Chhattisgarh Swami Vivekananda Technical University, Bhilai

Name of program: Bachelor of Technology Branch:All Branches **Semester: III**
Subject: Mathematics – III **Code: B000311(014)**
Total Theory Periods: 03 **Total Tutorial Periods: 01**
Class Tests: Two (Minimum) **Assignments: Two (Minimum)**
ESE Duration: Three Hours **Maximum Marks: 100** **Minimum Marks: 35**

Course Objectives:

1. To provide knowledge of Laplace transform of elementary functions including its properties and applications to solve ordinary differential equations.
2. To have thorough knowledge of partial differential equations which arise in mathematical descriptions of situations in engineering.
3. To study about a quantity that may take any of a given range of values that can't be predicted as it is but can be described in terms of their probability.
4. To provide a thorough understanding of interpolation and methods to solve ordinary differential equation.

UNIT-I Laplace transform: Definition, Transform of elementary functions, Properties of Laplace transform, Transform of derivatives & integrals, Multiplication by t^n, Division by t, Evaluation of integrals, Inverse Laplace Transform, Convolution theorem, Unit step function, Unit impulse function, Periodic function, Application to solution of ordinary differential equations.

UNIT- II Partial differential equation: Formation, Solution by direct integration method, Linear equation of first order, Homogeneous linear equation with constant coefficients, Non-homogeneous linear equations, Method of separation of variables.

UNIT- III Random variable: Discrete and continuous probability distributions, Mathematical expectation, Mean and Variance, Moments, Moment generating function, probability distribution, Binomial, Poisson and Normal distributions.

UNIT- IV Interpolation with equal and unequal intervals: Finite differences, Newton's Forward & Backward Difference Formulae, Central Difference Formula, Stirling's Formula, Bessel's Formula, Lagrange's Formula and Newton's Divided Difference Formula.

UNIT-V Numerical Solution of Ordinary Differential Equations: Picard's Method, Taylor's Series Method, Euler's Method, Euler's Modified Method, Runge-Kutta Methods, Predictor-corrector Methods- Milne's Method, Adams-Bashforth Method.

Text Books:

1. "Higher Engg. Mathematics", Dr. B.S. Grewal– Khanna Publishers.
2. "Advanced Engg. Mathematics" , Erwin Kreyszig – John Wiley & Sons.
3. "Numerical Methods in Engineering and Science" , Dr. B.S. Grewal, Khanna Publishers.
4. "Numerical Methods for Scientific and Engineering Computation" , M .K. Jain, S. R. K

Reference Books:

1. "Applied Mathematics", P. N. Wartikar& J. N. Wartikar. Vol-II Pune Vidyarthi Griha Prakashan, Pune.
2. "Applied Mathematics for Engineers & Physicists", Louis A. Pipes- TMH.
3. "Numerical Methods for Scientists and Engineers" K. Shankar Rao, Prentice Hall of India.
4. "Numerical Methods" P. Kandasamy, K. Thilagavathy and K. Gunavathi, S. Chand publication.

Course outcomes: After studying the contents of the syllabus in detail the students will be able to: Define (mathematically) unit step unit impulse, Laplace transform its properties, inverse and applications to solve ordinary differential equations and find Numerical solution of differential equations, which may be arising due to mathematical modelling based on engineering problems. Hands on these Mathematical topics will make them equipped to prepare for higher studies through competitive examinations.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Technology**
Branch: **Mechanical Engineering**
Subject: **Mechanical Measurement and Metrology**
Total Theory Periods: **02**
Class Tests: **Two (Minimum)**
Assignments: **Two (Minimum)**

Semester: **III**
Code: B037312(037)
Total Tutorial Periods: 01
Maximum Marks: 100
Minimum Marks: 35
ESE Duration: **Three Hours**

Course Objectives:

1. To provide an understanding of measurement system and its functional elements.
2. To impart knowledge of measurement of pressure and measurement of strain.
3. To impart knowledge of flow measurement, vibration measurement and data acquisition system.
4. To study about linear and angular measurement devices, measurement of geometrical forms, optical projectors, tool maker microscope and autocollimators.
5. To study about interferometer, comparators, screw thread and gear measurement and coordinate measuring machine.

UNIT I: Generalized Measurement System: Introduction - Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, static and dynamic performance characteristics of measurement devices, Calibration, Error- concept and sources, statistical analysis of errors, Sensors and Transducers– Types of sensors, type of transducers and their characteristics.

UNIT II: Measurement of pressure: Pressure standard, Bourdon tubes, Diaphragm and bellows, Measurement of very low pressure- Mcleod gauge and Pirani gauge.
Measurement of Strain: Type of strain gauges and their working, temperature compensation. Strain rosettes. Measurement of temperature by thermometers, bimetallic, thermocouples, thermistors and pyrometers-total radiation and optical pyrometry.

UNIT III: Measurement of flow: Variable head meters, hot wire and magnetic meters, ultrasonic flow meters. **Vibration measurement:** Seismic instruments, vibration pickups. **Data acquisition system:** Introduction to data acquisition systems, single and multi- channel systems, Input – output devices signal transmission and Processing.

UNIT IV: Metrology: Standards of measurement; Limits, Fits and Tolerances; Linear and angular measurement devices and systems limit gauges, gauge blocks. Measurement of geometric forms like straightness, flatness, roundness and circularity, surface texture measurement, principles and application of optical projectors, tool makers microscope, autocollimators etc.

UNIT V: Metrology: Principle and use of interferometry, Comparators, Screw Threads Measurement, Measurement of Gears tooth. Coordinate measuring machine (CMM): need, construction, types and application.

Tutorial from above units covering practical applications.

Text Books:

1. Mechanical Measurements – G. Beckwith Thomas G. – Pearson Education.
2. Mechanical Measurements and Control – D.S. Kumar – S.K. Kataria & Sons.

Reference Books:

1. Metrology and quality control- A.M. Badadhe -Technical Publication.
2. Measurement Systems, Application Design – E.O. Deoblein - McGraw Hill.
3. Engineering Metrology – K.J. Hume - MacDonald and Company.
4. Engineering Metrology – I.C. Gupta - Dhanpat Rai & Sons.
5. Mechanical & Industrial Measurements – R.K. Jain – Khanna Publishers.

Course Outcomes

On successful completion of the course, the student will be able to:

1. Describe the functional elements of measurement system and its performance characteristics.
2. Describe measurement of pressure, strain and temperature.
3. Describe flow measurement, vibration measurement and data acquisition system.
4. Describe linear and angular measurement devices, measurement of geometrical forms, optical projectors, tool maker microscope and autocollimators.
5. Describe interferometer, comparators, screw thread and gear measurement and coordinate measuring machine.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Technology**
Branch: **Mechanical Engineering**
Subject: **Engineering Mechanics**
Total Theory Periods: **02**
Class Tests: **Two (Minimum)**
Assignments: **Two (Minimum)**

Semester: **III**
Code: B037313(037)
Total Tutorial Periods: 01
Maximum Marks: 100
Minimum Marks: 35
ESE Duration: **Three Hours**

Course Objectives:

1. To provide an understanding of basic concepts and laws of engineering mechanics
2. To impart concepts related to friction and virtual work for solving applied problems.
3. To provide an understanding of centroid, area moment of inertia, product of inertia, centre of gravity and mass moment of inertia.
4. To impart concepts related to kinematics of a particle and rigid body.
5. To impart concepts related kinetics of rigid bodies.

UNIT–I:

Introduction to Engineering Mechanics- Rigid body, Force and force systems, Principles of mechanics, composition and resolution of forces, Resultant, types of supports and support reactions, free body diagrams, equilibrium of concurrent forces in a plane, Moment of Force and its Application- Varignon's Theorem, Parallel forces in a plane, General cases of forces in a plane. Forces in space-Resultant of system of force in space, equilibrium of spatial system of forces.

UNIT–II:

Friction-Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Angle of friction, Angle of Repose, Motion of Bodies, wedge friction, ladder friction, rolling friction.

Belt and rope friction- length of belt in open and closed belt drives, ratio of tensions, initial tension in belt, power transmitted, condition for maximum power, stress in belt material, V-belt. Screw jack & differential screw jack

Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium, Applications of energy method for equilibrium.

UNIT–III:

Centroid- Centroid of simple figures from first principle, centroid of composite sections.

Area moment of inertia- Definition, Area moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections;

Product of inertia: Definition, Product of inertia of plane sections from first principles Displacement of axes, Rotation of axes, Principle axes, Principal moment of inertia.

Centre of Gravity & Mass moment inertia - Plate, Cylinder, Cone, Sphere and Composite bodies

UNIT–IV: Kinematics

Rectilinear motion of Particle: Displacement, velocity and acceleration

Curvilinear motion of Particle: Rectangular components of velocity, Rectangular components of acceleration, component of motion: Radial and transverse components

Kinematics of rigid body: Translation, Rotation, Linear and angular velocity, Linear and angular acceleration in rotation General plane motion: absolute and relative velocity in plane motion, instantaneous centre of rotation in plane motion

UNIT-V: Kinetics

D'Alembert's principle and its applications in plane motion of connected bodies; **Work-energy principle** and its application in plane motion of connected bodies;

Principle of impulse and momentum and its application in plane motion of connected bodies;

Impact of Elastic bodies Coefficient of restitution, direct central impact, oblique impact.

Tutorial from above units covering practical applications.

Text Books:

1. Engineering Mechanics – A. K. Tayal - Umesh Publications.
2. Engineering Mechanics- S. Timoshenko and D.H. Young- TMH.
3. Vector Mechanics for Engineers - F. P. Beer and E. R. Johnston - Tata McGraw Hill.

Reference books:

1. Engineering Mechanics: Principles of Statics and Dynamics - R.C. Hibbeler - Pearson Press.
2. Engineering Mechanics -Irving H. Shames- PrenticeHall.
3. Introduction to Statics and Dynamics - Andy Ruina and Rudra Pratap - Oxford Univ Press.
4. Engineering Mechanics - Shanes and Rao - Pearson Education.
5. Engineering Mechanics (Statics, Dynamics) - Hibler and Gupta - Pearson Education.
6. Singer's Engineering Mechanics - Reddy Vijaykumar K. and K. Suresh Kumar.
7. A Text Book of Engineering Mechanics – R. K. Bansal - Laxmi Publications.
8. Engineering Mechanics – R. S. Khurmi - S. Chand.

Course Outcomes

On successful completion of the course, the student will be able to:

1. Apply basic concepts and laws of mechanics to determine resultant and analyze the systems of forces.
2. Analyze static system by applying law of friction/ principle of virtual work.
3. Determine the centroid, second moment of area and product of inertia of simple and composite plane figures and centre of gravity and mass moment of inertia of simple and composite bodies.
4. Analyze problem related to kinematics of a particle and rigid bodies.
5. Analyze problem related to kinetics of rigid bodies.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Technology** Semester: **III**
Branch: **Mechanical Engineering** Code: B037314(037)
Subject: **Engineering Thermodynamics** Assignments: **Two (Minimum)**
Total Theory Periods: **02** **Maximum Marks: 100**
Total Tutorial Periods: **01** **Minimum Marks: 35**
Class Tests: **Two (Minimum)** ESE Duration: **Three Hours**

Course Objectives:

1. To introduce students to basic concepts and first laws of thermodynamics.
2. To impart knowledge of concepts of second law of thermodynamics and entropy.
3. To introduce students to exergy and related concepts.
4. To study about properties of real gases and mixture of ideal non-reactive gases.
5. To provide an understanding of properties of pure substances

UNIT I: (a) Introduction to Engineering Thermodynamics-Macroscopic vs microscopic view point, Thermodynamic System, properties, process, cycle, thermodynamic equilibrium, Quasi-static Process, Zeroth Law of thermodynamics, concept of continuum. Exact & Inexact differentials. Work- electrical, magnetic, gravitational, spring and shaft work, Displacement work, flow work , free expansion, work done in various quasistatic process, work as a path function. Heat transfer-sensible heat, latent heat, heat as a path function.
(b) **First Law of thermodynamics**-Joule's experiment, internal energy as property of system, first law applied to various quasistatic process, PMMI , Limitations of the First Law, control volume, Steady flow energy equation, Applications of SFEE.

UNIT II: (a) Second law of thermodynamics: Thermal Reservoir, Heat Engine, cyclic Heat engine, Kelvin-Planck statement and Clausius Statements and their Equivalence, Refrigerator and Heat pump, COP, PMMII, ,reversibility and irreversibility, causes of irreversibility, Carnot cycle, reversed heat engine, Carnot theorem, corollaries of Carnot theorem, Absolute thermodynamic temperature scale.
(b) Entropy: Clausius theorem, the property of entropy, the inequality of Clausius,
Entropy
principle and its applications, Entropy change during different thermodynamic processes, entropygeneration in closed system and open system, first and second law combined.

UNIT III: Exergy: Available energy, availability and availability function of a closed system, availability and availability function of an open system , dead state, Helmholtz function , Gibbs functions, Irreversibility and Gouy-Stodola Theorem, Second law efficiency.

UNIT IV: (a) Properties of gases: Equation of state of a gas, Ideal gas, gas compression, deviation of Real gas from ideal gas, Vander Waal's equation of state, correction for the intermolecular attractions, correction for finite size of molecules, evaluation of constants a and b, virial expansions, limitations of the van der Wall's equation, Reduced coordinates, compressibility factor, the law of corresponding States.
(b) Properties of mixture of gases: Mass Fraction, Mole fraction, Dalton's Law of partial pressure, Amagat-Leduc's law of additive Volumes, Properties of mixture of ideal non- reactive gases –gas constant, molecular weight, specific heat, internal energy, enthalpy and entropy.

UNIT V: Properties of Pure substances: Thermodynamic properties of pure substances in solid, liquid and vapor phases, Phase Transformations, dryness fraction, Triple point, critical state, p-v, p-T, T-s, h-s diagrams, p-v-T surfaces, Properties and Processes in ideal vapor, use of steam tables and Mollier diagram in determination of steam properties, energy interaction and Entropy calculations, measurement of steam quality.

Tutorial from above units covering practical applications.

Text Books:

1. Thermodynamics- An Engineering Approach – Cengal & Boles – McGraw Hill.
2. Engineering Thermodynamics – P.K. Nag – TMH.

Reference Books:

1. Fundamental of engineering thermodynamics- R. Yadav-CPH.
2. Thermal Science & Engineering – D.S. Kumar – S.K. Kataria .
3. Fundamental of Thermodynamic- Claus Borgnakke, Richard E. Sonntag- Wiley.
4. An Introduction to Thermodynamics-Y.V.C. Rao- University Press.
5. Engineering Thermodynamics-M. Achuthan- PHI.
6. Thermodynamics & Thermal Engineering – J. Selwin Rajadurai – New Age.
7. Thermodynamics – C.P. Arora – TMH.
8. Thermodynamics – S.C. Gupta – Pearson.

Course Outcomes

On successful completion of the course, the student will be able to:

1. Apply basic concepts and first laws of thermodynamics to analyze thermodynamics system.
2. Apply the concepts of second law of thermodynamics and entropy to analyze thermodynamics system.
3. Apply the concepts of exergy to solve related problems.
4. Explain the equations of state and thermodynamic properties of real gases and calculate properties of mixture of ideal non- reactive gases.
5. Analyze processes involving pure substances.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Technology**
Branch: **Mechanical Engineering**
Subject: **Material Science**
Total Theory Periods: **02**
Class Tests: **Two (Minimum)**
ESE Duration: **Three Hours**

Semester: **III**
Code: B037315(037)
Total Tutorial Periods: 01
Assignments: Two
Maximum Marks: 100

Course Objectives:

1. To impart an understanding of crystal structure and crystal Imperfection.
2. To impart knowledge of mechanical properties of materials & theories of deformation.
3. To impart an understanding of theories of solidification & phase equilibrium.
4. To impart knowledge of heat treatment and surface treatment.
5. To study about various engineering materials.

UNIT I:

Structure of Materials: Crystalline and noncrystalline solid, Concept of unit cell and space lattice, Crystal structure of metal, Miller indices.

Crystal Imperfection: Point defects – Interstitial defect, Frankel defect and Schottky defect; Line defects- Edge dislocations, Screw dislocation; Surface defects- Grain boundary, Tilt boundary, Twin boundary and Volume defects- Stacking fault.

UNIT II:

Mechanical Properties of Materials: Stress-strain diagrams for engineering materials, Young's modulus, Yield strength, Tensile strength, Elasticity, Plasticity, Ductility, Malleability, Brittleness, Toughness, Stiffness, Hardness, Hardenability, Fatigue and Creep.

Deformation of Metals: Elastic deformation: Elastic after effect, Plastic deformation: deformation by slip (shear deformation)-Critical resolved shear stress, Deformation by twinning, Differences between slip and twinning. Dislocation theory - edge dislocation, screw dislocation. Strain hardening, Seasons cracking, Bauschinger effect, Yield point phenomena and related effects, Cold and hot working processes, Effect of cold work, recovery, recrystallization, grain growth on properties of crystalline materials.

UNIT III:

Solidification of Metals and Alloys: Mechanism of solidification, Nucleus formation and crystal growth, Homogeneous and heterogeneous nucleation, Metal ingot structure- Dendritic and columnar grains, Grain boundaries, Grain growth, solidification process, Effect of grain size on properties of metals.

Phase and Phase Equilibrium Diagram: Phase & types of phase, Hume-Rothery's rule, Cooling curve of pure metals and alloys, Gibb's phase rule, Types of phase equilibrium diagrams: Isomorphous- Lever rule, Monotectic, Eutectic-Hyper, Hypoeutectic, Eutectoid -Hyper, Hypoeutectoid, Peritectic and Peritectoid system. Allotropy of Iron, Iron-Iron carbide phase diagram.

UNIT IV:

Heat Treatment: Introduction, Purpose and advantages of heat treatment, T-T-T curve and Micro constituents in steel, Heat treatment processes: Annealing-Stress relief, Spheroidising, Process and full annealing, Normalising, Hardening, Tempering, Austempering, Martempering.
Surface Hardening-Flame, Induction and Case hardening: Carbuising- Pack and Gas carburizing, Nitriding, Cyaniding, Carbo-nitriding, Vacuum and Plasma hardening.

UNIT V:

Engineering Materials: Classifications of engineering materials, Composition, Properties and application of the following engineering materials:-**Ferrous: Cast Iron**- Grey cast iron, White cast iron, Malleable cast iron, and Spheroidal cast irons. **Steel**- Unalloyed or plain carbon steels- Low, Medium, High carbon steels **Alloy steel**- Stainless steel, Tool steel, Maraging steels, Spring steel. **Non-ferrous:** Copper alloys: Brasses – Muntz metal, Cartridge brass, Naval brass, Admiralty brass, Bronzes – Gun metal, Phospher bronze, Aluminium bronze, Copper-nickels alloys. Aluminium alloys : Duralumin, Cast aluminium alloys, Aluminium silicon alloys. Sintered carbide. Al-Cu-Mg alloy, Nickel base superalloy, Titanium alloy. **Composite materials.**

Tutorial from above units covering practical applications. Text

Books:

1. Material Science & Engineering A First Course- V. Raghavan- PHI.
2. Material Science- O.P. Khanna- Dhanpat Rai.

Reference Books:

1. Elements of Material Science & Engg. – Van Vlack- Pearson.
2. Physical Metallurgy – Clark & Varney- CBS Publishers & Distributors
3. Engineering Physical Metallurgy – Lakhtin- CBS Publishers & Distributors
4. Physical Metallurgy Principles – Robert E Reed Hill- Cengage Learning
5. Materials Science – Narang- CBS Publishers & Distributors
6. Engineering Materials – Woulf Series.

Course Outcomes

On successful completion of the course, the student will be able to:

1. Explain crystal structure and Imperfection in crystal structure.
2. Define basic mechanical properties of materials & explain the theories of deformation.
3. Explain solidification phenomenon of pure metal, alloys and interpret phase diagrams.
4. Explain how microstructure and mechanical properties of carbon and alloy steels are controlled by various heat treatment/surface treatment processes.
5. Compare characteristics of various ferrous, nonferrous and composite materials.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Technology**
Branch: **Mechanical Engineering** Semester: **III** Subject:
Computer Aided Machine Drawing Lab **Code: B037321(037)**
Total Lab Periods: **48** Batch Size - **30**
Maximum Marks: 40 **Minimum Marks: 20**

Course Objectives:

1. To impart an understanding of "Code of practice for general engineering drawings".
2. To impart an understanding of Limit, Fits, Tolerance and representation of dimensional and geometrical tolerance.
3. To impart practical experience in handling drafting software systems.
4. To prepare orthographic views and orthographic sectional view of machine components using standard CAD packages.
5. To prepare assembly drawings with its bill of material using standard CAD packages.

List of Exercises: (At least ten exercises including first five compulsorily)

1. Code of practice for general engineering drawings (BIS) – Conventional representation of lines, Letter, standard machine components, surface roughness, direction of lay of machining and welded joints.
2. Limits, Fits, Tolerances and representation of dimensional and geometrical tolerance in engineering drawing.
3. Conversion of pictorial view of solids to its orthographic views.
4. Sectional view: type of sectional views-full section, half section, partial or broken section and sectioning conventions-spokes, web, rib, shaft, pipes, different types of holes, hatching or section lines, conventions of sections of different metals and materials.
5. Conversion of pictorial view of solids to orthographic sectional view.
6. Assembly drawing of Screwed Fasteners.
7. Assembly drawing of Riveted Joint.
8. Assembly drawing of Cotter joint- Sleeve & Cotter Joint, Spigot and Cotter joint.
9. Assembly drawing of Pin Joint or Knuckle joint.
10. Assembly drawing of Bearing-Bushed bearing, Plummer block.
11. Assembly drawing of Coupling-Flange coupling, Flexible coupling.
12. Assembly drawing of Pulley-Fast and loose pulley.
13. Assembly drawing of Valves-Steam stop valve, Blow-off cock, Lever safety valve.

Note: Students are required to submit a mini project on assembly drawing of one important mechanical engineering assembly with its part drawing and bill of materials at the time of final assessment.

Software/ System/ Books Required:

1. Intel® Core 2 Duo or greater, 3.0 GHz or greater. Microsoft® 64-bit Windows® 7 or greater. RAM: 2 GB or greater recommended, Free Disk Space: 250 GB or greater recommended.
2. Software Required – Drafting Software.
3. N. D. Bhatt and V.M. Panchal, "Machine Drawing", Charotar Publishers
4. Gopalakrishna K.R., "Machine Drawing", Subhas Stores Books Corner, Bangalore
5. Junnarkar, N.D., "Machine Drawing", Pearson Education.

Course Outcome:

On successful completion of the course, the student will be able to:

1. Demonstrate an understanding of Indian standards on drawing practices, conventional symbol of surface roughness, lay of machining, welded joints and standard components.
2. Demonstrate an understanding of Limit, Fits, Tolerances and representation of dimensional and geometrical tolerance in mechanical engineering drawing.
3. Convert pictorial view of machine components into orthographic views and orthographic sectional view with sectioning conventions
4. Draw assembled orthographic views of screwed fasteners and riveted joints.
5. Draw assembly drawing from disassembled views of important mechanical engineering assembly e.g. cotter joint, pin joint, bearing, coupling, pulley and valves.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Technology**
Branch: **Mechanical Engineering** Semester: **III** Subject:
Mechanical Measurement and Metrology Lab **Code: B037322(037)**
Total Lab Periods: **24** Batch Size - **30**
Maximum Marks: 40 **Minimum Marks: 20**

Course Objectives

1. To expose students to real world measurement equipment.
2. To learn operation of various measurement equipment.
3. To expose students to real world metrology equipment.
4. To learn operation of various measurement equipment.
5. To provide students with the necessary skills for calibration and testing of different gauges and instruments.

List of Experiments: (At least Ten experiments are to be performed by each student)

(Minimum Seven experiments to be performed from the following group)

1. Measurement of Pressure Using Bourdon Pressure Gauge.
2. Calibration of Pressure Gauge Using Dead Weight Pressure Gauge Tester.
3. Measurement of Displacement Using LVDT.
4. Measurement of Temperature Using Thermister.
5. Measurement of Flow Rate Using Rotameter.
6. Measurement of Angle Using Angular Sensor.
7. Measurement of Torque Using Torque Transducer.
8. Measurement of Pressure Using Pressure Transducer.
9. Measurement of Strain Using Strain Cantilever Beam.
10. Measurement of Temperature Using RTD.
11. Measurement of Temperature Using Thermo Couple.
12. Measurement of Temperature by Themocouple.
13. Experimentation using Data Acquisition System.

(Minimum Three experiments to be performed from the following group)

1. Measurement of length, height, diameter by Vernier Calipers, Vernier Height Gauge, Micrometers.
2. Measurement of various angles using Bevel Protractor, Sine Bar & Combination Set.
3. Determination of the accuracy of Electrical and Optical Comparator.
4. Determination of the Surface Flatness and Contour using Interferometer.
5. Determination of the Effective Diameter of screw threads by using Two wire & Three wire methods.
6. Measurement of Gear Elements using Profile Projector and image analyzer.
7. Measurement of Tool Angles of a Single Point Cutting Tool by using Tool Makers Microscope.
8. Calibration of Vernier Calipers, Micrometer, Height Gauge, Depth Micrometer using Slip Gauges.

Note: Students are required to submit a mini project at the time of final assessment. List of

Equipment and Machine Required

Measurement	Metrology
1. Data Acquisition System **2.** Software compatible with DAS **3.** Displacement Measurement Tutor Using (LVDT) **4.** Pressure Measurement Tutor Using Pressure Transducer **5.** Strain Measurement Tutor Using Strain Cantilever Beam **6.** Torque Measurement Tutor Using Torque Transducer **7.** Temperature Measurement Tutor Using RTD Sensor 8. Temperature Measurement Tutor Using Thermistor **9.** Temperature Measurement Tutor Using Thermistor **10.** Angular Measurement Tutor Using Angular Sensor **11.** Rotameter Trainer Module **12**. Dead Weight Pressure Gauge Tester **13**. Bourdon Gauge Trainer **14**. Image Analyzer	**1.** Vernier Calipers **2.** Vernier Height Gauge **3.** Depth Micrometers **4.** Set of Slip Gauges **5.** Interferometer **6.** Tool Makers Microscope **7.** Profile Projector **8.** Bevel Protector **9.** Sine Bar **10.** Combination Set **11.** Optical & Electrical Comparator **12.** Optical Flats **13.** Surface Plates **14.** Dial Indicators **15.** Snap and Ring Gauges (Go and No-Go Type)

Course Outcomes

On successful completion of the course, the student will be able to:

1. Identify different mechanical measurement and metrological instruments.
2. Describe the working of different mechanical measurement and metrological instruments.
3. Conduct experiments, observe, interpret data and report results of pressure, displacement, temperature, flow rate, angle, torque and strain measurement instruments.
4. Conduct experiments, observe, interpret data and report results of heights, lengths, diameter, various angles, accuracies in electrical and optical comparator, surface flatness and contour etc using various types of metrological instruments.
5. Calibrate vernier calipers, micrometer, height gauge, depth micrometer using slip gauge.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Technology**
Branch: **Mechanical Engineering** Semester: **III**
Subject: **Engineering Thermodynamics Lab** **Code: B037323(037)**
Total Lab Periods: **24** Batch Size - **30**
Maximum Marks: 40 **Minimum Marks: 20**

Course Objective:

1. To physically engage students to real world thermal equipments through active experimentation to develop deeper understanding of theoretical concepts.
2. To impart an understanding of boiler classification, boiler mountings, accessories, boiler performance parameters and draught.
3. To study about of steam engine, steam turbines.
4. To study about surface and jet condenser.
5. To study about reciprocating air compressor.

List of Experiments: (At least Ten experiments are to be performed by each student)

1. To study the rise in temperature of liquid due to external work.
2. Effect of reduction in temperature in a steam pressure vessel.
3. To study the expansion process using throttling devices.
4. To study the effect of mixing of two/three fluid streams having different flow rates and temperatures.
5. To study the different thermodynamic working fluid e.g. air, steam.
6. To study boiler, boiler classification and performance parameters of boiler.
7. To study draught, classification of draught and related parameters.
8. To study the Cochran boiler and its accessories and mountings.
9. To study the Lancashire boiler and its accessories and mountings.
10. To study the Babcock Wilcox boiler and its accessories and mountings.
11. To study a simple steam engine.
12. To study a compound steam engine.
13. Performance and testing of surface steam condenser.
14. Performance and testing of steam jet condenser.
15. Study of steam turbines.
16. Study of reciprocating air compressor.

Note: Students are required to submit a mini project at the time of final assessment.

Equipment/Machines/Instruments/Tools/Software Required:

- Insulated agitated vessel.
- Steam pressure vessel with arrangement for external cooling.
- Compressed air tank with expansion device.

- Arrangement of mixing of two/three fluid streams.
- Boiler mountings
- Boiler accessories
- Cochran boiler
- Lancashire boiler
- Babcock and Wilcox boiler
- Simple Steam engine
- Compound steam engine
- Steam Turbines
- Surface steam condenser
- Jet steam condenser
- Reciprocating air compressor

Course Outcomes

On successful completion of the course, the student will be able to:

1. Demonstrate an ability to explain basic knowledge of laws of thermodynamics and its verification through experimentation.
2. Describe construction and working of various types of boilers, boiler mountings, accessories, performance parameters and draught.
3. Describe various types of steam engine, steam turbines.
4. Describe surface and jet condenser.
5. Describe reciprocating air compressor.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Technology**
Branch: **Mechanical Engineering** Semester: **III**
Subject: **Software Lab** Code: **B037324(037)**
Total Lab Periods: **24** Batch Size - **30**
Maximum Marks: 40 **Minimum Marks: 20**

Course Objective:

1. To impart an understanding of basics of surface and solid modeling concepts.
2. To impart practical experience related to surface/solid modeling with use of advance features of current CAD models.
3. To impart practical experience related to surface modeling by using dedicated surface modeling commands.
4. To prepare assembly from part modeling using standard CAD packages.
5. To impart an understanding of sheet metal modeling.

List of Exercises: (At least ten exercises)

Part A: Surface and solid modeling

1. Introduction to surface modeling, surface representation method and classification of surface entity.
2. Introduction to solid modeling, solid representation and classification of solid entity.
3. Introduction to sketcher module of modeling software and practice drawing.
4. Surface/solid modeling using extrude, sweep features.
5. Surface/solid modeling using revolve features.
6. Editing of surface/solid model using editing tools such as pattern, holes, fillet and chamfer features.
7. Practice engineering drawing use of various surface commands.
8. Create assembly using Bottom-up Assembly Modeling Catalogs & CAD Data Formats.

Part B: Working with sheet metal module

1. Introduction to sheet metal process in CAD software and its applications in engineering.
2. Sheet metal modeling using different flange, wall and wall on edge features.
3. Design of sheet metal using bend features.
4. Design of sheet metal using extrusion features.
5. Design of sheet metal using cut-out, tear drop features.

Note: Students are required to submit a mini project on assembly modeling of equipment of practical application at the time of final assessment.

Software and System Requirement:

• Software: 3D Modeling Software

The following operating systems are recommended:

• Microsoft Windows 7 or Windows 10 (64-bit)

• Multi-core, 64-bit processor (ex. Intel Dual Core, Intel i3, i5 etc.)

• Dedicated graphics card recommended (not integrated on motherboard such as Intel Integrated graphics)

• 4GB of RAM - 8GB or more is highly recommended

• Minimum 10GB Free Hard Disk space

• Microsoft Office 2013 or newer for report generation

Course Outcome:

On successful completion of the course, the student will be able to:

1. Demonstrate various concepts of surface/solid modeling and sheet metal design.
2. Demonstrate an understanding of different features used in surface/solid modeling and sheet metal in engineering practice.
3. Design a part or assembly of parts using Computer-Aided Design software.
4. Apply top-down design principles to model a design.
5. Make appropriate selection of CAD functionality to use as tools in the design process and communicate effectively the geometry and intent of design features