Bio materials and nano-materials

**POWDER METALLURGY:** Introduction, Steps in Powder metallurgy, Powder characterizations, powder compact methods.

#### **TEXT BOOKS:**

1. Introduction to Physical Metallurgy/ Sidney H.Avner/ 2nd edition, McGraw Hill Education (India) Private Limited/2016.
2. Materials Science and Engineering/William D Callister (Adapted by R. Bala subramaniam) /Wiley Inida (P) Ltd/ 2007
3. Material Science and Metallurgy/ Dr.V.D.Kodgire/40<sup>th</sup> edition, Everest Publishing House/2017

#### **REFERENCE BOOKS**

1. Materials Science and Engineering/ V. Raghavan /5th Edition) Prentice-Hallof India Pvt. Ltd/2004.
2. Essential of Materials science and engineering /Donald Askeland/2nd edition Thomson/2014
3. Engineering mechanics of Composite Materials/Isaac M.Daniel, Ori Ishai/ 5th edition/Oxford Publications/2015.

<b>Semester</b>	<b>III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>V20MET04</b>
<b>Name of the Course</b>	<b>Mechanics of Solids</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to	Knowledge Levels
CO1	Illustrate concept of stress and strain of composite bars.	K3
CO2	Solve shear force and bending moment in beams.	K3
CO3	Calculate flexural and shear stresses in a beam and understand the torsional rigidity of shaft.	K3
CO4	Analyze the principal stresses in structural members.	K4
CO5	Solve the buckling load capacity of columns, and longitudinal stress and strains in thin cylinders.	K3

**UNIT – I**

**SIMPLE STRESSES & STRAINS:** Definitions of stress and strain – types of stresses and strains – Elasticity –Hooke’s law–Stress–Strain diagram for Mild steel – working stress- factor of safety-Lateral strain–Poisson’s ratio and volumetric strain – Elastic Moduli and the relationship between elastic constants– Bars of varying section – composite bars – temperature stresses.

**STRAIN ENERGY:** Definition – Resilience – Strain Energy due to gradually applied; suddenly applied and impact loads–simple applications.

**UNIT – II**

**SHEAR FORCE & BENDING MOMENT DIAGRAMS:** Definition of beam –Types of beams – concept of SF and BM – SF & BM diagrams for cantilever, Simple support and over hanging beams subject end point loads, Uniform distributed load (UDL), uniformly varying loads–point of contra flexure –Relationship between S.F, BM and rate of loading.

**UNIT – III**

**FLEXURAL STRESSES:** Theory of simple Bending – Assumptions–Derivation of Bending equation – Neutral axis – Determination of bending stresses – section modulus of rectangular, Circular sections (Solid and Hollow), I and T channel sections.

**DEFLECTION OF BEAMS:** Relation between curvature, slope and deflection; Slope and deflection of cantilever, simply supported with point and U.D.L– Macaulay’s method.

**UNIT – IV**

**PRINCIPAL STRESSES AND STRAINS:** Introduction – stresses on an inclined section of a bar under axial loading - compound stresses - Normal and tangential stresses on an inclined plane for biaxial stresses-Two perpendicular normal stresses–representation of stress on Mohr’s circle diagram, Introduction to theories of Failure.

**UNIT – V**

**COLUMNS:** Buckling and Stability, Columns with Pinned ends, Columns with other support Conditions, Limitations of Euler’s Formula, Rankine’s Formula.

**THIN CYLINDERS:** Thin seamless cylindrical shells– Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders.

**TEXT BOOKS:**

1. Strength of materials/R.K.Bansal/LaxmiPublications5<sup>th</sup> edition/2017
2. Mechanics of Materials/Gere and Timoshenko,/TMH4<sup>th</sup>edition/2010
3. Strength of materials/ S.Ramamrutham/Dhanpatrai publishers 1<sup>st</sup> edition /2016

**REFERENCE BOOKS:**

1. Solid Mechanics, by Popov/PHIpublications2<sup>nd</sup> edition/2017.
2. Introduction to Solid Mechanics / Irving H Shames/ 4<sup>th</sup> edition PEARSON /2014.
3. Strengthofmaterials/Young,D.H.Timoshenko,Stephen/CBSpublishers/2002

<b>Semester</b>	<b>III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>V20MET05</b>
<b>Name of the Course</b>	<b>Fluid Mechanics with Machine Learning</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to	Knowledge Levels
CO1	Explain the concepts of fluid properties and measurement of pressure.	K2
CO2	Describe the types of flows, lines & apply equations of fluid mechanics and its applications.	K3
CO3	Calculate losses and force on different types of vanes.	K3
CO4	Calculate the performance of turbines and pumps.	K3
CO5	Understand the fundamentals of machine learning and machine learning for fluid mechanics.	K2

**UNIT – I**

**FLUID STATICS:** Dimensions and units-Physical properties of fluids-Density, Specific gravity, Viscosity, Surface tension, Vapour pressure, Capillarity, Bulk modulus. Pressure types-Atmospheric, absolute, gauge and vacuum pressure and measurement of pressure- Piezometer, different types of manometers.

**UNIT – II**

**FLUID KINEMATICS:** stream line, path line and streak line and stream line, classification of flows steady & unsteady, uniform & non uniform, laminar & turbulent, rotational & irrotational flows-equation of continuity for one dimensional flow and three dimensional flow. Equation of continuity in differential form.

**FLUID DYNAMICS:** Surface and body forces, Bernoulli's equation along a stream line, Momentum equation, application of momentum equation on pipe bend. Measurement of flow: Pitot tube, Venturimeter, Orifice meter.

**UNIT – III**

**CLOSED CONDUIT FLOW:** Reynolds experiments, Darcy-Weisbach equation, Major and minor losses, Hydraulic gradient line, Total energy line, Pipes in series and parallel.

**BASICS OF TURBO-MACHINERY:** Determination of hydrodynamic force of jet on stationary and moving flat, inclined, curved vanes (jet striking at tip and centre), velocity diagrams, work done and efficiency, flow over radial vanes, series of vanes.

**UNIT – IV**

**TURBINES AND PUMPS:** Classification of turbines, Pelton wheel, Francis turbine, Kaplan turbine-working proportions, work done, efficiencies. Draft tube-types, functions and efficiency.

**CENTRIFUGAL PUMPS:** Working, work done, heads, efficiencies, losses.

**RECIPROCATING PUMPS:** Working, work done, slip, indicator diagrams.

**UNIT – V**

**FUNDAMENTALS OF MACHINE LEARNING:** Supervised, semi-supervised and supervised learning.

**MACHINE LEARNING FOR FLUID MECHANICS:** Introduction, historical developments, challenges and opportunities; concepts of flow modelling and flow optimization & control.



**TEXT BOOKS:**

1. Hydraulics, Fluid mechanics and Hydraulic machinery – Modi & Seth.
2. Fluid mechanics and Hydraulic machines – R.K. Bansal.
3. Introduction to Fluid mechanics and fluid machines – S.K. Som & G. Biswas. (Tata – Mcgrawhill)
4. Ethem Alpaydin, Introduction to Machine Learning , MIT Press, Prentice Hall of India, Third Edition 2014.

**REFERENCE BOOKS:**

1. Fluid mechanics and machinery – G. Ramadurgaih ( New age international publishers)
2. Fluid mechanics and fluid power engineering – D.S.Kumar (S.K. Kataria and sons)

<b>Semester</b>	<b>III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>V20MET06</b>
<b>Name of the Course</b>	<b>Thermodynamics</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to	Knowledge Levels
CO1	Discuss the basic terms related to work and heat.	K2
CO2	Explain first law of thermodynamics and internal energy.K2	K2
CO3	Apply the second law of thermodynamics to basic thermal systems.	K3
CO4	Analyze various thermodynamic cycles.	K4
CO5	Discuss about pure substance.	K2

**UNIT – I**

Thermodynamic System, boundary, Surrounding, control volume, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi – static Process, Irreversible Process, Causes of Irreversibility – Energy in State Work and Heat, Point and Path function. Zeroth law of thermodynamics.

**UNIT – II**

Joule’s Experiments – First law of Thermodynamics –First law applied to a Process – First law applied to a flow system –Energy balance for closed systems-Specific heats at constant volume and pressure - Internal energy and Enthalpy, Some steady flow energy equation applied to Nozzle, Turbine, Compressor and heat exchanger devices, PMM-I, Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance.

**UNIT – III**

Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM of Second kind, Carnot’s principle, Carnot cycle and its specialties, Clausius theorem Clausius Inequality, Entropy, Principle of Entropy Increase, availability and irreversibility(Basic definitions), T-ds relations, Helmholtz and Gibbs functions, Gibbs relations, Maxwell relations, Elementary Treatment of the Third Law of Thermodynamics.

**UNIT – IV**

**THERMODYNAMIC CYCLES:** Carnot vapor cycle, ideal Rankine cycle, Rankine reheat cycle, air-standard Otto cycle, air-standard Diesel cycle, air-standard Brayton cycle, vapor-compression refrigeration cycle.

**UNIT – V**

**PURE SUBSTANCES:** P-V-T- surfaces, T-S and h-s diagrams, Mollier Charts, Phase Transformations, Triple point and critical point, properties during change of phase, Dryness Fraction, Clausius – Clapeyron Equation.

**TEXT BOOKS:**

1. Engineering Thermodynamics, PK Nag 5th Edn, TMH,2014.
2. Thermodynamics, An engineering Approach, Y.A. Cengel& M.A. Boles, 7th Edn- McGraw Hill, 2014.
3. Internal Combustion Engine –V Ganeshan.4th edition, TMH, 2016

**REFERENCE BOOKS:**

1. Engineering Thermodynamics by Y.V.C. Rao, 1st edition, Universities, 2005.
2. A text book of Engineering thermodynamics, R.K Rajput, 4th edition, Lakshmi Publishers, 2010.

<b>Semester</b>	<b>III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>V20MBT51</b>
<b>Name of the Course</b>	<b>Managerial Economics &amp; Financial Analysis</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to	Knowledge Levels
CO1	Understand the basic concepts of managerial economics, demand, elasticity of demand and methods of demand forecasting.	K2
CO2	Interpret production concept, least cost combinations and various costs concepts in decision making.	K3
CO3	Differentiate various Markets and Pricing methods along with Business Cycles.	K2
CO4	Prepare financial statements and its analysis.	K3
CO5	Assess various investment project proposals with the help of Capital Budgeting techniques for decision making.	K3

**UNIT – I**

**INTRODUCTION TO MANAGERIAL ECONOMICS AND DEMAND ANALYSIS:** Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Concept of Demand-Types-Determinants-Law of Demand its Exceptions-Elasticity of Demand-Types and Measurement-Demand forecasting and its Measuring Methods.

**UNIT – II**

**PRODUCTION AND COST ANALYSIS:** Production function-Iso-quants and Iso-cost-Law of Variable proportions- Cobb-Douglas Production function-Economies of Scale-Cost Concepts- Opportunity Cost-Fixed vs Variable Costs-Explicit Costs vs Implicit Costs- Cost Volume Profit analysis- Determination of Break-Even Point- BEP Chart (Simple Problems).

**UNIT – III**

**INTRODUCTION TO MARKETS, PRICING POLICIES & FORMS OF ORGANIZATIONS AND BUSINESS CYCLES:** Market Structures: Perfect Competition, Monopoly, Monopolistic and Oligopoly – Features – Price, Out-put Determination – Methods of Pricing: Evolution of Business Forms - Features of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises. Business Cycles – Meaning and Features – Phases of Business Cycle.

**UNIT – IV**

**INTRODUCTION TO ACCOUNTING & FINANCING ANALYSIS:** Introduction to Double Entry System – Preparation of Financial Statements- Trading Account, Profit & Loss Account and Balance Sheet - Ratio Analysis – (Simple Problems).

**UNIT – V**

**CAPITAL AND CAPITAL BUDGETING:** Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods.

**TEXT BOOKS:**

1. Dr. N. AppaRao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011
2. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011
3. Prof. J.V.Prabhakararao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.

**REFERENCE BOOKS:**

1. Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House, 2014.
2. V. Maheswari: Managerial Economics, Sultan Chand.2014
3. Suma Damodaran: Managerial Economics, Oxford 2011.
4. VanithaAgarwal: Managerial Economics, Pearson Publications 2011.
5. Sanjay Dhameja: Financial Accounting for Managers, Pearson
6. Maheswari: Financial Accounting, Vikas Publications.
7. S. A. Siddiqui& A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012
8. Ramesh Singh, Indian Economy, 7th Edn., TMH2015
9. Pankaj Tandon A Text Book of Microeconomic Theory, Sage Publishers, 2015
10. Shailaja Gajjala and Usha Munipalle, Univerties press, 201

<b>Semester</b>	<b>III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>	<b>V20MEL02</b>
<b>Name of the Course</b>	<b>Fluid Mechanics &amp; Hydraulic Machines Lab</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to	Knowledge Levels
C01	Determine the force exerted by jet, friction factor, loss of head due to sudden contraction.	K3
C02	Examine and Analyze the performance of pumps and turbines.	K3
C03	Calibrate different flow measuring devices.	K3

1. Determination of force exerted by jet on a flat vane.
2. Determination of loss of head due to sudden contraction.
3. Determination of friction factor.
4. Calibration of Venturimeter.
5. Calibration of Orifice meter.
6. Calibration of Turbine flow meter.
7. Analyze the performance of single stage centrifugal pump.
8. Analyze the performance of multi stage centrifugal pump.
9. Analyze the performance of reciprocating pump.
10. Analyze the performance of Pelton wheel.
11. Analyze the performance of Francis turbine.

<b>Semester</b>	<b>III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>	<b>V20MEL03</b>
<b>Name of the Course</b>	<b>Mechanics of Solids &amp; Materials Engineering Lab</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to	Knowledge Levels
CO1	Assess the Mechanical properties of different metals.	K3
CO2	Examine the micro structures of different Ferrous and non Ferrous metals.	K3
CO3	Identify the effect of heat treatment and cooling rates on the Properties of steels.	K4

**NOTE: Any 6 experiments from each section A and B.**

**A) MECHANICS OF SOLIDS LAB:**

1. Direct tension test
2. Bending test
  - a) Simply supported beam
  - b) Cantilever beam
3. Torsion test
4. Hardness test
  - a) Brinell hardness test
  - b) Rockwell hardness test
5. Test on springs
6. Compression test on cube
7. Impact test
8. Punch shear test

**B) METALLURGY LAB:**

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Micro structure of Mild steels, Medium carbon steels, and \ high-Csteels.
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys–Brass and Bronze.
5. Study of the Micro structures of Heat treated steels.
6. Hard enability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.

**REFERENCE BOOKS:**

1. Strength of materials, S.S.Bhavikatti Vikas Publications, 4<sup>th</sup> edition, 2013.  
Material Science and Metallurgy, Dr.V.D.Kodagire, Everest Publishing House, 40<sup>th</sup> Edition, 2017

<b>Semester</b>	<b>III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>	<b>V20MEL04</b>
<b>Name of the Course</b>	<b>Machine Drawing</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to	Knowledge Levels
CO1	Identify the national and international standards pertaining to machine drawing.	K2
CO2	Illustrate the importance of the linking functional and visualization aspects in the preparation of the part drawings	K3
CO3	Apply limits and tolerances to assemblies and choose appropriate fits for given assemblies.	K3
CO4	Interpret the Machining and surface finish symbols on the component drawings.	K3
CO5	Develop the part or assembly drawings as per the conventions.	K3

**INTRODUCTION:** (AUTO CAD or any other drafting Software)

Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing, Drawing units, grid and snap. Conversion of pictorial views into orthographic projections of simple machine parts (with and without section). Hidden line conventions. Precedence of lines

**PART-A**

**SECTIONS OF SOLIDS:** Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting only on their bases (No problems on axis inclinations, spheres and hollow solids). True shape of sections. Conversion of pictorial views into orthographic projections of simple machine parts. Hidden line conventions. Precedence of lines. Conversion of pictorial views into orthographic projections of simple machine parts (with section planes indicated on the part).

**THREAD FORMS:** Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW (Internal & External) square and Acme. Sellers thread, American Standard thread.

**FASTENERS:** Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

**KEYS:** Parallel key, Taper key, Feather key, Gib-head key and Woodruff key.

**JOINTS:** Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods. Couplings: Split Muff coupling, Protected type flanged coupling, pin (bush) type flexible coupling, and universal coupling (Hooks' Joint)

**PART-B**

Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, machining symbols, types of fits with symbols and applications, geometrical tolerances on drawings. Standards followed in industry.

**Assembly Drawings (Any modeling software)**

1. Plummer block (Pedestal Bearing)
2. Stuffing box
3. Propeller Blade
4. Spur Gear
5. Tailstock of lathe
6. Machine vice
7. Tool head of shaper

**TEXT BOOKS:**

1. Machine drawing \_ K.L. Narayana, P. Kanniah& K.Venkata reddy, 1st edition, Radiant, 2016
2. Tool Engineering & Design \_ G.R. Nagpal/Khanna publishers, 1st edition, Khanna Publishers,2009
3. Machine Drawing with Auto CAD- Pohit and Ghosh, 1st edition, Pearso, 2017

**REFERENCE BOOKS:**

1. Machine Drawing by Nagpal,1st edition, khanna publishers, 2009
2. Machine drawing, Ajeet Singh, 2nd edition, TMH, 2016
3. Machine drawing with autocad, Pohit; Goutam, 1st edition, Pearson, 2017.



<b>Semester</b>	<b>III</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>MNC</b>	<b>V20ENT02</b>
<b>Name of the Course</b>	<b>Professional Communication Skills - I</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to	Knowledge Levels
CO1	Use vocabulary in regular chores of life with accuracy, make meaningful sentences, and describe people and their traits vividly.	K3
CO2	Distinguish between places of pilgrimage and holiday spots; describe incidents, things and process; and frame questions, statements and expressions.	K4
CO3	Demonstrate their knowledge of idioms which are similar to those of native speakers while speaking and writing and use phrases clearly and precisely to articulate their views that compare and contrast indianisms with native expressions and avoid common errors.	K3
CO4	Employ the vocabulary of netizens with ease and walk through the letters and emails for effective official correspondence and infer the accurate meaning of the homophones that are often confusing.	K3
CO5	Summarize their profile; introduce themselves as well as others by incorporating their accomplishments and Sketch stories and anecdotes in an interesting and engaging manner that arouses curiosity of the audience.	K5

**UNIT – I**

**BUILDING VOCABULARY FOR DAILY ACTIVITIES**

**NAMES:** Things- Kitchen Utensils – Occupation- tools – spices- vegetables –flowers - sciences of study – Professions .

Framing Questions – statements – expressions related to the Vocabulary taught

**PEOPLE :** Describing people - Physical characteristics,-Mental attributes – various professions

Framing Questions – statements – expressions related to the Vocabulary taught

**ACTIVITY :** Related to the topics learnt in Unit – 1

**UNIT – II**

**BUILDING VOCABULARY FOR PLACES, THINGS & PROCESS**

**PLACES:** Describing favourite place – famous place- Places of Pilgrimage

**THINGS:** Describing a thing- Describe an incident or an event

**PROCESS:** Describe a process –Recipe – experiment –Entrance test application

Framing Questions – statements – expressions related to the Vocabulary taught

**ACTIVITY :** Related to the topics learnt in Unit – II

**UNIT – III**

**NATIVE EXPRESSIONS** – Idioms and Phrases – in day to day activities for different occasions - Usage written & spoken –

**PHRASES** with as—as expressions – used to compare & contrast

**COMMON MISTAKES-** in spoken & written

**INDIANISMS-** Most often used expressions – accepted in India – found place in Dictionary

**ACTIVITY :** Related to the topics learnt in Unit – III

#### **UNIT -IV**

**NET VOCABULARY:** Acronyms and abbreviations that are most often used

**HOMOPHONES :** Words often confused – Spelling & Pronunciation

**Letter Writing :** Formal & Informal- Letters for all occasions

**Email Writing :** Business mails – project status mails – informative mails

**ACTIVITY :** Related to the topics learnt in Unit – IV

#### **UNIT -V**

**SELF-INTRODUCTION:** Basic information - Academic and personal - interests– strengths and weaknesses – goal.

**PROFILE BUILDING:** Resume writing – CV Building – Types

**STORYTELLING WITH CREATIVITY:** Reading and Narrating a story – narrating anecdotes

**ACTIVITY :** Related to the topics learnt in Unit – V

#### **REFERENCES:**

- Lewis Norman, Word Power Made Easy (2008). Goyal Publishers & Distributors Pvt. Ltd.
- Sunita Mishra & C.Muralikrishna, Communication Skills for Engineers (2006). Dorling Kindersley (India) Pvt. Ltd., licensees of Pearson Education in South Asia.
- Chaturvedi PD & Chaturvedi Mukesh, Business Communication (2006). Dorling Kindersley (India) Pvt. Ltd., licensees of Pearson Education in South Asia.
- Joshi Manik, Popular English Idioms and Phrases: English Idiomatic Expressions (2013).
- Joshi Manik, Homonyms, Homophones and Homographs: Vocabulary Building (2014).
- Gupta S.C. A Handbook for Letter Writing (2018). Arihant Publishers
- Lisa McGrimmon, The Resume Writing Guide: A Step-by-Step Workbook for Creating a Winning Resume (2013). CareerChoiceGuide; 2nd edition.
- Sawhney, Clifford. Improve your Word Power (2013). V&S Publishers

#### **Web References: (NET Vocabulary)**

- <https://www.grammarly.com/blog/texting-abbreviations/>
- <https://www.slicktext.com/blog/2019/02/text-abbreviations-guide/>
- <https://www.webopedia.com/reference/text-abbreviations/>

## IV Semester

<b>Semester</b>	<b>IV</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>V20MAT04</b>
<b>Name of the Course</b>	<b>PROBABILITY AND STATISTICS</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

### **Course Outcomes:**

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Find the Expectation of Random variables	K3
CO2	Apply probability distribution to real time problems	K3
CO3	Plot a best fit curve to an experimental data and find the correlation and regression	K3
CO4	Find good estimators to various parameters	K3
CO5	Apply the principles of Statistical Inference to practical problems	K3

### **UNIT – I**

#### **Random Variables and Expectation:**

Random Variables: Discrete and continuous - Probability function – density and distribution function, Expectation of a Random Variable, Moments, Chebychev's Inequality (Without proof).

### **UNIT – II**

#### **Probability Distributions**

Probability distributions: Binomial, Poisson and Normal - Evaluation of statistical parameters: Mean, Variance and their properties, Introduction to Exponential, Gamma and Weibull distributions

### **UNIT – III**

#### **Bivariate Distributions**

Curve fitting by the method of Least squares- Fitting of straight line, parabola and exponential curves, Simple Correlation and Regression – Rank correlation.

### **UNIT – IV**

#### **Sampling Distribution and Estimation**

Introduction –Sampling distribution of means with known and unknown standard deviation

Estimation: Criteria of a good estimator, point and interval estimators for means and proportions

### **UNIT – V**

#### **Tests of Hypothesis**

Introduction-Type-I, Type-II Errors, Maximum Error, one-tail, two-tail tests, Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means.

Test of significance: Small sample test for single mean, difference of means and test of ratio of variances (F-Test) - Chi-square test for goodness of fit and independence of attributes.

### **TEXT BOOKS:**

1. **B. V. Ramana**, A text Book of Engineering Mathematics, Tata McGraw Hill.
2. **Miller & Freund's**, Probability & Statistics for Engineers – Eighth Edition,  
Richard. A. Johnson

### **REFERENCES BOOKS:**

1. **S. Ross**, “A First Course in Probability”, Pearson Education India, 2002.
2. **Dr.T.S.R.Murthy**, Probability and Statistics for Engineers, BS Publications.
3. **T. Veerarajan**, “Engineering Mathematics”, Tata McGraw-Hill, New Delhi, 2010.

<b>Semester</b>	<b>IV</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>V20MET07</b>
<b>Name of the Course</b>	<b>Kinematics of Machinery</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Explain the inversion of the four bar, slider crank and double slider chains.	K2
CO2	Analyze and perform the velocities and accelerations in mechanisms by graphical method.	K4
CO3	Explain the working of copying mechanism, straight line motion mechanisms, steering gears and Hooke's joint.	K2
CO4	Develop the cam profiles for given follower motions.	K3
CO5	Describe tooth profiles for gears, gear trains and compute the velocity ratio and torque in gear trains and calculate various parameters related to belts.	K3

**UNIT – I**

**MECHANISMS :** Introduction, terminology, definitions and assumptions, planar, spherical and spatial mechanisms, mobility, classification of mechanisms, kinematic inversion, inversions of four bar chain, slider crank chain and double slider chain, Grashoff's law, mechanical advantage.

**UNIT – II**

**VELOCITY ANALYSIS :** Introduction, Absolute and relative motions, Vectors, Addition and subtraction of vectors, Motion of a link, Four-link mechanism, Velocity diagrams, Angular velocity of links, Velocity of rubbing, Slider-crank mechanism, crank and slotted lever mechanism, Instantaneous center, Kennedy's theorem, Locating I-centers, Angular velocity ratio theorem.

**ACCELERATION ANALYSIS:** Introduction -Acceleration, four-link mechanism, Acceleration of intermediate and offset points, Slider-crank mechanism, Coriolis component, Crank and slotted lever mechanism using graphical method, Klein's Construction.

**UNIT – III**

**LOWER PAIRS:** Pantograph, Exact straight line mechanism condition, Peaucellier, Hart Scott-Russel mechanisms. Approximate straight line mechanisms, Grasshopper, Watt, Chebyshev, Robert mechanisms. Steering gears-condition for correct steering, Davis, Ackerman steering gears, Hooke's joint-velocity ratio, angular acceleration of driven shaft, double Hooke's joint.

**UNIT – IV**

**CAMS:** Types of cams and followers, types of follower motion, velocity and acceleration diagrams, profile of cams.

**UNIT – V**

**GEARS:** Classification of gears, spur gears- terminology, fundamental law of toothed gearing, involute and cycloidal profile, Path of contact, arc of contact, contact ratio, minimum number of teeth, interference and methods of avoiding interference, rubbing velocity.

**GEAR TRAINS:** Introduction, Types - Simple , compound and reverted gear trains , Epicyclic gear train.

**BELT DRIVES:** Belt and rope drives, open and crossed belt drives, velocity ratio, slip, material for belts and ropes, crowning of pulleys, ratio of friction tensions, power transmitted, centrifugal effect on belts, maximum power transmitted by a belt, initial tension.

**TEXT BOOKS:**

1. Theory of Machines/ Rattan SS, Tata McGraw Hill Education Publishers, 4<sup>th</sup> Edition 2015.
2. Theory of Machines / Beven Thomos / CBS publication, 3<sup>rd</sup> edition /2005

**REFERENCE BOOKS:**

1. Theory of Machines / R.K.Bansal/ Laxmi Publications 5<sup>th</sup> edition /2016
2. Mechanisms of Machines, V Ramamurthy, Narosa publishing House, Reprint ,2019
3. Theory of Machines by R S Khurmi, S Chand Publications, 1st Edition, 2011.
4. Theory of Machines and Mechanisms, Ballaney P, Khanna publications,1st Edition,2011.

<b>Semester</b>	<b>IV</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>V20MET08</b>
<b>Name of the Course</b>	<b>Manufacturing Science with Artificial Intelligence</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Understand fundamentals of casting-patterns and its materials, Gating System	K2
CO2	Distinguish various welding processes and select a suitable process based on the application and requirements, explain advanced welding techniques, testing methods	K2
CO3	Explain the knowledge on Hot working and Cold Working Process	K3
CO4	Describe various bulk forming processes, sheet metal forming and processing of plastics.	K2
CO5	Apply the concepts of Artificial intelligence in manufacturing processes.	K3

**UNIT – I**

**CASTING** - Steps involved in making a casting, types of sands – Advantage of casting and its applications.

**PATTERNS AND PATTERN MAKING** – Types of patterns – Materials used for patterns, pattern allowances and their construction, risers, Centrifugal, Die, Investment castings.

**PRINCIPLES OF GATING** – Gating ratio and design of Gating systems.

**METHODS OF MELTING** – Crucible melting and cupola operation.

**SOLIDIFICATION OF CASTING** – Concept – Solidification of pure metal and alloys.

**UNIT – II**

**WELDING:** Classification of welding process types of welds and welded joints and their characteristics, design of welded joints Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding, Inert Gas welding - TIG & MIG, welding, Laser welding, Soldering & Brazing. welding defects, destructive non-destructive testing of welds.

**UNIT – III**

**HOT & COLD WORKING:** strain hardening, recovery, re-crystallization and grain growth, Comparison of properties of Cold and Hot worked parts.

**ROLLING FUNDAMENTALS** – Theory of rolling, types of Rolling mills and products

**EXTRUSION OF METALS:** Basic extrusion process and its characteristics.

Hot extrusion and cold extrusion - Forward extrusion and backward extrusion– Impact extrusion Hydrostatic extrusion

**DRAWING** – Wire drawing and Tube drawing

**UNIT – IV**

**BULK FORMING PROCESSES:** Principles of forging – Tools and dies – Types Forging – Smith forging, Drop Forging – Roll forging – Forging hammers: Rotary forging – forging defects.

**SHEET METAL FORMING:** Stretch Forming, Deep Drawing, Coining, Spinning, Blanking and Piercing – Bending and Forming, Stamping dies, Spring Back effect.

**PROCESSING OF PLASTICS:** Types of Plastics, Properties, applications and their Processing methods & Equipment (blow & injection moulding)

## **UNIT – V**

**ARTIFICIAL INTELLIGENCE IN MANUFACTURING INDUSTRY:** Introduction, developments of Artificial intelligence in manufacturing Industry; Advantages, limitations and applications of Artificial Intelligence in Manufacturing industry- fault diagnosis, Quality inspection, inventory control, industrial safety and maintenance.

### **TEXT BOOKS:**

1. Manufacturing Engineering and Technology/ Kalpakjian, Serope,Steven,Schmid R. / Pearson, 1<sup>st</sup> Edition 2013.
2. Manufacturing Technology / P.N. Rao/ Tata McGraw Hill, 4<sup>th</sup> Edition 2016.
3. Russell, S. and Norvig, P. 2015. Artificial Intelligence - A Modern Approach, 3rd edition, Prentice Hall.

### **REFERENCE BOOKS**

1. Production Technology / R.K. Jain /Khanna publishers,17<sup>th</sup> edition 2004.
2. Principles of Metal Castings / Richard W Heine and Roenthal. McGraw HillEducation, 2nd Edition 2017.
3. Welding Process and technology /Dr. Paramar / Khanna Publishers,3rdEdition.
4. Production Technology /Sarma P C / S.Chand Publications,4<sup>th</sup> Edition 2014.



<b>Semester</b>	<b>IV</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>V20MET09</b>
<b>Name of the Course</b>	<b>Mechanical Measurements and Metrology</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Discuss the basic concepts of measurement system and Linear measuring Instruments.	K2
CO2	Explain various types of Temperature, Pressure and Flow measuring Instruments.	K2
CO3	Understand the working of Acceleration, Vibration and Strain measuring devices.	K2
CO4	Apply tolerances and fits for selected product quality and explain various Linear, Angular and Optical measuring instruments and their applications	K3
CO5	Explain the measurement of surface finish with various comparators	K2

**UNIT – I**

**BASIC CONCEPTS:** Introduction, Fundamental Measuring Processes and methods, Generalized measurement system and its functional elements, Performance characteristics.

**DISPLACEMENT MEASUREMENT:** Principle and construction of various transducers – piezo electric, inductive, capacitance, resistance, ionization and photo electric transducers, calibration procedures.

**UNIT – II**

**TEMPERATURE MEASUREMENT :** Thermometry , scales of temperature, electrical resistance – thermister, RTD, thermocouple , pyrometers.

**PRESSURE MEASUREMENT :** Working of Various instruments - dead weight pressure gauge , bourdon pressure gauges, bellows , diaphragm gauges.

**FLOW MEASUREMENT-** Rota meter, Magnetic, Ultrasonic, hot – wire anemometer, Laser Doppler Anemometer (LDA).

**UNIT – III**

**ACCELERATION AND VIBRATION MEASUREMENT:** Principles of seismic instruments – Vibrometer and Accelerometer

**STRAIN MEASUREMENTS:** Various types of strain measuring instruments – electrical strain gauge – gauge factor – use of resistance strain gauge for measuring bending compressive and tensile strains, strain gauge rosettes.

**UNIT – IV**

**LIMITS AND FITS:** Introduction, Normal size, Tolerance limits, Deviations, Allowance, Fits and their types – unilateral and bilateral tolerance system, hole and shaft basis systems – interchangeability and selective assembly. Indian standard Institution system.

**LINEAR MEASUREMENT:** Standards of measurements- line and end standard. Basic principle and applications of slip gauges, dial indicator and micrometers.

**ANGULAR MEASUREMENTS:** Bevel protractor – angle slip gauges – sine bar, rollers and spheres used to determine the tapers, Applications of angular measurement.

**OPTICAL MEASURING INSTRUMENTS:** Tool maker’s microscope and its uses – collimators, optical projector – optical flats and their uses, interferometer, and those applications.

## **UNIT – V**

**SURFACE TEXTURE:** Factors effecting surface roughness, reasons for controlling surface texture, Differences between surface roughness and surface waviness, Elements of surface texture -Numerical assessment of surface finish – CLA, R, R.M.S Values – Ra values, and Rz values. Basic principle of profile meter and Talysurf. ISI symbols for indication of surface finish, Applications surface texture.

**COMPARATORS:** Types – Mechanical, Optical, Electrical and Electronic, Pneumatic Comparators and Their Uses.

### **TEXT BOOKS:**

1. Measurement Systems: Applications & design / D.S Kumar/ Metropolitan/1st/2015
2. Mechanical Measurements / BeckWith, Marangoni,Linehard/ Pearson/6th/2018
3. Engineering Metrology by R.K.Jain / Khanna Publishers

### **REFERENCE BOOKS**

1. Dimensional Metrology, Connie Dotson, Cengage Learning.
2. Engineering Metrology by I.C.Gupta / DhanpatRai Publishers.
3. Precision Engineering in Manufacturing by R.L.Murthy / New Age.
4. Engineering Metrology and Measurements by NV Raghavendra, L Krishna murthy, Oxford publishers.
5. Engineering Metrology by KL Narayana, Scitech publishers.
6. Mechanical and Industrial Measurements / R.K. Jain/ Khanna Publishers/2008
7. Measurement systems: Application and design/Doebelin Earnest. O. Adaptation/ TMH/ 6th edition, 2018

<b>Semester</b>	<b>IV</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>V20MET10</b>
<b>Name of the Course</b>	<b>Applied Thermodynamics</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Illustrate the working of various IC engines and associated systems such as lubricating system, cooling system, fuel feed system and ignition system.	K2
CO2	Explain the working of boilers and its performance parameters.	K2
CO3	Compute the performance of steam nozzles and steam turbines.	K3
CO4	Analyze the working of steam condensers and their performance parameters.	K4
CO5	Compute the performance of gas turbines.	K3

**UNIT – I**

**I. C. ENGINES:** Classification, Working principles of Four & Two stroke engine- SI & CI engines, Valve and Port Timing Diagrams, Engine systems- Carburetor, Fuel injection systems for CI engines, Ignition, Cooling and Lubrication system.

**UNIT – II**

**STEAM BOILERS:** Classification, working principles Cochran, Locomotive, Babcock and Wilcox, Benson and Loeffler boiler with sketches, mountings and accessories- working principles, boiler horse power, equivalent evaporation, efficiency and heat balance, Draught: classification, height of chimney for given draught and discharge, condition for maximum discharge, efficiency of chimney.

**UNIT – III**

**STEAM NOZZLES:** Applications and Types, Flow through nozzles, Thermodynamic analysis – assumptions -velocity of fluid at nozzle exit, Ideal and actual expansion in a nozzle, velocity coefficient, Condition for maximum discharge, critical pressure ratio, Super saturated flow in nozzles- its effects, Wilson’s line.

**STEAM TURBINES:** Classification, Impulse turbine- mechanical details- velocity diagram- effect of friction- power developed, axial thrust, blade or diagram efficiency- condition for maximum efficiency. Methods to reduce rotor speed-Velocity compounding, Pressure compounding and velocity & pressure Compounding, - Velocity and Pressure variation along the flow – Combined velocity diagram for a velocity compounded impulse turbine.

**UNIT – IV**

**REACTION TURBINE:** Mechanical details, principle of operation, thermodynamic analysis of a stage, degree of reaction, velocity diagram, Parson’s reaction turbine, condition for maximum efficiency.

**STEAM CONDENSERS:** Classification of condensers- working principles of Jet, Evaporative and surface condensers, Vacuum and its Measurement, Vacuum efficiency and condenser efficiency, Sources of air leakage and its affects in condensers- Condenser Efficiency, Daltons law of partial pressures, Determination of mass of cooling water.

**UNIT – V**

**GAS TURBINES:** Simple gas turbine plant- Ideal cycle, essential components, parameters of performance, actual cycle, regeneration, inter cooling and reheating, closed and open cycles, merits and demerits.

**TEXT BOOKS:**

1. Engineering Thermodynamics, PK Nag 4th Edn, TMH.
2. Thermodynamics. An engineering Approach with student resources/ DVD. Y.A. Cengel & M.A. Boles/ 8th Edn-McGrawHill/2016.
3. Gas Turbines / V Ganesan/3rd edition, TMH/2016.

**REFERENCE BOOKS**

1. Thermal Engineering/ R.K.Rajput/4th edition/ Laxmi Publications/2010
2. Applied Thermodynamics-II / R. Yadav./6th edition, Central Publishing House/2016
3. Gas turbines and Propulsive Systems/1st edition, DhanpatRai/2014
4. Tables of the properties of steam and other vapours and temperature-Entropy table by Cecil H Peabody by Forgotten books
5. Steam tables by C.P Kodandaraman – New age International

<b>Semester</b>	<b>IV</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>	<b>V20MEL05</b>
<b>Name of the Course</b>	<b>Mechanical Measurements and Metrology Lab</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Experiment and examine errors in calibration of various instruments	K3
CO2	Explain the working principle of metrology and measuring equipments.	K2
CO3	Compute distance, angle and surface finish by using standard measuring equipments	K3

**List of experiments :**

**METROLOGY**

1. Measurement of length, height and diameter by vernier calipers, micrometer and height gauge.
2. Surface roughness measurement using talysurf.
3. Taper angle measurement.
4. Tool maker's microscope.
5. Measurement of bores using dial bore indicator.
6. Measurement of thickness of gear tooth by vernier tooth caliper.

**INSTRUMENTATION & CONTROL SYSTEMS LAB**

**List of experiments:**

1. Study and calibration of LVDT transducer for displacement measurement.
2. Calibration of pressure gauge.
3. Angular Measurement using angular sensor.
4. Measurement of speed using opto-coupler pickup.
5. Calibration of strain gauge.
6. Study & calibration of resistance temperature detector (RTD) transducer for temperature measurement.
7. Study and calibration of a rota meter for water flow measurement.
8. Vibration measurement trainer.

<b>Semester</b>	<b>IV</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>	<b>V20MEL06</b>
<b>Name of the Course</b>	<b>Manufacturing Process Lab</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to	Knowledge Levels
CO1	Design and Make a pattern, test the properties of sand and prepare a casting.	K3
CO2	Perform Arc welding, Spot welding, TIG, MIG welding and Plasma Arc Cutting operations	K3
CO3	Perform blanking, piercing, Drawing and bending operations.	K3
CO4	Operate injection and blow moulding machines to manufacture plastic components	K3

**METAL CASTING:**

Pattern Design and pattern making using wood turning lathe Sand properties testing for Compression strength and permeability. Mould preparation, melting and casting.

**WELDING:**

ARC Welding Lap, Butt & T- Joint Spot Welding –Lap & Butt Joint  
TIG Welding -Butt Joint  
MIG Welding- Butt Joint Plasma Arc Cutting

**METAL FORMING:**

Blanking & Piercing operation by using Progressive die

**PROCESSING OF PLASTICS:**

Injection Molding, Blow molding

**REFERENCE BOOKS:**

1. Production technology lab – college manual.
2. Manufacturing Engineering and Technology/ Kalpakjian, Serope; Steven, Schmid R./Pearson, 1<sup>st</sup> Edition, 2013
3. Manufacturing Technology / P.N. Rao/TMH, 4<sup>th</sup> Edition, 2016.

<b>Semester</b>	<b>IV</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>	<b>V20MEL07</b>
<b>Name of the Course</b>	<b>Thermal Engineering Lab</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to	Knowledge Levels
CO1	Evaluate the performance of I.C.Engines.	K4
CO2	Evaluate the performance of compressors.	K4
CO3	Describe the working of Boilers.	K2

1. I.C. Engines valve and port timing diagrams.
2. I.C. Engines performance test and Exhaust emission measurements (4 -stroke diesel engine).
3. I.C. Engines Performance Test for 2 Stroke SI engines
4. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine.
5. Draw the heat balance sheet for 4- stroke multi cylinder petrol engine.
6. I.C. Engines Retardation Test
7. Economical speed test of an IC engine.
8. Performance test on variable compression ratio engines.
9. Performance test on reciprocating air compressor unit.
10. Dis-assembly / Assembly of Engines
11. Study of Boilers

<b>Semester</b>	<b>IV</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Course Code</b>
<b>Regulation</b>	<b>V20</b>	<b>0</b>	<b>4</b>	<b>-</b>	<b>MNC</b>	<b>V20ENT03</b>
<b>Name of the Course</b>	<b>Professional Communication Skills – II</b>					
<b>Branch</b>	<b>Mechanical Engineering</b>					

**Course Outcomes:**

	After successful completion of the course, the student will be able to:	Knowledge Level
CO1	Demonstrate grammatical competence, analyze noun and pronoun dispositions, classify various kinds of verbs, adjectives and adverbs and identify errors in sentences; distinguish the subtle meanings of various words in different contexts, recognize similar words as well as words with contrast meanings and use them appropriately.	K2
CO2	Organize individual words into one whole sentence using new vocabulary and focus on the error analysis of prepositions and conjunctions, build conversations which befit the situations and develop pre-reading strategies to improve comprehension skills. Distinguish and acquire knowledge of using words of the same category in a sentence and learn new words that promote communicative finesse. Find errors in sentences where the modifiers are misplaced and put them at the appropriate place, use hit pair words and send an email that is concise and lucid.	K3
CO3	Recognize the easiest and best possible way of solving problems in the area of Number and Letter Series, Analogy, Classification, Coding & Decoding Symbols, Ranking and Analytical Reasoning.	K4
CO4	Investigate the different types of logics involved in Mirror and Water Images, Logical Reasoning & Arithmetic Reasoning.	K4
CO5	Find the common traps in the questions and errors likely to be made from the concepts of Blood Relations, Directions, Average, Clock and Calendar, Data Sufficiency, Permutations-Combinations and Probability.	K3

**UNIT – I**

**ERROR ANALYSIS:** Nouns & Pronouns – Singular & Plural – Kinds of Nouns & Pronouns- Collective Nouns - Personal and Reflexive Pronouns. Subject – Verb agreement. Adjectives – Adverbs – role of modifiers – place of Adjectives– Adverbs of frequency.

**VOCABULARY :** Word Power Made Easy Sessions 15- 30, Antonyms and Synonyms and One word substitutes

**EXPANSION OF PROVERBS:** Meaning – interpretation – explanation.

**UNIT – II**

**ERROR ANALYSIS:** Prepositions - kinds of prepositions –appropriate use - conjunctions –sub-ordinating– coordinating.

**ROLE PLAY:** Day to day situations - practical approach – real life experiences.

**READING COMPREHENSION:** Reading as a skill – quick reading - analyzing – answering - Skimming – scanning - summarizing – problem solving.

**ERROR ANALYSIS:** Parallel grammatical forms – same grammatical structures. Dangling modifiers – misplacement of modifiers – arrangement.

**SENTENCE IMPROVEMENT:** Better choice – error-free sentences – effective – syntax.

**EMAIL WRITING:** Format – method of exchanging – technicalities.



### UNIT – III

#### **Number And Letter Series, Coding & Decoding, Analogy, Classification Ranking. (K1)**

Problems of how to find the next number in the series, Finding the missing number and related sums, Sums related to Classification, Sums related to letter series, Relation between number series and letter series, Finding odd one out from groups, Identify the rank in different places.

### UNIT-IV

#### **Problems On Ages& Numbers, Mirror And Water Images, Logical Reasoning & Arithmetic Reasoning.(K4)**

Definition and concept of Venn Diagram – its applications. statements – Affirmations, Denials and Contradictions. Sums related to Ages & numbers. Problems on ages with different logics. Identifying the images of water and Mirror.

### UNIT-V

#### **Blood Relations, Directions, Average, Clock And Calendar, Data Sufficiency, Permutations-Combinations And Probability.(K3)**

Deriving the formula to find the angle between hands for the given time, History of calendar-, Finding the day for the given date, Problems related to directions. Difference between words Permutation and Combinations – Various cases - Real Time Scenarios. Concept of Probability – - Conjunctions – Rules & Cases of Probability.

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