

Chhattisgarh Swami Vivekanand Technical University, Bhilai

SCHEME OF TEACHING AND EXAMINATION BE (MECHANICAL ENGINEERING) III Semester

S. No.	Board of Study	Sub. Code	SUBJECT	PERIODS PER WEEK			SCHEME OF EXAM Theory/Practical			Total Marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1.	Appl Mathematics	337351(14)	Mathematics-III	4	1	-	80	20	20	120	5
2.	Mech. Engg	337352(37)	Machine Drawing	4	1	-	80	20	20	120	5
3.	Mech. Engg	337353(37)	Material Science & Metallurgy	3	1	-	80	20	20	120	4
4.	Mech. Engg	337354(37)	Mechanics of Solids-I	4	1	-	80	20	20	120	5
5.	Mech. Engg	337355(37)	Engineering Thermodynamics	4	1	-	80	20	20	120	5
6.	Mech. Engg	337356(37)	Mechanical Measurements & Metrology	3	1	-	80	20	20	120	4
7.	Mech. Engg	337361(37)	Machine Drawing Lab	-	-	3	40	-	20	60	2
8.	Mech. Engg	337362(37)	Material Testing Lab	-	-	2	40	-	20	60	1
9.	Mech. Engg	337363(37)	Engineering Thermodynamics Lab	-	-	2	40	-	20	60	1
10.	Mech. Engg	337364(37)	Mechanical Measurements & Metrology Lab	-	-	2	40	-	20	60	1
11.	Humanities	337365(46)	Value Education	-	-	2	-	-	40	40	1
12.			Library	-	-	1	-	-	-	-	-
Total				22	6	12	640	120	240	1000	34

L: Lecture, T: Tutorial, P: Practical, ESE: End Semester Exam, CT: Class Test, TA: Teachers Assessment

Note: Duration of End Semester Examination all theory papers will be of Three Hours except for Machine Drawing Paper (at Sl. No. 2) which is of four hours duration.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	III
Branch:	Mechanical Engineering	Code:	337351(14)
Subject:	Mathematics - III	Total Tutorial Periods:	10
Total Theory Periods:	40	Assignments:	Two (Minimum)
Class Tests:	Two (Minimum)	Maximum Marks: 80	Minimum Marks: 28
ESE Duration:	Three Hours		

Course Objectives:

1. To make the students understand that Fourier series analysis is a powerful method where the formulas are integrals and to have knowledge of expanding periodic functions that explore variety of applications of Fourier series.
2. To provide knowledge of Laplace transform of elementary functions including its properties and applications to solve ordinary differential equations.
3. To have a thorough knowledge of PDE which arise in mathematical descriptions of situations in engineering.
4. To provide a sound background of complex analysis to perform a thorough investigation of major theorems of complex analysis and to apply these ideas to a wide range of problems that include the evaluation of both complex line integrals and real integrals.
5. To study about a quantity that may take any of a given range of values that can't be predicted exactly but can be described in terms of their probability

UNIT- I FOURIER SERIES: Euler's Formula, Functions having points of discontinuity, Change of interval, Even & Odd functions, Half range series, Harmonic analysis.

UNIT-II LAPLACE TRANSFORM: Definition, Transform of elementary functions, Properties of Laplace transform, Transform of derivatives & integrals, Multiplication by tn , 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- III 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-IV COMPLEX VARIABLES: Derivative, Cauchy-Riemann equations, Analytic functions, Harmonic functions, Flow problems, Complex integration, Cauchy theorem, Cauchy integral formula, Taylor & Laurent series, Singularity, Residue, Evaluation of real definite integrals.

UNIT-V STATISTICS: Random variables, Discrete & continuous probability distributions, Expectation, Mean & Standard Deviation, Moments & moment generating function, Distributions- Binomial, Poisson and Normal distributions.

Text Books:

1. Higher Engg. Mathematics by Dr. B.S. Grewal– Khanna Publishers.
2. Advanced Engg. Mathematics by Erwin Kreyszig – John Wiley & Sons.

Reference Books:

1. Advanced Engg. Mathematics by R.K. Jain and S.R.K. Iyengar – Narosa Publishing House.
2. Applied Mathematics by P.N. Wartikar & J.N. Wartikar. Vol- II– Pune Vidyarthi Grih Prakashan, Pune
3. Applied Mathematics for Engineers & Physicists by Louis A. Pipes- TMH.

Course Outcome: After studying the contents of the syllabus in detail the students will be able to

1. define Fourier series including half range series, Harmonic analysis and variety of its applications.
2. define (mathematically) Unit step, Unit impulse, Laplace transforms, its properties, Inverse and applications to solve ordinary differential equations.
3. form and solve by direct integration method Linear equation of first order including Homogeneous and Non-homogeneous Linear equations and also method of separation of variables.
4. solve difficult problems using theorems of complex analysis and apply Residue theorem to evaluate real integrals.
5. understand discrete and continuous probability distribution and be able to find mean and standard deviation and use the Uniform distribution.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	III
Branch:	Mechanical Engineering	Code:	337352(37)
Subject:	Machine Drawing	Total Tutorial Periods:	10
Total Theory Periods:	40	Assignments:	Two (Minimum)
Class Tests:	Two (Minimum)	Maximum Marks: 80	Minimum Marks: 28
ESE Duration:	Four Hours		

Course Objectives:

- Understand the different steps in producing drawings according to bureau of Indian standards (B.I.S.) as per SP:46 (1988)
- Understand the application of industry standards and techniques applied in Machine Drawing
- Comprehend general projection theory, with an emphasis on the use of orthographic projection to represent three-dimensional objects in two-dimensional views
- Apply auxiliary or sectional views to most practically represent engineered parts
- Assemble important parts used in major mechanical engineering applications.

UNIT- I Machine Drawing Conventions

a) Conventional representation of machine components-leaf spring, leaf spring with eyes, coil spring (tension and compression), disc spring, spiral spring, splined shaft, serrated shaft, square end of shaft, ball and roller bearing, spur gearing, bevel gearing, worm and worm wheel, straight knurling, diamond knurling, internal and external thread, method of designating and dimensioning metric thread.

b) Representation of geometrical and dimensional tolerance-Straightness, flatness, circularity, cylindricity, parallelism, perpendicularity, angularity, concentricity and coaxiality, symmetry, radial run out and axial run out. Representation of dimensional tolerance of hole, shaft and fits.

c) Representation of surface roughness and direction of lay of machining.

d) Representation of welded joints- representation of form, location and size of welds.

UNIT-II

a) Conversion of pictorial views into orthographic views-First angle projection and third angle projection.

b) Sectional view

Introduction, cutting plane line, type of sectional views-full section, half section, partial or broken section, revolved section, removed section, offset section, sectioning conventions-spokes, web, rib, shaft, pipes, different types of holes, hatching or section lines, conventions of section lines for different metals and materials.

UNIT- III

a) Screwed Fasteners

Drawing hexagonal nut and square nut, hexagonal headed bolt, square headed bolt and washer.

b) Riveted Joint

Form and properties of snap or cup head rivet, dimensions of rivet joint, Type of riveted joints, single riveted lap joint, double riveted (chain) lap joint, double riveted (zigzag) lap joint, single riveted (single strap) butt joint, single riveted (double straps) butt joint.

UNIT-IV

Assembly Drawing

Preparation of assembly drawing and bill of materials of following assemblies from its disassembled views:

- (i) Cotter joint- Sleeve & Cotter Joint, Spigot and Cotter joint
- (ii) Pin Joint or Knuckle joint
- (iii) Bearing-Bushed bearing, Plummer block
- (iv) Coupling-Flange coupling, Flexible coupling
- (v) Pulley-Fast and loose pulley
- (vi) Valves-Steam stop valve, Blow-off cock, Lever safety valve

Marks allotted to UNIT I to UNIT III is 16 each whereas for UNIT IV it is 32

Text Books:

1. Machine Drawing, N.D. Bhatt, Charotar Book Stall, Anand
2. A Text Book of Machine Drawing, P.S.Gill, S.K.Kataria, Delhi

Reference Books:

1. Machine Drawing, R.K.Dhawan,S,Chand,Delhi
2. Textbook of Machine Drawing, K.C. John,PHI,Delhi
3. Machine Drawing, N.Sidheswar,P. Kanniah, &V.V.S. Sastry, TMH,Delhi
4. Machine Drawing With Autocad,, Pohit, Goutam & Ghosh, Goutam,Pearson,Delhi
5. Engineering Drawing Practice for School & Colleges, SP 46:1988, Bureau of Indian Standards

Course outcomes:

- After going through this course, the student shall be able to understand the drawings of mechanical components and their assemblies along with their utility for design and development of mechanical system.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.
- Skillfully use modern engineering tools and techniques such as CAD- CAM softwares for mechanical engineering design, analysis and application

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	III
Branch:	Mechanical Engineering	Code:	337353(37)
Subject:	Material Science & Metallurgy	Total Tutorial Periods:	10
Total Theory Periods:	40	Assignments:	Two (Minimum)
Class Tests:	Two (Minimum)	Maximum Marks: 80	Minimum Marks: 28
ESE Duration:	Three Hours		

Course Objectives:

- To understand various mechanical properties of materials.
- To understand how and why the properties of materials are controlled by its structure at the microscopic and macroscopic levels.
- To understand how and why the structure and composition of a material may be controlled by processing.
- To understand the inter-relationship between composition, structure and properties of engineering materials.
- Get knowledge about different materials, their properties and application.

UNIT I 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.

UNIT II Mechanical Properties of Materials: Elastic and Plastic behaviour of solids, Material properties – Elasticity, Plasticity, Ductility, Malleability, Brittleness, Toughness, Stiffness, Yield strength, Resilience, Hardness, Hardenability, fatigue, creep, and Tensile strength.

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. Imperfection in crystal structure: Point defects – Interstitial Defect, Frankel Defect and Schottky defect; Line defects- Edge dislocations, Screw dislocation; Surface defects – Tilt boundary, Twin boundary and Stacking fault; Volume defects. Strain hardening, Season cracking, Baushinger effect, Cold and Hot working processes, effect on properties like recovery, recrystallization, grain growth and grain size.

UNIT III Phase Diagrams: Phase and phase equilibrium: solidification of pure metals and alloys, Gibb's phase rule, Hume-Rothery's rule, Types of Phase Equilibrium diagrams: Isomorphous- Lever rule, Monotectic, Eutectic-Hyper, hypoeutectic, Eutectoid-Hyper, hypoeutectoid, Peritectic and Peritectoid system. Allotropy of iron and Fe-C diagram.

UNIT IV Heat Treatment of carbon and alloy steels: Introduction, purpose and advantages of heat treatment, defects due to faulty heat treatment, T-T-T curve and micro constituents in steel heat treatment processes like Annealing-stress relief, spheroidising, Process and Full annealing; Normalising, Hardening, Tempering- Austempering, Martempering, Surface hardening-Flame, Induction and Case hardening: Carburising- Pack and Gas carburizing, Nitriding, Cyaniding, Carbo-Nitriding.

UNIT V Engineering Materials: Composition, Properties and Application of the following Engg. Materials:-
Ferrous Metals: Cast Iron & Steel, **Cast Iron**-Grey Cast Iron, White Cast Iron, Malleable Cast Iron, Nodular Cast Iron, Chilled CI, Alloy CI, Mechanite CI, **Steels**- Unalloyed steels or Plain carbon steels- Low, Medium, High carbon steels. Alloy steels- Stainless steel, Martensitic stainless steel, Ferritic stainless steel, High Speed Steel, Heat resisting alloys; spring steel. **Non-Ferrous Metals & Alloys** - Copper Alloys: Brasses – Muntz metal, Cartridge brass, Admiralty brass, Naval Brass, Bronzes – Gun Metal, Phosphor Bronze, Aluminium Bronze, Copper-Nickels alloys. Bearing metals- Babbit, Copper lead alloys, Bronze bearing alloys. Light metal alloys: Aluminium alloys- Duralumin, Cast Aluminium alloys, Aluminium Silicon Alloys. Sintered Carbide.

Text Books:

1. Material Science & Engg. – A first course – V. Raghavan – PHI(P) Ltd., Delhi, 2003
2. A Text Book of Material Science & Science & Metallurgy, O.P. Khanna, Dhanpat Rai & Sons, New Delhi

Reference Books:

1. Elements of Material Science & Engg. – Van Vlack. – Addison – Wesley Longman, 6th Edn., New York
2. Physical Metallurgy – Clark & Varney, East West Edn., New Delhi
3. Engineering Physical Metallurgy – Lakhtin – CBS Publishers & Distributors
4. Materials Science – Narang – CBS Publishers & Distributors
5. Engineering Materials – Woulf Series.
6. Physical Metallurgy Principles – Robert E Reed Hill – Affiliated East-West Press Pvt. Ltd., New Delhi, 2004

Course outcomes:

- Acquire knowledge and hands-on competence in applying the concepts of material science in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering .
- Identify, analysis, and solve mechanical engineering problems useful to the society.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	III
Branch:	Mechanical Engineering	Code:	337354(37)
Subject:	Mechanics of Solids – I	Total Tutorial Periods:	10
Total Theory Periods:	40	Assignments:	Two (Minimum)
Class Tests:	Two (Minimum)	Maximum Marks: 80	Minimum Marks: 28
ESE Duration:	Three Hours		

Course Objectives:

- To gain a fundamental understanding of the concepts of stress and strain by analysis of solids and structures.
- To study engineering properties of materials, force-deformation and stress-strain relationship
- To learn fundamental principles of equilibrium, compatibility, and force-deformation relationship, and principle of superposition in linear solids and structures
- To analyze; determinate and indeterminate axial members, torsional members and beams to determine axial forces, torque, shear forces, bending moments, slopes and deflection.
- To determine stress, strain, and deformation of bars, beams and springs.
- To be able to perform structural analysis by hand computations and design axial and torsional members.

- UNIT I** **Introduction:** Basic of Stress & Strain, elastic constants, stress – strain diagram, Hooke’s law, Poisson’s ratio, shear stresses, stresses in the components subjected to multi-axial forces, thermal stresses, statically indeterminate systems.
- UNIT II** **(A) Beams:** Introduction of Beams, Various type of Beams, Various type of Supports, Reactions at supports, Shear force and bending moment at any section of a beam, Methods for determination of S.F. and B.M. diagrams of beams (simply supported, overhang and cantilever) subjected to various loads, Relation between Shear Force and Bending Moment, Point of contra-flexure.
(B) Bending of beams: Bending of beams with symmetric section, boundary conditions, pure bending, and bending equation problems of simple bending,
(C) Transverse shear stress
- UNIT III** **Deflection of beam:** Relation between slope deflection and radius of curvature, solution of beam deflection, problem by Macaulay’s method, Direct integration method, Moment Area Method, Conjugate Beam method.
- UNIT IV** **(A) Torsion:** Deformation in circular shaft due to torsion, basic assumptions, torsion equations, stresses in elastic range, angular deflection, hollow & stepped circular shaft.
(B) Springs: Types of spring, Closed & Open Coil Helical Springs subjected to Axial Load, springs in parallel & series.
- UNIT V** **(A) Principal stresses and strain:** Transformation of plane stresses, Principal stresses, Maximum shear stresses, Mohr’s circle for plane stresses, Plain strain and its Mohr’s circle representation, Principal strains, Maximum shear strain.
(B) Combined Loading: Components subjected to bending, torsion & axial loads.

Text Books:

1. Elements of Strength of Material – Timoshenko & Young- EWP press
2. Strength of Materials – Dr. Sadhu Singh – Khanna publication

Reference Books:

1. Strength of Materials – R.K. Rajput – Dhanpat Rai & Sons
2. Mechanics of Material-Gere and Timoshenko CBS Publications
3. Mechanics of Solids – Beer & Johnson, Tata McGraw Hill Publications
4. Strength of material – Ryder–ELBS
5. Introduction to Solid Mechanics – I.H.Shames–PHI
6. Engineering Mechanics of Solids – E.P. Popov – PHI

Course outcomes:

- Apply knowledge of mechanics of deformable body for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts mechanics of solid in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	III
Branch:	Mechanical Engineering	Code:	337355(37)
Subject:	Engineering Thermodynamics	Total Theory Periods:	40
Total Theory Periods:	40	Total Tutorial Periods:	10
Class Tests:	Two (Minimum)	Assignments:	Two (Minimum)
ESE Duration:	Three Hours	Maximum Marks: 80	Minimum Marks: 28

Course Objectives:

- To provide a mature approach to the basic principle of classical thermodynamics and to apply it to system surroundings interactions; involving work and heat transfer with associated property changes.
- To Use classical thermodynamics principles to develop algebraic relationships among key physical parameters and variable based on analysis of a specified system
- Use references that provide tabulated physical data that are useful to mechanical engineers.
- Familiarity with construction and performance parameters of Boilers

- UNIT I** **a) Second law of thermodynamics:** Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements and their Equivalence, PMM of Second kind, reversibility and irreversibility, causes of irreversibility, Carnot cycle, Carnot theorem, Absolute thermodynamic temperature scale.
- b) Entropy:** Clasius theorem, the property of entropy, the inequality of Clausius, Entropy principle and its applications, Entropy change during different thermodynamic processes.
- UNIT II** **a) Availability and Irreversibility:** Available energy, availability of a closed system, availability function of a closed system availability of steady flow system, availability function of open system, Helmholtz function, Gibbs functions, Irreversibility for closed and open system, Second law efficiency.
- b) Thermodynamic Relationships:** Maxwell's equations, T-ds equations, difference in heat capacities, coefficient of Volume expansion and isothermal compressibility, adiabatic compressibility, ratio of specific heat, energy equations, Joule-Kelvin effect, Clausius-Clapeyron equation.
- UNIT III** **a) Equation of state:** Ideal gas equation of state, deviation of Real gas from ideal gas, van der 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 as per van der Wall's principle.
- b) Mixture of perfect gases:** Mass Fraction, Mole fraction, Dalton's Law of additive pressure, Amagat-Leduc of additive volumes, Properties of mixture of ideal non reactive gases –gas constant, molecular weight, specific heat, internal energy, enthalpy and entropy.
- UNIT IV** **Properties of Pure substances:** Thermodynamic properties of pure substances in solid, liquid and vapour 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 vapour, use of steam tables and Mollier's diagram in determination of steam properties, energy interaction and entropy calculations.
- UNIT V** **Boilers:** Classification of boiler, difference between water tube and fire tube boiler, construction and working of Cochran fire tube boiler, construction and working of Babcock Wilcox water tube boiler, High pressure boiler- advantages, construction and working of Lamont boiler, function of various boiler mounting and accessories, Draught-definition and classification. Performance of Boiler: Evaporation rate, equivalent evaporation, factor of evaporation, Boiler efficiency, Boiler trial, heat balance sheet of boiler.

Text Books:

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

Reference Books:

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

Course outcomes:

- Apply knowledge of classical thermodynamics for formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts of thermal sciences in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.
- Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.
- To continue the study of the applied thermodynamics.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	III
Branch:	Mechanical Engineering	Code:	337356(37)
Subject:	Mechanical Measurement & Metrology		
Total Theory Periods:	40	Total Tutorial Periods:	10
Class Tests:	Two (Minimum)	Assignments:	Two (Minimum)
ESE Duration:	Three Hours	Maximum Marks: 80	Minimum Marks: 28

Course Objectives:

- To understand the concepts in measurement and metrology.
- To be familiar with different sensors and transducers.
- To build suitable measurement technique.
- To have the confidence to apply automation solutions for given industrial applications.
- To demonstrate the ability to design and conduct experiments, interpret and analyze data, and report results.
- To familiar with various standards and calibration methods used in industry.

- 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 pick ups.
Data acquisition system: Introduction to data acquisition systems, single and multi channel systems, microprocessors and PC based data acquisition systems. Input – output devices signal transmission and Processing. Devices and systems.
- UNIT IV Metrology:** Standards of measurement. 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.

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 Pune
2. Measurement Systems, Application Design – E.O. Deoblein - McGraw Hill
3. Engineering Metrology – K.J. Hume - MacDonal and Company
4. Engineering Metrology – I.C. Gupta - Dhanpat Rai & Sons
5. Mechanical & Industrial Measurements – R.K. Jain – Khanna Publishers

Course outcomes:

- Acquire knowledge and hands-on competence in applying the concepts of measurement and metrology in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.
- Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**
Branch: **Mechanical Engineering**
Subject: **Machine Drawing Laboratory**
Total Lab Periods: **36**
Maximum Marks: **40**

Semester: **III**
Code: **337361(37)**
Batch Size: **30**
Minimum Marks: **20**

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

1. General introduction of GUI
2. Setting up the drawing environment: Drawing aids, setting drawing units, setting grid, setting limits, function keys, object snap.
3. Using co-ordinate system-Cartesian coordinate, polar coordinate (Absolute and relative co-ordinate, direct distance entry methods).
4. Drawing Object-Use of various draw tools with illustrative exercise.
5. Modifying Objects- Use of various modify tools with illustrative exercise.
6. Creating texts and tables
7. Basic dimensioning, Geometric dimensioning and tolerancing
8. Adding constraints to sketches
9. Advance options for making complicated drawings –Layers, Blocks, View port.
10. Exercise problems on conversion of pictorial view to orthographic view
11. Exercise problems on conversion of pictorial view to orthographic sectional view
12. Assembly drawing of machine components.

Equipment/Machines/Instruments/Tools/Software Required:

1. P-IV, 2.6 G. Hz., 128/256 MB SDRAM, 40 GB HDD, 1.44 MB FDD, 14” Colour Monitor, 52 X CD RW, Laser Scroll Mouse
2. Software Required – Drafting Software

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**
Branch: **Mechanical Engineering**
Subject: **Materials Testing Laboratory**
Total Lab Periods: **24**
Maximum Marks: **40**

Semester: **III**
Code: **337362(37)**
Batch Size: **30**
Minimum Marks: **20**

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

1. To study the Universal Testing Machine.
2. To perform the Tensile Test of Mild Steel on U.T.M and To Draw Stress–Strain Curve.
3. To determine strength of wood on U.T.M (i) Along the Grain (ii) Across the Grain.
4. To determine shear strength of Mild Steel on U.T.M.
5. To observe Flexural Behavior of Timber specimen and to determine it's strength under transverse loading on U.T.M.
6. To study the Impact Testing Machine and test specimen of Izod and Charpy.
7. To determine Izod and Charpy Value of the given mild steel specimen.
8. To study the Fatigue Testing Machine and to discuss the procedure to find out endurance limit of given material.
9. To study the Spring Testing Machine.
10. To determine modulus of rigidity for the material of open and closed Coiled Helical Spring Subjected to Axial Load by spring testing machine.
11. To study the Torsion Testing Machine
12. To determine ultimate shear stress and modulus of rigidity under Torsion.
13. To study the Cupping Test Machine and to determine Erichsen value of Mild Steel sheet.
14. To study the Rockwell Hardness Testing Machine and to determine the Rockwell Hardness of the given material.
15. To study the Brinell Hardness Machine and to determine the Brinell hardness of the given material.
16. To study the Vickers Hardness Machine and to conduct a hardness test on the machine.
17. To study Column testing machine and to conduct Buckling Test of column.

Equipment/Machines/Instruments/Tools/Software Required:

- Universal Testing Machine
- Impact Testing Machine
- Fatigue Testing Machine
- Spring Testing Machine
- Torsion Testing Machine
- Cupping Testing Machine
- Rockwell Hardness Testing Machine
- Brinell Hardness Machine
- Vickers Hardness Machine
- Column Testing Machine

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Engineering Thermodynamics Laboratory**

Total Lab Periods: **24**

Maximum Marks: **40**

Semester: **III**

Code: **337363(37)**

Batch Size: **30**

Minimum Marks: **20**

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 Mountings & Accessories of a Boiler.
7. To study the Cochran Boiler and it's Accessories and Mountings.
8. To study the Lancashire and it's Accessories and Mountings.
9. To study the Babcock Wilcox and it's Accessories and Mountings.
10. To study a Simple Steam Engine.
11. To study a Compound Steam Engine.
12. Performance and testing of surface steam condenser.
13. Performance and testing of steam jet condenser.
14. Study of Steam Turbines
15. Study of Reciprocating Compressor

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 turbine
- Compound steam turbine
- Surface steam condenser
- Jet steam condenser
- Steam turbine
- Reciprocating air compressor

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**
 Branch: **Mechanical Engineering**
 Subject: **Mechanical measurement & Metrology Laboratory**
 Total Lab Periods: **24**
 Maximum Marks: **40**

Semester: **III**
 Code: **337364(37)**
 Batch Size: **30**
 Minimum Marks: **20**

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. To Measure Pressure Using Bourdon Pressure Gauge.
2. To Calibrate Pressure Gauge Using Dead Weight Pressure Gauge Tester.
3. To Measure Displacement Using LVDT
4. To Measure Temperature Using Thermister
5. To Measure Flow Rate Using Rotameter.
6. To Measure Angle Using Angular Sensor.
7. To Measure Torque Using Torque Transducer
8. To Measure Pressure Using Pressure Transducer.
9. To Measure Strain Using Strain Cantilever Beam.
10. To Measure Temperature Using RTD.
11. To Measure Temperature Using Thermo Couple.
12. To perform the following experiments using Data Acquisition System
13. To measure Temperature by Themocouple

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

1. Measurements of lengths, heights, diameter by Vernier Calipers, Vernier Height Gauge, Micrometers.
2. Measurement of various angles using Bevel Protractor, Sine Bar & Combination Set.
3. Determining the accuracy of Electrical and Optical Comparator.
4. Determine the Surface Flatness and Contour using Interferometer.
5. Determine 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 Caliper, Micrometer, Height Gauge, Depth Micrometer using Slip Gauges.

LIST OF EQUIPMENTS/MACHINES REQUIRED

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

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	III
Branch:	Mechanical Engineering	Code:	337365(46)
Subject:	Value Education	Total Tutorial Periods:	NIL
No. Of Periods:	2 Periods/Week	Minimum Marks:	24
Maximum Marks:	40		

Course Objectives:

1. This course is designed to provide the importance of education with why, what & how.
2. To impart students with an understanding of fundamental humanitarian viewpoint and its outcomes.
3. To provide the knowledge about whole existence and its impact on values.
4. To bring the awareness about life long exercise so that they can fulfill their responsibility towards themselves, the family, the society, the planet.

UNIT-I Aim of Education and Necessity for Value Education: Education in values/wisdom/etc and education in traits/technologies/etc as the two fundamental strands of education; Answer to the frequently asked questions such as “Why to do studies”, “What studies to do in overall”, “How to do studies in a proper way”, “How to think systematically and talk systematically”

UNIT-II Humanitarian Viewpoint and Basic Human Objective: Meaning and concept of happiness, Need for a fundamental viewpoint to judge things in all cases of human concerns, Proposal of the natural path of humanitarian coexistentialism; Consciousness development and its expression; Fundamental want of sustainable happiness in human being; Understanding the distinct activities and needs of self (I) and body in human being; Fundamental goal of human being; Sustainable-solution in individual (At the place of delusion); Sustainable-prosperity in family (At the place of poverty); Sustainable-cooperation in society (At the place of competition); Sustainable-coexistence in planet (At the place of struggle)

UNIT-III Elements of Holistic and Systematic Perspective: Need for study of fundamental information categories to develop holistic perspective; Particular-time actions and general-time laws; Need for fundamental information sequence to develop systematic perspective, Some examples for systematic study sequence

UNIT-IV Elements of Society-friendly and Environment-friendly Goals: Elements of Knowledge of whole existence; Elements of Knowledge of human being; Elements of fundamental Values and Wisdom; Value spectrum with reference to general relationships and particular relationships of the objects in nature; Elements of History and Contemporarity used to set current goals; Elements of Sciences and Techniques to formulate methods to achieve goals; Elements of Motoricity and Mattericity to make actions to execute the methods

UNIT-V Lifelong Exercise for All-round Sustainability: Collecting information for sustainability issues; Motivating people towards sustainable life-style; Ability to identify and develop appropriate technologies and management patterns for society-friendly and environment-friendly systems for production /protection/ utilization/ experimentation ; Ability to establish and execute the fundamental five-fold system in order to ensure sustainable peace-and-prosperity worldwide.

Text Books:

Value Education for Consciousness Development by Dr P B Deshmukh, Radha K Iyer, and Deepak K Kaushik (2nd Edition, 2012, ISBN: 978-81-924034-0-3)

Reference Books:

1. International Research Handbook on Values Education and Student Wellbeing by Terence Lovat, Ron Toomey, Neville Clement (Eds.), Springer 2010, ISBN: 978-90481-86747
2. Values Education and Lifelong Learning: Principles, Policies, Programmes by David N Aspin and Judith D Chapman (Eds.); Springer 2007, ISBN: 978-1-4020-6183-7
3. Fundamentals of Ethics for Scientists and Engineers by E G Seebaur and Robert L Berry, 2000, Oxford University Press

Chhattisgarh Swami Vivekanand Technical University, Bhilai

SCHEME OF TEACHING AND EXAMINATION

BE (MECHANICAL ENGINEERING) IV Semester

S. No.	Board of Study	Sub. Code	SUBJECT	PERIODS PER WEEK			SCHEME OF EXAM Theory/Practical			Total Marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1.	Mech. Engg	337451(37)	Fluid Mechanics	4	1	-	80	20	20	120	5
2.	Mech. Engg	337452(37)	Mechanics of Solids-II	4	1	-	80	20	20	120	5
3.	Mech. Engg	337453(37)	Applied Thermodynamics	4	1	-	80	20	20	120	5
4	Mech. Engg	337454(37)	Kinematics of Machines	4	1	-	80	20	20	120	5
5	Mech. Engg	337455(37)	Numerical Analysis & Computer Programming (C & C++)	4	1	-	80	20	20	120	5
6	Mech. Engg	337456(37)	Manufacturing Science-I	3	1	-	80	20	20	120	4
7	Mech. Engg	337461(37)	Fluid mechanics Lab	-	-	2	40	-	20	60	1
8	Mech. Engg	337462(37)	Computer Aided Drafting Lab	-	-	2	40	-	20	60	1
9	Mech. Engg	337463(37)	Kinematics of Mechanics Lab	-	-	2	40	-	20	60	1
10	Mech. Engg	337464(37)	NACP Lab	-	-	2	40	-	20	60	1
11	Humanities	337465(46)	Health, Hygiene & Yoga	-	-	2	-	-	40	40	1
12			Library	-	-	1	-	-	-	-	-
Total				23	6	11	640	120	240	1000	34

L: Lecture, T: Tutorial, P: Practical, ESE: End Semester Exam, CT: Class Test, TA: Teachers Assessment

Note (1): Duration of all theory papers will be of Three Hours.

Note (2): Industrial Training of six weeks is mandatory for B.E. students. It is to be completed in two parts. The first part will be in summer after IV semester after which students have to submit a training report which will be evaluated by the college teachers during V Semester.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	IV
Branch:	Mechanical Engineering	Code:	337451(37)
Subject:	Fluid Mechanics	Total Tutorial Periods:	10
Total Theory Periods:	40	Assignments:	Two (Minimum)
Class Tests:	Two (Minimum)	Maximum Marks: 80	Minimum Marks: 28
ESE Duration:	Three Hours		

Course Objectives:

- Obtaining a solid understanding of the fundamentals of Fluid Mechanics
- The ability to formulate basic equations for Fluid Engineering problems
- The ability to use tables and figures to determine the friction energy loss for various pipes/ducts geometries and Fluid engineering applications
- The ability to perform dimensional analysis and identify important parameters

- UNIT- I** **Properties of fluid:** Fluid, ideal and real fluid, properties of fluid : mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus. Newtonian and non-Newtonian fluids
Fluid Statics: Pressure, Pascal's law, Hydrostatic law, Manometry, Hydrostatic force on submerged plane and curved surface, Buoyancy and Flotation.
- UNIT-II** **Fluid Kinematics:** Description of fluid motion, Lagrangian and Eulerian approach, Type of fluid flow, Type of flow lines-path line, streak line, stream line, stream tube. Continuity equation, acceleration of a fluid particle, motion of fluid particle along curved path, Normal and tangential acceleration, Rotational flow, Rotation and Vorticity, circulation, stream and potential function, flow net ,its characteristics and utilities. Liquid in relative equilibrium.
- UNIT- III** **Fluid Dynamics:** Euler's Equation, Bernoulli's equation and its practical application, Venturimeter, Orifice meter, Nozzle, Pitot tube. Impulse momentum equation, Momentum of Momentum equation, Kinetic energy and Momentum correction factor, Vortex motion, Radial flow.
- UNIT-IV** **Laminar Flow:** Reynold's experiment, flow of viscous fluids in circular pipe, shear stress and pressure gradient relationship, Velocity distribution, Hagen-Poiseuille Equation, flow of viscous fluids between two parallel plates (Coutte flow) shear stress and pressure gradient relationship, Velocity distribution, Drop of pressure head.
Turbulent flow: Effect of turbulence, Expression for loss of head due to friction in pipes (Darcy-Weisbach equation), Expression for co-efficient of friction in terms of shear stress.
Flow through pipe: Loss of energy in pipes, Hydraulic gradient and total energy line, pipe in series and parallel, equivalent pipe power transmission through pipe, water hammer in pipes.
- UNIT-V** **Dimensional Analysis:** Methods of dimensional analysis, Rayleigh's method, Buckingham's theorem, Limitations.
Model analysis: Dimensionless number and their significance, model laws, Reynolod's model law, Fraude's model law, Euler's model law, Weber's model law, Mach's model law, Type of models, scale effect in model, limitation of hydraulic similitude.

Text Books:

1. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar– Kataria & Sons – New Delhi
2. A text of Fluid Mechanics – R. K. Rajput – S. Chand & Company Ltd., Delhi

Reference Books:

1. Fluid Mechanics & Hydraulics Machines-R.K.Bansal-Laxmi Publications.,Delhi
2. Engineering Fluid Mechanics –K.L. Kumar, Eurasia Publication House, Delhi
3. Mechanics of Fluid – B.S. Massey – English Language Book Society (U.K.)
4. Fluid Mechanics- Yunush A. Cengel, John M. Cimbala- TMH,Delhi
5. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas- TMH ,Delhi
6. Hydraulics and Fluid Mechanics Including Hydraulic Machine- PN Modi,& SM Seth-Standard, Delhi
7. Theory and Application of Fluid Mechanics- K.Subramanya-TMH Delhi

Course Outcomes:

- Apply knowledge of Fluid Mechanics formulating and solving engineering problems.
- Acquire knowledge of fluid mechanics for the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.
- Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.
- Develop fundamentals to continue the study of the advance subject fluid machinery, Heat and mass transfer etc.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	IV
Branch:	Mechanical Engineering	Code:	337452(37)
Subject:	Mechanics of Solids – II	Total Tutorial Periods:	10
Total Theory Periods:	40	Assignments:	Two (Minimum)
Class Tests:	Two (Minimum)	Maximum Marks: 80	Minimum Marks: 28
ESE Duration:	Three Hours		

Course Objectives:

- To analyze solid mechanics problems using energy methods
- To analyze fixed beams and continuous beams.
- To solve for stresses and deflections of beams under unsymmetrical loading;
- To analyze column
- To analyze thin and thick pressure vessels

UNIT-I Energy Methods: Introduction, Strain energy, Elastic strain energy in tension, compression, bending and torsion. Impact loading in tension and bending, Theorem of Castiglione's and its applications, Reciprocal relations, Maxwell -Betti theorem,

UNIT-II Fixed Beams: Fixed beam subjected to different types of loads and couples, Calculations of fixing moments and reactions at supports, deflection. Effect of sinking of support.

Continuous beams: Continuous beams subjected to different type of loads and couples, beams with overhang, beams with one end fixed, Chaperon's theorem. Effect of sinking of supports.

UNIT- III Bending of curved bars: Bending of curved bars in plane of loading, Winkler- Bach theory, crane hooks, chain links, bending of circular bars subjected to symmetric loading, bending of circular rings, stresses in circular rings.

UNIT-IV Unsymmetrical Bending: Introduction to unsymmetrical bending, Stresses and deflection in unsymmetric bending, Shear center for angle, Channel and I-sections.

Columns: Struts and Columns, Stability of columns, Euler's formula for different end conditions, Equivalent load, Eccentric loading, Rankine's formula.

UNIT-V Thin Pressure Vessel: Thin Pressure Vessels, Circumferential and longitudinal stresses in thin cylindrical shells and thin spherical shell under internal pressure,

Thick Pressure Vessel: Introduction, Lames Theorem, Thick Pressure vessels subjected to internal pressure, External Pressure & both, compound cylinders.

Text Books:

1. Elements of Strength of Material – Timoshenko & Young – EWP Press
2. Strength of Material – S.S.Rattan TMH Publications

Reference Books:

1. Strength of Material – Dr. Sadhu Singh – Khanna Publishers
2. Mechanics of Material-Gere and Timoshenko CBS Publications
3. Advanced Mechanics of Materials–A.P. Boresi and O.M. Sidebottom–John Wiley & Sons
4. Strength of Materials – G.H. Rider – Macmillan
5. Mechanics of Material – J.M. Gere and S.P. Timoshenko – CBS publisher
6. Mechanics of Material – F.P. Bear & E.E. Johnston – McGraw Hill
7. Introduction to Solid Mechanics – I. H. Shames – PHI
8. Engineering Mechanics of Solids – E.P. Popov – PHI
9. Strength of Material – Shaums Outline Series – McGraw Hill

Course Outcomes:

- Apply knowledge of mechanics of deformable body for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts mechanics of solid in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	IV
Branch:	Mechanical Engineering	Code:	337453(37)
Subject:	Applied Thermodynamics	Total Tutorial Periods:	10
Total Theory Periods:	40	Assignments:	Two (Minimum)
Class Tests:	Two (Minimum)	Maximum Marks: 80	Minimum Marks: 28
ESE Duration:	Three Hours		

Course Objectives:

- To understand the applications of engineering thermodynamics in real life situations
- To perform gas power cycle analysis
- To analyze reciprocating air compressors
- To perform vapour power cycle analysis
- To analyze steam condenser, cooling pond and cooling towers.
- To analyze thermodynamic system with compressible fluid.

UNIT-I Gas power cycles: An overview of reciprocating engine, Air standard cycle, Otto, Diesel, dual cycle - Description and representation on P-V and T-S diagram, Thermal Efficiency, Mean Effective Pressures, comparison of cycles. An overview (only p-v and T-s diagram) of Stirling, Ericsson, Atkinson and Lenoir cycle

UNIT-II Reciprocating Air Compressors: Classification of air compressors, working of single acting single cylinder reciprocating compressor, single acting reciprocating compressor without clearance, single acting reciprocating compressor with clearance-equation of work, volumetric efficiency. Multistage reciprocating air compressors, advantage of multistage compression, two stage air compressor-minimum work, Indicator diagram, mean effective pressure and indicated power, compressor power, efficiencies, shaft power of the compressor, Advantages and limitations of reciprocating compressors.

UNIT-III Vapour Power Cycle: Simple steam power cycle, Rankine cycle; p-v, T-s and h-s diagrams, efficiency, steam rate, heat rate. Comparison of Rankine and Carnot cycles, mean temperature of heat addition, reheat cycle, ideal regenerative cycle, practical regenerative cycle, Feed Water Heaters (FWH)- open and closed FWH, characteristics of ideal working fluids, binary vapour cycle

UNIT-IV Steam Condensers: The function of condenser, Element of a water cooled condensing unit, types of condenser, advantages and disadvantages of various types of condenser, condenser vacuum, mass of circulating water required, source of air its effects and removal, vacuum efficiency, condenser efficiency
Cooling ponds and Cooling tower: Cooling pond, cooling towers, classification and working principles.

UNIT-V Thermodynamics of Compressible Fluids: Velocity of pressure waves in a fluid, Mach number, isentropic stagnation state, stagnation enthalpy, temperature, pressure, density, one dimensional steady isentropic flow, area velocity relationship, critical properties-choking in isentropic flow, dimensionless velocity, Effect of back pressure on the performance of nozzle flow. Flow of steam through nozzle, throat area for maximum discharge, supersaturated Flow in nozzle.

Text Books:

1. Thermodynamics- An Engineering Approach – Cengel & Boles – McGraw Hill, Delhi
2. Engineering Thermodynamics – P.K. Nag – TMH Publishers

Reference Books:

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

Course Outcomes:

- Apply knowledge of classical thermodynamics for formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts of thermal sciences in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.
- Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	IV
Branch:	Mechanical Engineering	Code:	337454(37)
Subject:	Kinematics of Machines	Total Tutorial Periods:	10
Total Theory Periods:	40	Assignments:	Two (Minimum)
Class Tests:	Two (Minimum)	Maximum Marks: 80	Minimum Marks: 28
ESE Duration:	Three Hours		

Course Objectives:

- To synthesis, both graphically and analytically, multilink mechanisms.
- To perform mechanism analyses to find the position, velocity, acceleration, and dynamics of multi-bar mechanisms.
- To synthesis mechanism to perform certain prescribed task/motion
- To analyze gear trains.
- To analyze thrust bearings, Brakes and dynamometers.

- UNIT-I Relative velocity:** Elements, pairs, Mechanism, Four bar chain and its inversion, Velocity diagrams, Relative velocity method, Instantaneous centre method.
- UNIT-II Relative Acceleration:** Synthesis of mechanism, Pantograph, Lower pair mechanism, Relative acceleration diagram, Kliens construction, Coroillis component of acceleration.
- UNIT- III Cams:** Classification of cams and followers, Nomenclature of a radial cam, Description of follower movement, Displacement diagrams, Uniform and modified uniform motion, Simple harmonic motion, Uniform acceleration motion and its modifications, Cycloidal motion, Synthesis of cam profile by graphical approach, Considerations of pressure angle. Cams with specified contours: Circular arc cam & tangent cam.
- UNIT-IV Gear:** Types of gears, Gear terminology, Law of gearing, Gear tooth forms, Involute and Cycloid tooth profile, Interference and Undercutting of Involute teeth, Minimum number of teeth on pinion to avoid interference.
Gear trains: Simple, Compound, Reverted, and Epicyclical gear trains, computation of velocity ratio in gear trains by different methods.
- UNIT-V (a) Friction:** Applications of friction, Pivot and collar friction, Thrust bearing.
(b) Belt-Drives: Ratio of tensions for flat belt & V-belt, Centrifugal tension, condition for maximum power transmission.
(c) Brakes and dynamometer: Simple block and shoe brake, Band brake, Band and block brake, and internal expanding shoe brake, Absorption dynamometer, Transmission dynamometer.

Text Books:

1. Theory of Machine – S. S. Ratan-Tata McGraw Hill.
2. The Theory of Machine – Thomas Beven – CBS Publishers.

Reference Books:

1. Theory of mechanism and machine – A. Ghosh, A.K. Mallik –EWP Press.
2. Theory of Machine – Shigley, JE
3. Theory of Machine Jagdish Lal
4. Theory of machine – J.E. Singh – McGraw Hill.

Course Outcomes:

- Apply knowledge of Kinematics of machine for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts kinematics of machine in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	IV
Branch:	Mechanical Engineering	Code:	337455(37)
Subject:	Numerical Analysis & Computer Programming (C & C++)		
Total Theory Periods:	40	Total Tutorial Periods:	10
Class Tests:	Two (Minimum)	Assignments:	Two (Minimum)
ESE Duration:	Three Hours	Maximum Marks: 80	Minimum Marks: 28

Course Objectives:

- To learn about existence and uniqueness criteria for numerical methods
- To learn about convergences criteria and to be aware of reasons why numerical methods may fail.
- Find numerical approximations to the roots of an equation by Newton method, Bisection Method, Secant Method, etc.
- Find numerical solution to a system of linear equations by Gaussian Elimination and Gauss-Siedel Iterative
- Find numerical solution for Curve fitting
- Find numerical solution for ordinary differential equation.
- Find numerical solution for Partial differential equation.
- To understand the basics of computer programming

- UNIT- I Approximation and Errors in Computation:** Approximation and round of errors, truncation errors and Taylor Series, Determination of roots of polynomials and transcendental equations by Graphical methods and Bisection, Regula-falsi, Secant and Newton-Raphson methods, Solution of Linear simultaneous, linear algebraic equations by Gauss Elimination Gauss-Jordan and Gauss-Siedel iteration method.
- UNIT-II Empirical laws, Curve Fitting & Interpolation:** Curve fitting linear and non-linear regression analysis (Method of group average and Least squares) Finite differences, Backward, forward and central difference relation and their use in Numerical differentiation and integration and their application in interpolation.
- UNIT- III Numerical Solution of Ordinary Differential Equations:** Numerical integration by Trapezoidal rule, Simpson's (1/3rd & 3/8th) rule and its error estimation. Application of difference relations in the solution of partial differential equations. Application of difference relations in the solution of partial differential equations. Numerical solution of ordinary differential equations by Taylor's series, Euler, Modified Euler, Runge-Kutta and Predictor-Corrector method.
- UNIT-IV Numerical Solutions of Partial Differential Equations:** Introduction, Classification of second order equations, Finite difference approximations to partial derivatives, Elliptic equations, solution of Laplace equation, Solution of Poisson's equation, Solution of elliptic equations by relaxation method, Parabolic equations, Solution of one-dimensional heat equation, Solution of two-dimensional heat equation, Hyperbolic equations, solution of wave equation.
- UNIT-V Computer Programming:** I/O statement, Mathematical, Relational & Conditional Statements & Expressions. Switch Loops and Control Statements. Introduction to one dimensional arrays and two dimensional arrays. Basics of I/O file handling.

Text Books:

1. Numerical Methods in Engineering & Science – Dr. B.S. Grewal – Khanna Publishers, 6th Edn. 2004
2. Numerical Methods – P. Kandasamy, K. Thilagavathy & K. Gunavathy – S. Chand & Co., 2nd Rev. Edn. – 2003

Reference Books:

1. Let us C – Yashwant Kanitkar, 5th Edn. – BPB Publishers – New Delhi. 2004
2. Introductory Methods of Numerical Analysis – S.S. Sastry, 3rd Edn. – PHI – New Delhi, 2003
3. Numerical Mathematical Analysis – James B. Scarborough, 6th Edn. – Oxford & IBH Publishing Co. – New Delhi
4. Theory & Problems in Numerical Methods – T. Veerarajan, T. Ramchandran – TMH, New Delhi, 2004
5. Numerical Methods for Engineers – Steven C. Chapra, Raymond P. Canale, 4th Edn. – TMH, New Delhi
6. The Spirit of C – Henry Mullish & Herbert L. Cooper - Jaico Pub. House

Course Outcomes:

- Apply knowledge of numerical analysis for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts of Numerical Analysis and Computer Programming in the analysis of mechanical systems.
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary analysis.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	IV
Branch:	Mechanical Engineering	Code:	337456(37)
Subject:	Manufacturing Science – I	Total Tutorial Periods:	10
Total Theory Periods:	40	Assignments:	Two (Minimum)
Class Tests:	Two (Minimum)	Maximum Marks: 80	Minimum Marks: 28
ESE Duration:	Three Hours		

Course Objectives:

- To understand various manufacturing processes & its classifications
- To understand various Casting processes
- To understand various welding processes
- To understand various metal removal process
- To appreciate the capabilities, advantages and the limitations of the processes

- UNIT- I Introduction to Manufacturing Processes:** Importance of Manufacturing Processes, classification, technological definitions. **Metal Casting (Foundry): Introduction :** Basic Principle, Advantages and Limitations, Applications. **Pattern Making:** Pattern materials, allowances, types of pattern, color code scheme **Mould Making:** Green and dry sand casting process, types of sand, molding sand and its properties, molding sand composition and applications. **Elements of mould:** Cores; Use, core material, types of cores, advantages and limitations, core prints, chaplets, Gating and Riser System, Sand casting defects: appearance, causes & remedies. **Special Molding Processes:** Carbon dioxide molding process, investment casting process, Die casting process, shell molding process, continuous casting process, centrifugal casting processes.
- UNIT-II Welding – I: Introduction:** Principle, classification based on application of filler material & without filler material, source of energy, fusing and pressure welding processes, application of welding processes. **Arc welding:** Principle, power source and equipments, welding electrodes- types composition & specification, Metal Arc welding (MAW), flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding processes. (AHW). **Gas Welding:** Principle, Oxy-Acetylene welding, Reaction in Gas welding, Flame characteristics, Gas torch construction & working, forward and backward welding.
- UNIT- III Welding – II: Resistance Welding:** General, principle of heat generation in resistance welding, application of resistance welding processes. Process details and working principle of spot, seam and projection welding, electrode materials, shapes of electrodes, electrode cooling, selection of welding currents, voltages. **Special type of welding:** Friction welding, Explosive welding, Thermit welding, Laser welding, Electron beam welding, Electroslag welding, Ultrasonic welding; principle, equipments, operations. **Soldering, Brazing & Braze welding, Welding Defects**
- UNIT-IV Machine Tools: Lathe:** Principle of operation, basic parts of a lathe, types – speed lathe, engine, bench, tool room, capstan, turret, automatic, specification, construction, operations-facing, turning, knurling, taper turning, thread cutting, drilling, boring, reaming, work holding devices & tools, mechanism and attachments for various operations. **Shaper:** Principle of operation, parts, types- horizontal, vertical, universal, Operations – horizontal cutting, vertical cutting, angular cutting, irregular cutting, specification, Quick return Mechanisms. Table feed mechanism, work holding devices. **Planner:** Principle of operation, parts, types – double housing, open side, pit type, plate type, divided table. Specification, types of drives.
- UNIT-V Milling :** Principle of operation, parts, specification, types- horizontal, vertical, universal, milling operations – plain, face, slotting, gear cutting mechanisms and attachments for milling, indexing-simple, compound and differential. **Broaching:** Principle of operation, parts, types of broaches- horizontal, vertical, pull, surface-internal and external broaching machines, nomenclature, of broach. **Drilling:** Principle of operation, parts, drill nomenclature, types of drilling machines, other operations like counter boring, counter sinking, spot facing etc. **Reaming:** Principle of operation, parts, description of reamers, type of reaming operations. **Boring:** Principle of operation, parts, types of boring machines, boring operations, boring tools

Text Books:

1. Manufacturing Technology (Vol. – I & II) – P.N. Rao – Tata McGraw Hill Pub. Company, New Delhi.
2. A Text Book of Production Technology (Manufacturing Processes) – P.C. Sharma – S. Chand and Company Ltd., New Delhi.

Reference Books:

1. Manufacturing Science – A. Ghosh & A.K. Mallik – East West Press Pvt. Ltd., New Delhi
2. Manufacturing Engineering and Technology – S. Kalpakjian & S.R. Schmid – Addison Wesley Longman, New Delhi
3. Production Technology – R. K. Jain – Khanna Publishers, New Delhi
4. A Text Book of Production Technology (Vol. I & II) – O.P. Khanna – Dhanpat Rai & Sons, New Delhi.

Course Outcomes:

- Acquire knowledge and hands-on competence in applying the concepts of manufacturing science in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.
- Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program:	Bachelor of Engineering	Semester:	IV
Branch:	Mechanical Engineering	Code:	337461(37)
Subject:	Fluid Mechanics Laboratory	Batch Size:	30
Total Lab Periods:	24	Minimum Marks:	20
Maximum Marks:	40		

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

1. To determine the meta-centric height of a ship model.
2. To verify Bernoulli's Theorem.
3. To verify Impulse Momentum Principle.
4. To calibrate a Venturimeter and study the variation of coefficient of discharge.
5. To calibrate an orifice-meter.
6. Experimental determination of critical velocity in pipe.
7. To determine of head loss in various pipe fittings.
8. Flow measurement using Pitot tube.
9. To study the transition from laminar to turbulent flow and to determine the lower critical Reynold's number.
10. To determine the hydraulic coefficients (C_c , C_d and C_v) of an orifice.
11. To determine the coefficient of discharge of a mouth piece.
12. To obtain the surface profile and the total head distribution of a forced vortex.
13. To study the velocity distribution in pipe and to compute the discharge by integrating velocity profile.
14. To study the variation of friction factor for pipe flow.
15. To determine the roughness coefficient of an open channel.

List of Equipment/Instruments/Machines/Software Required:

- Apparatus for determination of metacentric height
- Bernoulli's apparatus
- Impact of jet apparatus
- Venturimeter
- Orificemeter
- Pipe friction apparatus
- Orifice apparatus
- Mouth Piece apparatus with the provision for determination of hydraulic coefficient C_c , C_d & C_v
- Vortex flow apparatus
- Apparatus of head loss in various pipe fittings.
- Reynold's apparatus
- Complete setup for flow measurement using Pitot tube
- Complete set for open channel apparatus

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**
Branch: **Mechanical Engineering**
Subject: **Computer Aided Drafting
Laboratory**

Semester: **IV**
Code: **337462(37)**

Total Lab Periods: **24**
Maximum Marks: **40**

Batch Size: **30**
Minimum **20**
Marks:

List of Experiments:

1. Understanding of various 3D CAD commands and creating simple 3D objects.
2. Understanding of holes, cuts and model tree relations.
3. Creation shafts, rounds, chamfers and slots.
4. Sketch Tools & Datum planes
5. Creation of objects by Extrusion, revolved features (Simple protrusion), patterns and copies.
6. Creation of objects by sweeps and blends (Advance protrusion) methods.
7. Creation of engineering drawing details such as dimensioning, sectional views, adding esthetics.
8. Assembling of part models using constraints
9. Assembly operations - part modifications, adding another assembly features – display

List of Equipment/Instruments/Machines/Software Required:

1. P-IV, 2.6 G. Hz., 128/256 MB SDRAM, 40 GB HDD, 1.44 MB FDD, 14" Colour Monitor, 52 X CD RW, Laser Scroll Mouse
2. Software Required – Drafting Software

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**
Branch: **Mechanical Engineering**
Subject: **Kinematics of Machines**
Laboratory

Semester: **IV**
Code: **337463(37)**

Total Lab Periods: **24**
Maximum Marks: **40**

Batch Size: **30**
Minimum Marks: **20**

List of Experiments:

1. To determine the jump phenomena of cam follower apparatus.
2. To draw displacement, velocity and acceleration curve of cam motion.
3. To find out the load carrying capacity of bearing.
4. To find out the Coefficient of friction of bearing.
5. To find out the frictional horse power of bearing.
6. To find out the Pressure around the bearing by journal bearing apparatus.
7. To measure co-efficient of friction, power transmitted with varied belt tension by slip & creep apparatus.
8. To find out the percentage slip at fixed belt tension by varying load with slip & creep apparatus.
9. To find out belt slip and creep by slip and creep measurement apparatus.
10. To verify the corioli's component of acceleration with theoretical and practical results.
11. To find the speed and torque of different gear in an epicyclic gear train.
12. To find the speed and torque of different gear in a simple, compound and reverted gear train.
13. To Study and analysis of Pantograph.
14. To study Four-bar mechanism and its inversions.
15. To study internal expanding and external contracting shoe brakes.
16. To study rope brake dynamometer and calculation of torque and power.

List of Equipment/Instruments/Machines/Software Required:

- Cam analysis apparatus
- Journal bearing apparatus.
- Corioli's component of acceleration apparatus
- Slip & Creep Measurement Apparatus in Belt Drive
- Simple, compound, reverted and epicyclic gear train apparatus.
- Pantograph apparatus (with all accessories)
- Internal / external shoe brake (complete set with accessories)
- Four bar mechanism and its inversions.
- Rope brake dynamometer apparatus (with all accessories)
- Mechanoset.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**
Branch: **Mechanical Engineering**
Subject: **Numerical Analysis &
Computer Programming
Laboratory**

Semester: **IV**
Code: **337464(37)**

Total Lab Periods: **24**
Maximum Marks: **40**

Batch Size: **30**
Minimum **20**
Marks:

List of Experiments:

1. Write a program to calculate the area & perimeter of the rectangle and the area & circumference of the circle. The length and breadth of a rectangle and radius of a circle are input through keyboard.
2. Write a program to determine whether the character entered through a keyboard is a capital letter, a small case letter, a digit or a special symbol.
3. Write a program to add first seven terms of the following series using looping statements series is

$$S = \frac{1}{1!} + \frac{2}{2!} + \frac{3}{3!} + \frac{4}{4!} + \dots\dots\dots$$

4. Write a program which has the following options:
 - a. Factorial of a number
 - b. Prime or not
 - c. Odd or even
5. Write a program to implement Bubble sort on a set of 10 numbers.
6. Write a program to store every character typed at the keyboard into a file. The procedure should come to an end as soon as the 'Esc' key is pressed.
7. Write a program to find the roots of an equation using Newton Raphson Method.
8. Write a program to practice one of the Numerical Integration Method.
9. Write a program to find the solution of Differential Equation by Modified Euler's Equation.
10. Write a program to find the solution of Differential Equation by Runge Kutta Equation.

List of Equipment/Instruments/Machines/Software Required:

1. P-IV, 2.6 G. Hz., 128/256 MB SDRAM, 40 GB HDD, 1.44 MB FDD, 14" Colour Monitor, 52 X CD RW, Laser Scroll Mouse
2. Software Required – C & C++

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Health, Hygiene & Yoga**

No. Of Periods: **2 Periods/Week**

Maximum Marks: 40

Semester: **IV**

Code: **337465(46)**

Total Tutorial Periods: **NIL**

Minimum Marks: 24

Course Objectives:

- 1 To provide understanding the importance of health.
- 2 To provide insight into the hygiene aspect & quality of life.
- 3 To study the concepts of various medical therapy.
- 4 To practice the various yogasans.
- 5 To provide knowledge about common diseases and its cure through yagasans and pranayam.
- 6 To develop concentration through various methods.

UNIT- I HEALTH & HYGIENE: Concept of health, Physical health and mental health and wellbeing and how to achieve these, longevity and how to achieve it, concept and common rules of hygiene, cleanliness and its relation with hygiene; Overeating and underrating, amount of food intake required, intermittent fasting; adequate physical labour, sleep; consumption of junk fast food vs nutritious food; fruits, vegetables cereals and qualities of each of these.

UNIT-II INTRODUCTORY KNOWLEDGE OF COMMON STREAMS OF MEDICINAL CURE: History, development, basic concepts, modes of operation of Alopathy, Ayurved, Homoeopathy, Biochemic, Unani, Siddha, Accurpressure, Accupuncture, Naturopathy, Yogic and Herbal system of medicines, Introduction of Anatomy and Physiology concerned.

UNIT- III YOGASANS: Meaning and concept of Yoga, Yogasans and its mode of operation, How to perform Yogasans, Common Yogasans with their benefits, such as, Padahastasan, Sarvangasan, Dhanurasan, Chakrasan, Bhujangasan, Paschimottasan, Gomukhasan, Mayurasan, Matsyasan, Matsyendrasan, Pawanmuktasan, Vajrasan, Shalabhasan, Sinhasan, Shashankasan, Surya Namaskar, Halasan, Janushirasan, Utshep Mudra.

UNIT-IV YOGASANS FOR COMMON DISEASES: From Yogic Materia Medica with symptoms, causes, asans and herbal treatment.

- **Modern silent killers:** High blood pressure, diabetes and cancer, causes and cure; Common health problems due to stomache disorders, such as, indigestion, acidity, dycentry, piles and fissures, artheritis, its causes, prevention and cure.
- **Asans for relaxation:** Shavasan, Makarasan, Matsyakridasan, Shashankasan.
- **Asans to increase memory and blood supply to brain:** Shirsh padasan, Shashankasan.
- **Asans for eye sight:** Tratak, Neti Kriya .
- **Pranayam:** Definition and types: Nadi Shodhan, Bhastrik, Shitakari, Bhramari useful for students.

UNIT-V CONCENTRATION: Concentration of mind and how to achieve it. **Tratak (त्राटक)**, Concentration on breath, **Japa (जप)**, **Ajapajap (अजपाजप)**, internal silence (**अन्तर्मीन**), visualization in mental sky (**चिदाकाश धारणा**), Concentration on point of light (**ज्योति ध्यान**), Concentration on feeling (**भाव ध्यान**), Concentration on figure (**मूर्त्त ध्यान**).

Text Books:

Health, Hygiene & Yoga, Dr P B Deshmukh, Gyan Book Pvt Ltd. New Delhi.

Reference Books:

- (1) Yogic Materia Medica
- (2) Asan, Pranayam and Bandh.

Chhattisgarh Swami Vivekanand Technical University Bhilai (C.G.)

SCHEME OF TEACHING AND EXAMINATION

B.E. V SEMESTER MECHANICAL ENGINEERING

S. No.	Board of Study	Sub. Code	SUBJECT	PERIODS PER WEEK			SCHEME OF EXAM Theory/Practical			Total Marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1.	Mech. Engg	337551 (37)	Machine Design – I	4	1	-	80	20	20	120	5
2.	Mech. Engg	337552 (37)	Turbo Machinery	4	1	-	80	20	20	120	5
3.	Mech. Engg	337553 (37)	Dynamics of Machines	4	1	-	80	20	20	120	5
4.	Mech. Engg	337554 (37)	Fluid Machinery	4	1	-	80	20	20	120	5
5.	Mech. Engg	337555 (37)	Manufacturing Science - II	3	1	-	80	20	20	120	4
6.	Mech. Engg	337556 (37)	Operations Research	4	1	-	80	20	20	120	5
7.	Mech. Engg	337561 (37)	Machine Design-I Lab	-	-	2	40	-	20	60	1
8.	Mech. Engg	337562 (37)	Manufacturing Science Lab	-	-	2	40	-	20	60	1
9.	Mech. Engg	337563 (37)	Dynamics of machines Lab	-	-	2	40	-	20	60	1
10.	Mech. Engg	337564 (37)	Fluid Machinery Lab	-	-	2	40	-	20	60	1
11.	Humanities	300565 (46)	Personality Development	-	-	2	-	-	20	20	1
12.	Mech. Engg	337566 (37)	*Practical Training Evaluation/Library	-	-	1	-	-	20	20	1
Total				23	6	11	640	120	240	1000	35

L: Lecture

T: Tutorial **P:** Practical

ESE: End Semester Examination

CT: Class Test

TA: Teacher's Assessment

*** Industrial Training of eight weeks is mandatory for B.E. student. It is to be completed in two parts. The first part will be in summer after IV semester after which students have to submit a training report which will be evaluated by the college teachers during B.E. V semester.**

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering/Mechatronics Engineering** Semester: **V**
Subject: **Machine Design I** Code: **337551(37)**
Total Theory Periods: **40** Total Tutorial Periods: **10**
No. of class Tests to be conducted: **2 (Minimum)** No. of assignments to be submitted: **2 (Minimum)**

ESE Duration: **Four Hours** Maximum Marks in ESE: **80** Minimum Marks in ESE: **28**

Note: Design data book by PSG and ISI data sheets are allowed in the examination.

Course Objectives:

- To choose proper materials to different machine elements depending on their physical and mechanical properties.
- To design and analyze basic elements of machine e.g. key, shaft and axle.
- To design and analyze various type of joints for members with axial load
- To design and analyze couplings and clutches for members in torsion
- To design and analyze threaded fastener and power screws
- To design and analyze riveted and welded joint

Course outcomes:

- Apply knowledge of machine design for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
- Identify, analyze, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

- UNIT I** **General Considerations:** Selection of Materials, Design Stress, Factor of Safety, Stress concentration factor in tension, bending and torsion, theories of failures. Notch sensitivity, design stress for variable and repeated loads, fatigue stress concentration factor, endurance diagrams.
- UNIT II** **Basic Elements Design:** Design of socket-spigot cotter joint, sleeve and cotter joint, design of Knuckle joint.
Keys and Couplings: Types of keys, design of keys, design of splines.
Types of couplings, design of flange and flexible couplings, compression coupling, muff coupling.
- UNIT III** **Shafts and Axles:** Transmission shaft, Design against static load, Design for strength, rigidity and stiffness, design under continuous loading for fatigue.
Clutches: Friction clutches, Friction materials, Torque transmitting capacity, Single & Multiple plate clutch, centrifugal clutches.
- UNIT IV** **Threaded fasteners:** Geometry of thread forms, terminology of screw threads and thread standards, specifications of steel bolts, initial tension, and relation between bolt tension and torque, design of statically loaded tension joints, design of bolted joints due to eccentric loading.
Power Screws: Power screws, Force analysis-square and trapezoidal threads, Collar friction, Stresses in screw, coefficient of friction, efficiency of thread.
- UNIT V** **Riveted Joints:** Types of rivet heads, types of riveted joints, failure of riveted joint, strength of rivet joint, efficiency of riveted joint, design of riveted joint for boiler.
Welded joints: Types of welded joints, stresses in butt and fillet welds, strength of welded joints, location and dimension of weld design, eccentrically loaded joint, welded joint subjected to bending moment, design procedure, fillet welds under varying loads, stress relieving techniques.

TEXT BOOKS:

1. Design of Machine Elements- V.B.Bhandari - TMH, New Delhi
2. Mechanical Engineering Design - Shigley – McGraw Hill, Delhi

REFERENCE BOOKS:

1. Machine Design - Movnin – MIR Publishers, Moscow
2. Machine Design - Fundamental & Application – Gope – PHI, New Delhi
3. Machine Design - Sharma & Agrawal – Katson, New Delhi
4. Principles of Mechanical Design - R. Phelan – McGraw Hill, New Delhi.
5. Machine Design – Sundarajamoorthy & Shanmugum – Anuradha Agencies, Chennai

Name of the Programme: Bachelor of Engineering ::: **Duration of the Programme: Four Years**

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering** Semester: **V**
Subject: **Turbo Machinery** Code: **337552(37)**
Total Theory Periods: **40** Total Tutorial Periods: **10**
No. of class Tests to be conducted: **2 (Minimum)** No. of assignments to be submitted: **2 (Minimum)**

ESE Duration: **Four Hours** Maximum Marks in ESE: **80** Minimum Marks in ESE: **28**

Note: Steam tables are allowed in the Examination

Course Objectives

- To study classifications of turbo-machines.
- To study construction and working of different turbo- machines
To acquire the knowledge and skill of analyzing different turbo- machines

Course Outcomes:

1. Apply knowledge of turbo machinery for understanding, formulating and solving engineering problems.
2. Acquire knowledge and hands-on competence in the design and development of mechanical systems.
3. Identify, analysis, and solve mechanical engineering problems useful to the society.
4. Work effectively with engineering and science teams as well as with multidisciplinary designs.

- UNIT I** Impulse Turbine: Steam turbine – Principal of operation of steam turbine, types of impulse turbine, compounding of steam turbine-pressure compounded, velocity compounded and pressure velocity compounded impulse turbine. Velocity diagram for impulse turbine, force on the blade and work done. Blade or diagram efficiency, axial thrust, gross stage efficiency. Influence of ratio of blade velocity to steam velocity on blade efficiency in a single stage impulse turbine. Efficiency of multi-stage turbine. Impulse blade sections, choice of blade angle. Blade height in velocity compounded impulse turbine.
- UNIT II** Impulse Reaction Turbine: Velocity diagram, degree of reaction, impulse-reaction turbine with similar blade section and half degree of reaction. (Parson's turbine) Height of reaction turbine blading, Losses in steam turbine, Internal losses-throttling losses, Nozzle friction losses, blade friction losses, disc friction losses, blade windage losses or partial admission losses, leakage or clearance losses, loss due to wetness of steam, carry-over loss, residual loss, radiation loss, external losses-Mechanical friction and bearing losses.
- UNIT III** State Point Locus and Reheat Factor: Stage efficiency of impulse turbines, stage point locus of an impulse turbine, state point locus for multistage turbine, reheat factor. Internal efficiency, overall efficiency, relative efficiency, Governing of steam turbine. Throttle governing, nozzle governing, bypass governing, combination of throttle and nozzle, governing and combination of bypass and throttle governing. Effect of governing on the performance of steam turbine.
- UNIT IV** Gas Turbine: Classification of gas turbine. Applications, Simple open cycle gas turbine, Ideal and actual cycle for gas turbine, polytropic or small stage efficiency, cycle air rate, cycle work ratio, Optimum pressure ratio for maximum specific output in actual gas turbine, optimum pressure ratio for maximum cycle thermal efficiency, means of improving the efficiency and specific output. Open cycle gas turbine with regeneration, reheat and inter cooling and effect of these modification on efficiency and output. Closed cycle gas turbine.
- UNIT V** **Turbo Compressors:** Introduction, classifications of Centrifugal compressors – components, working, velocity diagrams, calculations of power and efficiencies. Slip factor, surging and choking, power and efficiencies.
Axial Flow Compressor: Construction and working, velocity diagram, calculation of power and efficiencies. Degree of reaction, work done factor, stalling, comparison of centrifugal and axial flow compressor.

TEXT BOOKS

1. Steam and Gas Turbine and Power Plant Engineering-R. Yadav - Central Publishing House, Allahabad
2. Turbine, Compressors and Fan- S.M. Yahya - TMH, Delhi

REFERENCE BOOKS

1. Gas Turbine – V. Ganeshan – TMH, Delhi
2. Fundamental Of Compressible Flow- S.M. Yahya - TMH, Delhi
3. Gas Dynamics with Application: S.K. Kulshrestha
4. Fundamentals Of Compressible Fluid Dynamics- P.Balachandran- PHI, Delhi
5. Fundamental of Gas Dynamics-K.L.Yadao-Khanna Publications, Delhi

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	Mechanical Engineering/Mechatronics Engineering	Semester:	V		
Subject:	Dynamics of Machines	Code:	337553 (37)		
Total Theory Periods:	40	Total Tutorial Periods:	10		
No. of class Tests to be conducted:	2 (Minimum)	No. of assignments to be submitted:	2 (Minimum)		
ESE Duration:	Three Hours	Maximum Marks in ESE:	80	Minimum Marks in ESE:	28

Course Objectives:

- To study types of mechanical governors and to analyze its performance parameters
- To Apply the theory of balancing to rotating and reciprocating masses.
- To analyze gyro-effect on moving bodies
- To understand the concepts of mechanical vibration
- To perform inertia force analysis of machine elements
- To draw turning moment diagram of reciprocating engines
- To analyze performance parameters flywheel

Course Outcome

- Apply knowledge of Dynamics of machine for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts Dynamics of machine in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering
- Identify, analyze and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

UNIT I Governors: Characteristics of centrifugal governors, Gravity controlled governors, Porter and proell. Spring controlled centrifugal governor: Hartung, & Hartnell governor. Performance parameter: Sensitivity, stability, Isochronisms, Governor Effort and power.

UNIT II Balancing: Balancing of rotating masses, Static and dynamic balancing, Determination of balancing masses in two plane balancing, Balancing of internal combustion engines, Balancing of in-line engines, Firing order, Balancing of V-twin and radial engines, Forward and reverse crank method, Balancing of rotors.

UNIT III Gyroscope: Gyroscopic forces and couple, gyroscopic effect in Airplanes, Ship motion and Vehicles moving on curved path.

UNIT IV Mechanical Vibrations: One-dimensional, longitudinal, Transverse, and torsional vibrations, Natural frequency, Effect of damping on vibrations, Different types of damping. Forced vibration, Forces and displacement, Transmissibility, Vibration Isolation, Vibration sensors: seismometer and Accelerometers, Whirling of shafts with single rotor.

UNIT V (a) Inertia force analysis: Effective force and inertia force on link, Inertia force on reciprocating engine. Inertia force in four bar chain mechanism.
(b) Turning moment diagram and flywheel: Turning moment diagram for single and multi cylinder internal combustion engine, Coefficient of fluctuation of speed, Coefficient of fluctuation of energy, Flywheel.

TEXT BOOKS

1. Theory of Machine- S.S.Rattan - Tata McGraw Hill, New Delhi
2. Theory of Machines - Thomas Bevan, - CBS/ Cengage Publishers

REFERENCE BOOKS

1. Theory of Machines and Mechanism– Uicker, Pennock, & Shigley – Oxford Univ. Press
2. Theory of Mechanisms and Machines- A. Ghosh, A. K. Mallik – EWP Press.
3. Mechanism and Machine theory-Ambekar-PHI, Delhi
4. Theory of Machine – P.L. Ballaney – Khanna Publishers, New Delhi
5. Theory of Machine -Jagdish Lal- Metro Politan Books, New Delhi

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	Mechanical Engineering	Semester:	V
Subject:	Fluid Machinery	Code:	337554 (37)
Total Theory Periods:	40	Total Tutorial Periods:	10
No. of class Tests to be conducted:	2 (Minimum)	No. of assignments to be submitted:	2 (Minimum)
ESE Duration:	Three Hours	Maximum Marks in ESE:	80
		Minimum Marks in ESE:	28

Course Objectives:

- To understand boundary layer theory
- To formulate basic equations for impact of free jets
- To understand construction and working and performance of various Turbines
- To understand construction and working & performance of various Pumps
- To solve and analyze a variety of fluid mechanics and fluid machinery related problems.

Course Outcomes:

- Apply knowledge of fluid mechanics and fluid machinery for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts of fluid mechanics and fluid machinery in the design and development of mechanical systems.
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.
Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.

UNIT I Boundary Layer Theory : Boundary layer definition and characteristics, momentum equation, Laminar and turbulent boundary Layer, Total drag, separation and control. Flow around submerge bodies Force exerted by flowing fluid on a body: Drag and lift; stream lined and bluff body, Drag on sphere and cylinder, circulation and lift on circular cylinder, lift of an air foil, induced drag.

UNIT II Impact of Free Jets: Impulse momentum principle, force exerted by the jet on stationary flat and curved plate, hinged plate, moving plate and moving curve vanes, jet propulsion of ship.
Impulse Turbine: Classification of turbine, impulse turbine, Pelton wheel, Construction working, work done, head efficiency and Design aspects, Governing of impulse turbine.

UNIT III Reaction Turbine : Radial flow reaction turbine, Francis turbine: construction, working, work done, efficiency, design aspect, advantages & disadvantages over Pelton wheel. Axial flow reaction turbine Propeller and Kaplan turbine, bulb or tubular turbine, draft tube, specific speed, unit quantities, cavitation, degree of reaction, performance characteristics, surge tanks, governing of reaction turbine.

UNIT IV Centrifugal Pumps : Classification of Pumps, Centrifugal pump, Construction, working, work done, heads, efficiencies, multistage centrifugal pump, pump in series and parallel, specific speed, characteristic, net positive suction head, cavitation.

UNIT V Reciprocating Pumps: Classification, component and working, single acting and double acting pump, discharge, work-done and power required, slip & coefficient of discharge, indicator diagram, air vessels.

TEXT BOOKS:

1. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar– Kataria & Sons -Delhi
2. Fluid Mechanics- Yunush A Cengel, John M. Cimbala- TMH, Delhi

REFERENCES BOOKS:

1. A text of Fluid Mechanics – R. K. Rajput – S. Chand & Company Ltd., Delhi
2. Fluid Mechanics & Hydraulics Machines-R.K.Bansal- Laxmi Publications, Delhi
3. Mechanics of Fluid – B.S. Massey – English Language Book Society (U.K.)
4. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas- TMH, Delhi
5. Hydraulics and Fluid Mechanics Including Hydraulic Machine- PN Modi, & SM Seth-Standard, Delhi
6. Hydraulic Machines: Fundamentals of Hydraulic Power Systems – P. Kumar – BSP Books Pvt, Ltd., Hyderabad

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	Mechanical Engineering	Semester:	V
Subject:	Manufacturing Science - II	Code:	337555 (37)
Total Theory Periods:	40	Total Tutorial Periods:	10
No. of class Tests to be conducted:	2 (Minimum)	No. of assignments to be submitted:	2 (Minimum)
ESE Duration:	Three Hours	Maximum Marks in ESE:	80
		Minimum Marks in ESE:	28

Course Objectives:

- To understand grinding and other surface finishing operations.
- To understand various non conventional machining processes and their applications.
- To get knowledge of various metal forming processes.
- To understand principle of sheet metal forming operations
- To understand the process of Gear Shaping and Gear Hobbing.
- To understand the design considerations of Jigs and Fixtures.

Course Outcomes:

- Acquire knowledge and hands on competence in applying concept of manufacturing science in design and development of mechanical and other engineering systems.
- Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.
- Demonstrate creativeness in designing new system components and processes in the field of engineering in general and mechanical engineering in particular.
- Work effectively with engineering and science teams as well as with multidisciplinary design.

- UNIT I Grinding :** Processes. Grinding wheels, compositions- abrasives, bonding materials. Grinding wheel characteristics-abrasive type, grain size, bonding material, structure, and grade. Wheel specification and selection. Wheel life. Types of grinding operations, design consideration for grinding, specification of grinding wheel, process parameters, economics of grinding.
Surface finishing operations: Honing, lapping, super finishing, polishing, buffing, process parameters and attainable grades of surface finish.
- UNIT II Unconventional Machining:** Advantages, application and limitation, Processes- Electro Discharge Machining (EDM), Electro Chemical Machining (ECM), Ultrasonic Machining (USM), Abrasive Jet Machining (AJM), Electron Beam Machining (EBM), Laser Beam Machining (LBM), Electro Chemical grinding(ECG) .Mechanics of metal removal, tooling, equipment, process parameters and surface finish obtained & specific applications.
- UNIT III Introduction to metal forming:** Classification, Hot and Cold working.
Forging: Principle. Forging operations, drawing out and upsetting. Types of forging method-smith, drop, press and machine forging. Forging equipment. Forging dies. Tools and fixture of forging, forging dies. Forging design, Forging designs factors. Drop forging die design, Upset forging die design. Forging practice – sequence of steps. Forging defects. Inspection and testing of forged parts.
Extrusion: Principle, extrusion processes-hot extrusion, cold extrusions. Process parameters. Extrusion equipment. Extrusion of seamless tubes. Extrusion defects.
- UNIT IV Rolling :** Principle, classification of rolled products, Types of rolling mills, rolling mill train components, Roll pass sequences-break down passes, roughing passes, finishing passes. Roll passes design for continuous mill. Roll separating force. Rolling load calculation. Power required in rolling. Effect of front and back tensions. Effect of friction. Shape rolling operations-ring rolling, thread rolling. Defects in rolled products.
Drawing: Principle. Wire drawing, tube drawing. Drawing equipments and dies. Calculation of drawing load and power requirement
- UNIT V Sheet metal forming**
Types of presses: Selection of press, components of a simple press, press working operations – shear, bending.
Shearing operations: Blanking, piercing, trimming, shaving, nibbling and notching .Calculation of punching force and shear force. Punch and die size calculation. **Drawing operation:** Principle of operation. Draw die design.
Bending operation: Principle of operation. Bend allowances. Bending force. Length of sheet estimation. Bend radius. Spring back effect. **Other operation:** Spinning, Stretch forming, Embossing and Coining.

TEXT BOOKS:

1. Manufacturing Technology (Vol. - I & II) – P.N. Rao – Tata McGraw Hill Pub. Company, New Delhi
2. A Text Book of Production Technology (Manufacturing Processes) – P.C. Sharma – S. Chand and Company Ltd., New Delhi

REFERENCE BOOKS:

1. Manufacturing Engineering and Technology – S. Kalpakjian & S.R. Schmid – Addison Wesley Longman, New Delhi
2. Tool Engineering & Design – G.R. Nagpal – Khanna Publishers – New Delhi
3. A Text Book of Production Technology – O.P. Khanna – Dhanpat Rai & Sons, New Delhi
4. Manufacturing Science – A. Ghosh & A.K. Mallik – East West Press Pvt. Ltd., New Delhi
5. Production Technology – R.K. Jain – Khanna Publishers, New Delhi

Name of the Programme: Bachelor of Engineering :::: Duration of the Programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	Mechanical Engineering	Semester:	V		
Subject:	Operation Research	Code:	337556 (37)		
Total Theory Periods:	40	Total Tutorial Periods:	10		
No. of class Tests to be conducted:	2 (Minimum)	No. of assignments to be submitted:	2 (Minimum)		
ESE Duration:	Three Hours	Maximum Marks in ESE:	80	Minimum Marks in ESE:	28

Note: Four questions of 20 marks to be set taking one from each unit.

Course Objectives:

- Understand definition, scope, objectives, phases, models & limitations of operations research.
- To understand different application areas of operations research like transportation problem, assignment model, sequencing models, dynamic programming, game theory, replacement models & inventory models

Course Outcomes:

- Identify and develop operational research models from the verbal description of the real system.
- Understand the mathematical tools that are needed to solve optimization problems.
- Use mathematical software to solve the proposed models.
- Develop a report that describes the model and the solving technique, analyze the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.
- A student will be able use knowledge of operations research to solve transportation problems, assignment problems, sequencing problems, dynamic programming & game theory.

- UNIT I Introduction:** Various stages of O.R., Fields of application, optimization and its classification. General Linear Programming Problems- Introduction, maximization and minimization of function with or without constraints, formulation of a linear programming problem, graphical method and simplex method, Big M method degeneracy, application of L.P.P. in Mechanical Engineering.
- UNIT II The Transportation Problems:** Mathematical formulation computational procedures, Stepping stone method, Modified Distribution Method, Vogels Approximation Method, Solution of balanced and unbalanced transportation problems and case of Degeneracy.
The Assignment Problems: Mathematical formulation of assignment problems, solution of assignment problems, traveling salesman problems, Air crew Assignment problems.
- UNIT III Waiting Line Theory:** Basic queuing process, basic structure of queuing models, some commonly known queuing situations Kendall's service time, solution to $M/M/1: \infty/FCFS$ models.
Network Analysis: CPM/PERT, Network Representation, Techniques for drawing network. Resource smoothing and leveling, project cost, Optimum project duration, project crashing, updating, Time estimation in PERT.
- UNIT IV Game Theory:** Introduction, two person zero sum game, methods for solving two person zero sum game: when saddle point exists, when no saddle point exists, solution of $2 \times n$ and $m \times 2$ game.
Simulation: Basic concept of simulation, applications of simulation, merits and demerits of simulation, Monte Carlo simulation, simulation of Inventory system, simulation of Queuing system.

TEXT BOOKS:

1. Operation Research , Sasien Yaspan
2. Operation Research – N. D. Vohra – TMH
3. Operation Research– Hira & Gupta – S. Chand & Co.
4. Engineering Optimization: Theory and Practice- S.S.Rao- New Age Publishers

REFERENCE BOOKS:

1. Operation Research – H. Gillette – TMH, New Delhi
2. Operations Research – Hamdy.M. Taha – TMH, New Delhi
3. Fundamentals of Operation Research – Ackof Sasieni – Dhanpat Rai & Sons
4. Quantitative Approach to Management – Lovin and Krit Patrick – TMH
5. Operation Research– S.D. Sharma – S. Chand & Com. New Delhi

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering**
Subject: **Machine Design I Laboratory**
Total Lab Periods: **24**
Maximum Marks: **40**

Semester: **V**
Code: **337561(37)**
Batch Size: **30**
Minimum Marks: **20**

List of Experiments/Activities:

1. Select a daily use product and design the conceptual design by applying the design process taking the controlling parameters
2. Make a list of mechanical components and know their materials and suggest some alternative materials for the each one of them.
3. Find a flange coupling in the college laboratory and justify its design by actual measurements
4. Design a shaft used in some practical application, by actual working and loading conditions
5. Justify the design of single plate clutch of an engine assembly
6. Design a wall bracket, which is being used in real life by actual measurement of load
 - a. Welded joints
 - b. Riveted and bolted joints

In addition, justify your findings.

7. Design a screw jack.
8. Design a software in some high level language or excel sheets for design of a component
9. **Mini Project:** Each student will be given a real life problem for the complete design of a subsystem/system using either manual calculation with the help of design handbook or through computer programme, if needed. This will be done as home assignment to be submitted at the end of the semester.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering**
Subject: **Manufacturing Science Laboratory**
Total Lab Periods: **24**
Maximum Marks: **40**

Semester: **V**
Code: **337562(37)**
Batch Size: **30**
Minimum Marks: **20**

List of Experiments to be Performed (Minimum ten experiments are to be performed by each student)

Foundry

1. Moulding of a multi-piece pattern by green sand moulding
2. Making a mould (with core) and casting.

Machine Tool

3. Taper turning in a Lathe
4. Thread cutting in Lathe
5. Slot cutting in Shaper
6. Gear cutting in milling machine using indexing head.
7. Alignment testing of Lathe
8. Drilling, boring and reaming of a hole.

Cutting Tool

9. Study of turning tool of Lathe (Tool signature)
10. Study of twist drill

Welding

11. Joining MS plates by arc welding (SMAW,MIG)
12. Joining metal sheet by resistance welding
13. Joining metal by soldering/brazing

Inspection and Testing

14. Inspection of casting defect and welding defects
15. Non destructive testing of casting and welding defects

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Moulding equipment
2. Melting facility
3. Lathe
4. Shaper
5. Drilling Machine
6. Milling Machine
7. Reamers
8. Arc welding equipments
9. Soldering /Brazing equipments
10. Non destructive testing equipments

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering**
Subject: **Dynamics of Machines Laboratory**
Total Lab Periods: **24**
Maximum Marks: **40**

Semester: **V**
Code: **337563(37)**
Batch Size: **30**
Minimum Marks: **20**

List of Experiments to be Performed (Minimum ten experiments are to be performed by each student)

1. To find out the oscillations of simple pendulum with universal vibration apparatus.
2. To find out the oscillations of Compound pendulum with universal vibration apparatus.
3. To find out the radius of gyration of bi-filler suspension with universal vibration apparatus.
4. To find out undamped torsional vibrations of single rotor system with universal vibration apparatus.
5. To find out the frequency of damped torsional vibration of single rotor system with universal vibration vibration apparatus.
6. To measure the frequency of torsional vibrations of single rotor system with universal vibration apparatus.
7. To measure the frequency of torsional vibrations of double rotor system with universal vibration apparatus.
8. To find out free vibration of helical coiled spring with universal vibration apparatus.
9. To study forced damped vibration of a spring mass system and simple supported beam with universal vibration apparatus.
10. To find out the Gyroscopic couple and prove the Gyroscopic law with Gyroscope apparatus.
11. To find out the Power and effort of Proel, Porter & Hartnell Governor with Governor Apparatus.
12. To find out the critical speed for different diameters of shaft by whirling of shaft apparatus.
13. To verify the static and dynamic balancing for different planes and masses by balancing apparatus.

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Universal Vibration Apparatus
2. Whirling of Shaft Apparatus.
3. Balancing Apparatus (Both Static & Dynamic)
4. Epicyclic Gear Train and Holding Torque Apparatus
5. Gyroscope apparatus
6. Governor apparatus with differential attachments

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering**
Subject: **Fluid Machinery Laboratory**
Total Lab Periods: **24**
Maximum Marks: **40**

Semester: **V**
Code: **337564(37)**
Batch Size: **30**
Minimum Marks: **20**

List of Experiments/Studies to be Performed (Minimum seven experiments and three studies are to be performed by each student)

1. Performance characteristics of Pelton wheel turbine.
2. Performance characteristics of Francis turbine.
3. Performance characteristics of Kaplan turbine.
4. Performance characteristics of variable speed centrifugal pump.
5. Performance characteristics of rated speed centrifugal pump.
6. Performance characteristics of multistage centrifugal pump.
7. Study of Wind Tunnel (Open Circuit blower type)
8. Determination of Lift and drag force over an air foil.
9. To study the working of fluidic devices (Analog and Digital)
10. To study the Hydraulic Accumulator
11. To study the Hydraulic Intensifier
12. To study the Hydraulic Crane
13. To study the Hydraulic lift
14. To study the Hydraulic Ram
15. To study the Jet Pump
16. To study the Air Lift Pump

List of Equipments/Machines Required:

1. Pelton Wheel Turbine
2. Francis Turbine Test Rig
3. Kaplan Turbine Test Rig
4. Variable Speed Centrifugal Pump Test Rig
5. Rated Speed Centrifugal Pump Test Rig
6. Multi Stage Centrifugal Pump Test Rig
7. Reciprocating Pump Test Rig
8. Complete setup of Wind Tunnel (Open circuit blow type) with minimum wind speed not less than 30m/sec.
9. Fluidic devices (Analog and Digital)
10. Airofoil with the provision of measurement of pressure distribution over the surface.
11. Cut section model of Hydraulic Accumulator
12. Cut section model of Hydraulic Intensifier
13. Cut section model of Hydraulic Crane
14. Cut section model of Hydraulic Lift
15. Cut section model of Hydraulic Ram
16. Cut section model of Hydraulic Jet and Air lift pump.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of Program:	Bachelor of Engineering	Semester:	V
Branch:	Common to All Branches	Code:	300566 (46)
Subject:	Personality Development	Tutorial Period:	NIL
No. of Lectures:	2/Week	Marks in TA:	20
Total Marks in ESE:	NIL	Minimum number of Class Tests to be conducted:	Two

Objective: The course is introduced to develop one's outer and inner personality tremendously and enrich the abilities to enable one to meet the challenges associated with different job levels. Personality Development is essential for overall development of an individual apart from gaining technical knowledge in the subject.

Course Objectives

Upon completion of this course, the student shall be able

- To understand the concept of personality and image;
- To develop leadership, listening and interacting skills;
- To develop attitudinal changes;
- To develop decision-making qualities; and
- To communication skill.

- UNIT I** **Personality concepts:** What is Personality – its physical and psychic aspects. How to develop a positive self-image. How to aim at Excellence. How to apply the cosmic laws that govern life and personality. How to improve Memory – How to develop successful learning skills. How to develop and effectively use one's creative power. How to apply the individual MOTIVATORS that make you a self-power personality.
- UNIT II** **Interpersonal Skills:** Leadership: Leaders who make a difference, Leadership: your idea, What do we know about leadership? If you are serious about Excellence. Concepts of leadership, Two important keys to effective leadership, Principles of leadership, Factors of leadership, Attributes. Listening: Listening skills, How to listen, Saying a lot- just by listening, The words and the music, How to talk to a disturbed person, Listening and sometimes challenging. How to win friends and influence people, How to get along with others. How to develop art of convincing others. How can one make the difference. How to deal with others particularly elders. Conflicts and cooperation.
- UNIT III** **Attitudinal Changes: Meaning of attitude,** benefits of positive attitudes, How to develop the habit of positive thinking.
Negative attitude and wining: What is FEAR and how to win it. How to win loneliness. How to win over FAILURE. How to win over PAIN. How to win over one's ANGER and others anger. What is stress and how to cope up with it? The art of self-motivation. How to acquire mental well-being. How to acquire physical well-being.
- UNIT IV** **Decision Making:** How to make your own LUCK. How to plan goals/objectives and action plan to achieve them. How to make RIGHT DECISION and overcome problems. How to make a Decision. Decision making: A question of style. Which style, when? People decisions: The key decisions. What do we know about group decision making? General aids towards improving group decision making.
- UNIT V** **Communication Skills: Public Speaking:** Importance of Public speaking for professionals. The art of Speaking - Forget the fear of presentation, Symptoms of stage fear, Main reason for speech failure, Stop failures by acquiring Information; Preparation & designing of speech, Skills to impress in public speaking & Conversation, Use of presentation aids & media.
Study & Examination: How to tackle examination, How to develop successful study skills.
Group discussions: Purpose of GD, What factors contribute to group worthiness, Roles to be played in GD.

Course Outcomes:

- The students will be able to develop inner and outer personality exposure;
- The students will be able to develop effective leadership qualities and interacting skills;
- The students will be able to develop positive attitude, motivating skills and develop winning philosophies;
- The students will be able to develop decision-making tools; and
- The students will be able to develop group presentation, public speaking and impressive conversation.

Text Books:

1. Basic Managerial Skills for all by E. H. McGrawth, prentice Hall India Pvt. Ltd., 2006
2. Basic Employability Skills by P. B. Deshmukh, BSP Books Pvt. Ltd., Hyderabad, 2014

Reference Books:

1. How to Develop a Pleasing Personality by Atul John Rego, Better Yourself Books, Mumbai, 2000
2. How to Succeed by Brain Adams, Better Yourself Books, Mumbai, 1969
3. Personality: Classic Theories & Modern Research; Friedman ; Pearson Education, 2006
4. How to Win Friends and Influence People by Dale Carnegie, A. H. Wheeler 2006

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering/Mechatronics Engineering** Semester: **VI**
Subject: **Machine Design II** Code: **337651(37)**
Total Theory Periods: **40** Total Tutorial Periods: **10**
No. of class Tests to be conducted: **2 (Minimum)** No. of assignments to be submitted: **2 (Minimum)**

ESE Duration: **Four Hours** Maximum Marks in ESE: **80** Minimum Marks in ESE: **28**

Note: Design data book by PSG and ISI data sheets are allowed in the examination.

Course Objectives

- To design and analyze coil, leaf and laminated springs.
- To design and analyze spur, helical and bevel gears.
- To design and analyze rolling contact bearings.
- To design and analyze journal bearing.
- To design and analyze chain and belt drive.

Course outcomes:

- Apply knowledge of machine design for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

- UNIT I** **Spring:** Spring materials and their mechanical properties, equation for stress and deflection, helical coil springs of circular section for tension, compression and torsion, dynamic loading, fatigue loading, Wahl line, leaf spring and laminated spring.
- UNIT II** **GEARS: Spur Gears** - Gear Drives, Classification of Gears, Selection of Type of Gears, Law of Gearing, Force Analysis, Gear Tooth Failures, Selection of Material, Number of Teeth, Face Width, Beam Strength of Gear Tooth, Effective Load on Gear Tooth, Estimation of Module Based on Wear Strength, Lewis equation, Gear Design for Maximum Power Transmitting Capacity, Gear Lubrication.
- UNIT III** **Helical Gears:** Helical Gears, Terminology of Helical Gears, Virtual Number of Teeth, Tooth Proportions, Force Analysis, Beam Strength of Helical Gears, Effective Load on Gear Tooth, Wear Strength of Helical Gears.
Bevel Gears: Bevel Gears, Terminology of Bevel Gears, Force analysis, Beam strength of Bevel Gears, Wear Strength of Bevel Gears, Effective Load on Gear Tooth.
- UNIT IV** **Bearings: Rolling Contact Bearings** - Types of ball and roller bearings, selection of bearing for radial and axial load, bearing life, Mounting and lubrication, shaft scales – contact type and clearance type.
Journal Bearings: Types of lubrication, viscosity, Hydrodynamic theory of lubrication, Sommerfeld number, heat balance, self-contained bearings, bearing materials.
- UNIT V** **Chain Drives:** Chain drives, roller chains, geometric relationships, dimensions of chain components polygonal effect, power rating of roller chains.
Belt Drives: Flat and V-belts, belt constructions, geometrical relationships for length of the belt, analysis of belt tensions, condition for maximum power, selection of flat & V-belts, adjustment of belt tensions, Wire ropes, stresses in wire ropes

TEXT BOOKS:

1. Design of Machine Elements - V.B. Bhandari, TMH Publications, Delhi
2. Machine Design - Shigley – McGraw Hill, Delhi/Noida

REFERENCE BOOKS:

1. Machine Design - Movnin – MIR Publishers, Moscow
2. Machine Design - Fundamental & Application – Gope – PHI, New Delhi
3. Machine Design - Sharma & Agrawal – Katson, New Delhi
4. Principles of Mechanical Design - R. Phelan – McGraw Hill, New Delhi.
5. Machine Design – Sundarajamoorthy & Shanmugum– Anuradha, Chennai

Name of the Programme: Bachelor of Engineering :::: Duration of the programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	Mechanical Engineering	Semester:	VI
Subject:	Energy Systems	Code:	337652(37)
Total Theory Periods:	40	Total Tutorial Periods:	10
No. of class Tests to be conducted:	2 (Minimum)	No. of assignments to be submitted:	2 (Minimum)
ESE Duration:	Three Hours	Maximum Marks in ESE:	80
		Minimum Marks in ESE:	28

Course Objectives

- To understand the construction and operation of various jet and rocket engine
- To analyze jet engine and rocket engine from fluid and thermodynamic principle
- To study important non-conventional energy resources and the technologies for harnessing these.

Course Outcome:

- Demonstrate a basic understanding of jet and rocket engine design, function and performance.
- Acquire knowledge and hands-on competence in the design and development of mechanical systems.
- Compare different non-conventional energy resources and choose the most appropriate based on local conditions
- Perform simple techno-economical assessments of non-conventional energy resources
- Perform and compare basic environmental assessments of non-conventional energy resources and conventional fossil fuel systems
- Design renewable/hybrid energy systems that meet specific energy demands, are economically feasible and have a minimal impact on the environment

- UNIT I Propulsion Devices:** Types of jet engines, Ram Jet, pulse jet, Turbojet, Turbo propulsion, principle and operation. Energy flow through jet and variation of pressure and temperature, thrust equation, specific thrust and velocity of fluid. Thermodynamics of turbojet, efficiency & performance, parameters affecting performance, after burn, Injection of water & alcohol mixture.
- UNIT II Rocket Propulsion:** Basic theory, Physics equations, classifications, types of rocket engines, liquid propellant rockets, efficiency and performance, orbital & escape velocity application of space flight.
- UNIT III Non-Conventional Energy Conversion:** Classical sources of energy crisis and search for alternative sources of energy. **Solar energy:** Introduction,, earth sun angles, resolution, solar measurement, collection of solar energy, flat plate and focusing collector analysis, calculations ,design parameters. Applications of solar energy. Introduction to photovoltaic cell energy conversion techniques.
- UNIT IV Bio-Mass:** Introduction, Bio-mass conversion technologies, bio-gas generation, classification of bio-gas plant, Gasifiers, Gobar gas plant, applications. **Wind Energy:** Basic principles of wind energy conversion, wind energy estimation, site selection consideration, basic components of wind energy conversion system, classification, advantages & disadvantages of WECS.
- UNIT V Additional Alternate Energy Sources & Improved Energy Utilization:** Fuels cell technology, wave energy conversion, tidal energy conversion, ocean thermal energy conversion (OTEC). Principle of Magneto hydrodynamics (MHD)power system, types of MHD system, advantages, materials for MHD system. Geothermal energy, nature of geothermal fields, geothermal sources, prime movers for geothermal energy, advantages, disadvantages of geothermal energy over other energy forms, its application.

TEXT BOOKS

1. Fundamentals of Compressible Flow with Aircraft and Rocket Propulsion – S.M.Yahya – New Age International Publishers, Delhi
2. Non-Conventional Energy Sources - G.D. Rai – Khanna Publishers

REFERENCE BOOKS

1. Gas Dynamics & Space Propulsion – N. Shanmugam, M. Palani – Anuradha Agencies
2. Fundamental of Compressible Fluid Dynamics – P. Balachandran – PHI
3. Gas Turbine Theory & Jet Propulsion – J.K. Jain – Khanna Publishers, Delhi
4. Solar Energy -Fundamentals and Applications– H.P.Garg & J. Prakash – TMH ,Delhi
5. Non Conventional Energy Sources – Saeed, Hasan and DK Sharma, SK Kataria, Delhi
6. Non Conventional Energy Resources- DS Chauhan, and Srivastava, New Age, Delhi
7. Biogas Technology-B.T.Nijaguna,- New Age ,Delhi
8. Solar Energy – Principles of Thermal Collection and Storage- R Sukhatme- THM Delhi
9. Non Conventional Energy Resources: Alternative Energy Sources And Systems- R.K.Singhal, Kataria ,Delhi

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	Mechanical Engineering	Semester:	VI
Subject:	Internal Combustion Engine	Code:	337653(37)
Total Theory Periods:	40	Total Tutorial Periods:	10
No. of class Tests to be conducted:	2 (Minimum)	No. of assignments to be submitted:	2 (Minimum)
ESE Duration:	Three Hours	Maximum Marks in ESE:	80
		Minimum Marks in ESE:	28

Course Objectives

- To study classifications of internal combustion engine.
- To understand how and why actual cycles deviate from air standard cycle and fuel-air cycle.
- To understand combustion in spark ignition engine and diesel engines.
- To impart knowledge on fuel and its specifications
- To impart knowledge about carburetion, gasoline injection and diesel injection.
- To impart knowledge about ignition, cooling, lubrication and governing systems.
- To impart knowledge about various engine performance characteristics and its testing

Course Outcome:

- Demonstrate a basic understanding of engine design, function and performance.
- Acquire knowledge and hands-on competence in the design and development of mechanical systems.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.
- Demonstrate an understanding of the relationships between the design of the internal combustion engine and environmental issues

UNIT I	a) Introduction: Internal and external combustion engine and their comparison, four stroke cycle S.I. and C.I. engine, two stroke engine, comparison of four stroke and two stroke engines, comparison of S.I. and C.I. engine, classification of I.C. Engine on various basis Valve timing diagram for S.I. and C.I. engines. Effect of valve timing and engine speed on volumetric efficiency. b) Fuel-air cycles and actual cycle: Reasons for deviation of actual cycle from air standard cycles, fuel air cycles and their analysis, actual cycles and their analysis. Reasons of ignition advance and injection advance
UNIT II	a) Combustion: Combustion in S.I. engine, stages of combustion, factor influencing the flame speed, the phenomenon of knock in S.I. engine, effect of engine variable on knock, effects of detonation, Pre-ignition, effect of preignition. Combustion in C.I. engine: stages of combustion, factor influencing the delay period,, the phenomenon of knock in C.I. engine, effect of engine variable on knock, comparison between knock in S.I. and C.I. engine. b) Fuels: Basic requirement of I.C. Engine fuels, requirement of an ideal gasoline, structure of petroleum, effect of fuel structure on combustion, volatility of liquid fuels, ASTM distillation curve, effect of volatility on engine performance - cold starting, hot starting, vapour lock, acceleration, carburetor icing, and crank case dilution. Antiknock rating of fuels, CCR, HUCR, Octane number, performance number, Cetane number. Dopes.
UNIT III	Carburetion: Properties of air-petrol mixtures, mixture requirement, simple carburetor, limitation of simple carburetor, Nozzle lip, venturi depression, calculation of fuel jet and venturi throat diameter for given air fuel ratio. Element of complete carburetor, main metering system-compensating jet device, Idling system, power enrichment system, acceleration pump and cold starting system. Gasoline injection system: Disadvantages of carburetor, Type of injection system, components of injection system, Electronic gasoline fuel injection system, multi-point fuel injection system, working, advantages and disadvantages.
UNIT IV	Injection System for C.I. Engines: Requirement, type of injection systems, Bosch fuel injection pump, type of fuel injector, type of nozzle, atomization, spray penetration and spray direction. Electronic diesel injection System. Ignition System: Battery and magneto ignition system and their comparative study, spark plug heat range, electronic ignition system, firing order, Ignition timing, centrifugal and vacuum ignition advance. Cooling System: Cooling requirement, air cooling, liquid cooling, type of liquid cooling system, advantage and disadvantage of air cooling and water cooling system, Antifreeze mixture. Lubrication System: Function of lubricating system, Classification of lubricating system, mist lubrication system, dry sump lubrication, wet sump lubrication-splash, and modified and full pressure system Governing: Necessity of governing, methods of governing-hit and miss governing, quantity governing and quality governing
UNIT V	Testing and Performance: Performance parameters, measurements of brake power, indicated power, measurement friction power-Willan's line method, Morse test, motoring test, measurement fuel consumption, and measurements of air consumption, exhaust gas calorimeter. Calculation of various performance parameter, heat balance sheet and heat balance diagram. Performance curves of S.I. and C.I. Engine at full throttle variable speed operation and at constant speed variable load operation.

TEXT BOOKS:

1. A Course in Internal Combustion Engines – M.L. Mathur & R.P. Sharma – Dhanpat Rai & Sons, Delhi
2. Internal Combustion Engine – V. Ganeshan – TMH, New Delhi

REFERENCE BOOKS:

1. Internal Combustion Engine – R. Yadav – Central Publishing House, Allahabad
2. A Course in Internal Combustion Engine – V.M. Domkundwar – Dhanpat Rai & Sons, Delhi
3. Internal Combustion Engines – R.K. Rajput – Laxmi Publications
4. Internal Combustion Engine Fundamentals- John B. Heywood- McGraw Hill International, Delhi
5. Fundamental of Internal Combustion Engine – Paul W. Gill, James H. Smith, Eugene – Oxford and IBH Publishing Company
6. Fundamental of Internal Combustion Engine- H.N. Gupta-PHI- New Delhi
7. Engineering Fundamentals of the Internal Combustion Engine- Pulkrabek, Willard W-PHI Delhi
8. Elements of Internal Combustion Engines- A R Rogowski- TMH. New Delhi
9. A Textbook of Internal Combustion Engine Dr.R.K.Singhal- Standard Book House, Delhi
10. Automotive Mechanics: Principles And Practices- W.H.Crouse, and D.L. Anglin, TMH ,Delhi

Name of the Programme: Bachelor of Engineering :::: Duration of the programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	Mechanical Engineering	Semester:	VI
Subject:	Heat & Mass Transfer	Code:	337654(37)
Total Theory Periods:	40	Total Tutorial Periods:	10
No. of class Tests to be conducted:	2 (Minimum)	No. of assignments to be submitted:	2 (Minimum)
ESE Duration:	Three Hours	Maximum Marks in ESE:	80
		Minimum Marks in ESE:	28

Course Objectives

- To provide a fundamental understanding of the principles of heat transfer due to conduction, convection and radiation.
- To achieve an understanding of the basic concepts of phase change processes.
- To understand the principles of mass transfer.
- To learn about the design of heat exchangers.

Course Outcome:

- Apply knowledge of heat transfer for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts of heat and mass transfer in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

- UNIT I** **Introduction:** Heat transfer, Difference between heat transfer and thermodynamics, Various modes of heat transfer, Fourier's, Newton's and Stefan Boltzman's Law, Combined modes of heat transfer, thermal diffusivity, overall heat transfer coefficient. The thermal conductivity of solids, liquids and gases, factors influencing conductivity
Conduction : Heat conduction without heat generation: Derivation of general differential equation of heat conduction in Cartesian co-ordinate. One dimensional steady state conduction, linear heat flow through a plane and composite wall, heat conduction without heat generation in cylinder and sphere, critical thickness of insulation. Conduction with heat generation in flat wall and solid cylinder.
- UNIT II** **Heat transfer from extended surface (Fins):** Types of fins, Fin equation for uniform cross sectional area (rectangular profile), Solution for infinite length, negligible heat loss from fin tip, finite long and heat transfer from fin tip. Fin effectiveness and efficiency. Error in temperature measurement from thermometer.
Transient/Unsteady State Heat Conduction: Lumped system analysis, criteria for lumped system analysis, solution of transient heat conduction in large plane wall, long cylinders and sphere through Heisler's chart.
- UNIT III** **Forced Convection:** Physical Mechanism of Forced Convection, Dimensional analysis for forced convection, velocity and Thermal Boundary layer, Flow over plates, Flow across cylinders and spheres, Flow in tubes, Reynold's analogy.
Natural Convection: Physical Mechanism of Natural Convection, Dimensional analysis of natural convection; empirical relationship for natural convection.
- UNIT IV** **Two Phase Heat Transfer:** Boiling heat transfer, Pool boiling, boiling regimes and boiling curve, heat transfer correlations in pool boiling. Condensation heat transfer, Film condensation, derivation for the average heat transfer coefficient 'h' for the case of laminar film condensation over vertical plate, Heat transfer correlation for inclined plates, vertical tubes, Horizontal bank tubes.
Introduction to Mass Transfer : Mass and mole concentrations, molecular diffusion, eddy diffusion, Molecular diffusion from an evaporating fluid surface, Introduction to mass transfer in laminar and turbulent convection Combined heat and mass transfer, the wet and dry bulb thermometer.
- UNIT V** **Heat Exchangers:** Different types of heat exchangers; Determination of heat exchanger performance, Heat exchanger transfer units, Analysis restricted to parallel and counter flow heat exchanger (LMTD and NTU method)
Thermal Radiation: Introduction, absorbtivity, reflectivity & transmissivity. Concept of black body & grey body. Emissive power of surface, Kirchoff's law, emissivity , Concept of shape factor. Radiat heat exchange between two parallel grey surface and concentric cylinders. Errors in temperature measurement due to radiation. Concept of irradiation and radiosity.

TEXT BOOKS:

1. Heat Transfer – S.P. Sukhatme – TMH, Delhi
2. Heat & Mass Transfer – D.S. Kumar – S.K. Kataria & Sons, Delhi

REFERENCE BOOKS:

1. Heat transfer- C P Arora, TMH, Delhi
2. Heat & Mass Transfer – R, Yadav, Central Publishing House, Allahabad
3. Heat & Mass Transfer – R.K. Rajput, S.Chand, Delhi
4. Heat & Mass Transfer – P.K. Nag, TMH, Delhi
5. Heat Transfer – J.P. Holman – TMH, Delhi
6. Heat Transfer – A Practical Approach – Yunus A. Cengel – McGraw Hill , Delhi
7. Heat Transfer – P.S. Ghoshdastidhar – Oxford University Press
8. Heat And Mass Transfer Fundamentals And Applications- Cengel, Yunus, A and AJ Ghajar, TMH, Delhi
9. A Course In Heat And Mass Transfer- S.C. Arora & S Donkundwar, S- Dhanpat Rai, Delhi
10. Heat and Mass Transfer Data Book- C.P.Kothandaraman C.P. & S. Subramanyan , New Age, Delhi

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch:	Mechanical Engineering	Semester:	VI
Subject:	Production Management	Code:	337655(37)
Total Theory Periods:	40	Total Tutorial Periods:	10
No. of class Tests to be conducted:	2 (Minimum)	No. of assignments to be submitted:	2 (Minimum)
ESE Duration:	Three Hours	Maximum Marks in ESE:	80
		Minimum Marks in ESE:	28

COURSE OBJECTIVES:

1. To understand the basic concept of production management.
2. To understand the concept of breakeven analysis.
3. To learn the different methods to solve problems in sales forecasting.
4. To understand the concept of planning, organizing & controlling.
5. To understand the various models of inventory control.
6. To understand the methods of purchasing & store keeping.
7. To understand & analyze the various methods of quality control problems.

COURSE OUTCOMES:

1. Acquire knowledge recognize and perform the job of a competent production manager.
2. Identify, analyze and solve production engineering related problems in planning, decision-making, and expense control.
3. Understand the performance to establish setting goals & predicting expenses and planning budgets.
4. Work effectively with engineering and science teams as well as with multidisciplinary designs.
5. Skillfully use modern engineering tools and techniques in various production areas.
6. Additionally, this course will help the student to be a committed to quality, timeliness, and continuous improvement.
7. Pursue higher studies.

UNIT I Production Management: definition, objectives, scope, benefits, functions of production management, place of production management in an organization, types of production system, Product life cycle, product design and development, production cycle.

Costing and Cost Analysis: Elements of costs, Break even analysis, Incremental costs, make or buy decision.

UNIT II Sales Forecasting: Purposes, methods -Delphi, linear regression, economic indicators, time-series analysis, adjustment for seasonal variations, moving average, exponential smoothing.

UNIT III Production Planning and Control: Functions, Organization, Master Scheduling, Aggregate planning and strategies, Materials Requirement Planning, product structure tree, Routing, Loading Scheduling –forward and backward, Dispatching
–priority rules, Sequencing, Johnson’s algorithm for n jobs and two machines, Gantt’s chart, Bar chart, Flow process chart.

Materials Handling: Principles of materials handling, unit load, Types of materials handling equipment, Relation between materials handling and plant layout.

UNIT IV Material Management: Objectives and functions of materials management, Organization of materials management.

Procurement: Objectives of purchase department, purchase responsibilities and organization, types of purchasing, purchase procedures, Import and Export.

Stores Keeping: Stores management, functions of stores, classification of materials, standardization of materials, identification and maintenance of layout of stores, physical control of materials, pricing of stores, issuing of stores.

Inventory Control: Objective, scope and functions of inventory control, inventory control techniques, economic ordering quantity, periodic ordering quantity, A.B.C. analysis, General idea regarding inventory control under risk and uncertainty.

UNIT V Quality Control: Difference between inspection and quality control, acceptance sampling, procedure’s risk and consumer’s risk, operating characteristic curve for single sampling plan, AOQL

Quality of conformance, quality of design, economics of quality, SQC charts for variables and attributes.
Introduction to JIT manufacturing, Kanban system.

TEXT BOOKS:

1. Production and operation Management–By P. Ramamurty –New Age International Publication, New Delhi
2. Production and operation Management –By R. Mayer –TMH, New Delhi
3. Quality Planning and Analysis, Juran and Gryna

REFERENCE BOOKS:

1. Industrial Engineering & Production Management –Martand Telsang, S.Chand & Co
2. Production and operations Management by –Adam and Ebert –PHI, New Delhi
3. Production planning and Control –By Samuel Eilon, Navneet Prakashan Ltd., Bombay

Name of the Programme: Bachelor of Engineering :::: Duration of the programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering**

Semester: **VI**

Subject: **Machine Design - II Laboratory**

Code: **337661 (37)**

Total Lab Periods: **24**

Batch Size: **30**

Maximum Marks: **40**

Minimum Marks: **20**

Students have to solve at least four design problems out of the below mentioned topics

- Design of gears of a two stage gear-box (spur, helical or bevel)
- Design of a leaf spring for a given specification
- Design of chain drive for a given specification
- Design of belt drive for a given specification
- Design of rolling element bearing for a given specification
- Design of journal bearing for a given specification

B. Writing Computer programme for conventional design: Students are required to write computer program and validate it for the design of machine components done in theory subject

C. Mini Project: Each student will be given a real life problem (as below) for the complete design of a subsystem/system using either manual calculation with the help of design handbook or through computer programme, if needed. This will be done as home assignment to be submitted at the end of the semester.

- Design the transmission system for an overhead crane assuming suitable data
- Design the transmission system for a lathe machine assuming suitable data
- Design the transmission system for an automobile assuming suitable data
- Design the transmission system for a shaper machine assuming suitable data
- Design the transmission system for a flour mill assuming suitable data
- Design the transmission system for a crusher machine assuming suitable data

The design must contain design of shafts, keys, couplings, clutch, pulleys/chain/gear drives, and bearings. The results must be plotted in the form of two dimensional drawings (manually/using software) both in component level and assembly level.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering**

Semester: **VI**

Subject: **Internal Combustion Engine**

Code: **337662 (37)**

Laboratory

Total Lab Periods: **24**

Batch Size: **30**

Maximum Marks: **40**

Minimum Marks: **20**

List of Experiments (Minimum Six experiments and Four studies are to be performed by each student)

1. Study of IC Engine. (Engine components, material used and engine nomenclature)
2. Study of working of four stroke petrol engine and four stroke diesel engine with the help of cut section models.
3. Study of working of two stroke petrol and two stroke diesel engine with the help of cut section models.
4. Study of fuel supply system of a petrol engine (fuel pump and simple carburettor)
5. Study of complete carburettor
6. Study of Petrol Injection System.
7. Study of fuel supply system of a Diesel engine (fuel pump and fuel injector)
8. Study of Ignition systems of an IC Engine (Battery and Magneto ignition system and Electronic ignition system).
9. Study of Lubrication system of an IC Engine (Mist, Splash and Pressure lubrication)
10. Study of cooling systems of an IC Engine (Air cooling and water cooling)
11. To conduct a performance test on diesel engine to draw heat balance sheet for given load and speed.
12. To determine friction power of diesel engine by Willan's line or fuel rate extrapolation method.
13. To conduct a performance test on the variable compression ratio engine and to draw the heat balance sheet for given compression ratio, speed and load and plot the performance curves.
14. To conduct a performance test on a four cylinder four stroke petrol engine and to draw the heat balance sheet and performance curves.
15. To calculate the indicated power, friction power and mechanical efficiency of four stroke four cylinder petrol engine at full load and rated speed by Morse test.
16. To draw the valve timing diagram of a four-stroke S.I. or C.I. Engine using experimental setup.
17. Analysis of engine exhaust gases using Orsat apparatus / gas analyzer.

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Model of Two & Four Stroke Petrol Engine
2. Model of Two & Four Stroke Diesel Engine
3. Single Cylinder Actual S.I.Engine in Cut Section
4. Single Cylinder Actual C.I..Engine in Cut Section
5. Four Stroke, Four-Cylinder Petrol Engine in Cut Section
6. Carburettors in Cut Section / Without Cut Section.
7. Model of Petrol Injection System
8. Bosch Fuel Pump in Cut Section
9. Nozzles in Cut Section
10. Diesel Injectors in Cut Section
11. Four Stroke Single-Cylinder Diesel Engine Test Rig
12. Variable Compression Ratio Engine Test Rig
13. Four Stroke Multi-Cylinder Petrol Engine Test Rig
14. Experimental Setup for Drawing Valve Timing Diagram Of Four Stroke S.I. or C.I. Engines.
15. Orsat Apparatus / Gas Analyzer for Engine Exhaust Gas Analysis.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering**

Semester: **VI**

Subject: **Production Management**

Code: **337663 (37)**

Laboratory

Total Lab Periods: **24**

Batch Size: **30**

Maximum Marks: **40**

Minimum Marks: **20**

The lab work is intended to have exposure and enhance the knowledge of students in production/ operation Management field acquired in the theory class. The basic approach followed is an information decision – making approach using various cases / small projects. These cases / projects deal with the kind of information that is present in the real world of the system and can also be solved using simulation based software. Simulation software provides excellent ease of learning and to rapidly achieve a high degree of self-sufficiency in model building.

Considering any one manufacturing product, the following practical problems are to be solved by the students for the Production Management laboratory.

1. Case study on Sales Forecasting.
2. Product Development process including its major operations, production process etc of a simple product.
3. Study of the Organization and their process layout.
4. Material Requirement Planning of any industrial product.
5. Study of Material handling systems in any manufacturing organization.
6. Analysis of Inventory control in an organization.
7. Production cost study with Break Even Analysis in a manufacturing organization.
8. Quality Analysis of a product carried out in a manufacturing organization.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering**

Semester: **VI**

Subject: **Heat & mass Transfer**

Code: **337664 (37)**

Laboratory

Total Lab Periods: **24**

Batch Size: **30**

Maximum Marks: **40**

Minimum Marks: **20**

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

1. To Determine Thermal Conductivity of Insulating Powders.
2. To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).
3. To Measure the thermal Conductivity of Liquid.
4. To determine the transfer Rate & Temperature Distribution for a Pin Fin.
5. To Measure the Emmissivity of the Test plate Surface.
6. To Determine Stefan Boltzman Constant of Radiation Heat Transfer.
7. To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection.
8. Determination of Heat Transfer Coefficient in Drop Wise & Film Wise condensation.
9. To Determine Critical Heat Flux in Saturated Pool Boiling.
10. To Study Performance of Simple Heat Pipes.
11. To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.
12. To Find the Heat transfer Coefficient in Forced Convection in a tube.
13. To determine the total thermal conductivity and thermal resistance of the given compound resistance in series.
14. To find out the thermal conductivity of given slab material.
15. To determine the individual thermal conductivity of different lagging in a lagged pipe.
16. To study the rates of heat transfer for different materials and geometries
17. To understand the importance and validity of engineering assumptions through the lumped heat capacity method.
18. Testing and performance of different heat insulators.

List of Equipments/Machines required:

1. Thermal conductivity of insulating powder apparatus
2. Thermal conductivity of metal bar apparatus
3. Thermal conductivity of liquid apparatus
4. Transfer rate and temperature distribution for a pin fin apparatus
5. Emmissivity of the test plate surface apparatus
6. Stefan-Boltzman constant of radiation of heat transfer apparatus
7. Surface heat transfer coefficient for heated vertical cylinder in natural convection apparatus
8. Heat transfer coefficient in drop wise and film wise condensation apparatus
9. Critical heat flux in saturated pool boiling apparatus
10. Performance of different heat pipe apparatus
11. Heat transfer rate through heat exchanger apparatus
12. Heat transfer coefficient in forced convection of air in a tube apparatus
13. Heat transfer through composite wall apparatus
14. Thermal conductivity of insulating slab apparatus
15. Heat transfer through lagged pipe apparatus
16. Unsteady state heat transfer apparatus
17. Testing and performance test rig for heat insulators.

Chhattisgarh Swami Vivekanand Technical University, Bilai

Name of Program:	Bachelor of Engineering	Semester:	VI
Branch:	Common to All Branches	Code:	300665 (76)
Subject:	Managerial Skills	Tutorial	NIL
No. of Lectures:	2/Week	Period:	
Total Marks in ESE:	NIL	Marks in	40
		TA:	

Minimum number of Class Tests to be conducted: **Two**

Objective:

The course is introduced to develop managerial skills tremendously and enrich the abilities to enable one to meet the challenges associated with different job levels. Managerial skills are essential for overall professional development of an individual apart from gaining technical knowledge in the subject.

Course Objectives

Upon completion of this course, the student shall be able

- To define and explain the concept of managerial, written and oral communication skill;
- To understand the leadership skill;
- To develop self-appraisal and understand distinction between leader and manager;
- To develop positive attitude and thinking; and
- To understand managerial functions and develop creativity.

UNIT I Managerial Communication Skills: Importance of Business Writing: writing business letters, memorandum, minutes, and reports- informal and formal, legal aspects of business communication, oral communication- presentation, conversation skills, negotiations, and listening skills, how to structure speech and presentation, body language.

UNIT II Managerial skills - Leadership: Characteristics of leader, how to develop leadership; ethics and values of leadership, leaders who make difference, conduct of meetings, small group communications and Brain storming, Decision making, How to make right decision, Conflicts and cooperation, Dissatisfaction: Making them productive.

UNIT III Proactive Manager: How to become the real you: The journey of self-discovery, the path of self-discovery, Assertiveness: A skill to develop, Hero or developer, Difference between manager and leader, Managerial skill check list, team development, How to teach and train, time management, Stress management, Self-assessment.

UNIT IV Attitudinal Change: Concept of attitude through example, benefits of right attitude, how to develop habit of positive thinking, what is fear? How to win it? How to win over failure? How to overcome criticism? How to become real you? How to Motivate? How to build up self confidence?

UNIT V Creativity: Creativity as a managerial skill, Trying to get a grip on creativity. Overview of Management Concepts: Function of Management: Planning, organizing, staffing, controlling.

Course Outcome

- The students will be able to develop formal and informal, negotiation, written and oral communication skill;
- The students will be able to develop manage groups, resolve conflicts and leadership skill and decision making qualities;
- The students will be able to develop self-appraisal, teaching, training and managing stress and time;
- The students will be able develop positive thinking, motivating team members and winning race; and
- The students will be able to develop creativity and fundamental management functions.

Text Books:

1. Basic Managerial Skills for all by E.H. Mc Grawth, Prentice Hall India Pvt Ltd,2006
2. Basic Employability Skills by P. B. Deshmukh, BSP Books Pvt. Ltd., Hyderabad, 2014

Reference Books:

1. How to develop a pleasing personality by Atul John Rego, Better yourself books, Mumbai,2006
 2. The powerful Personality by Dr. Ujjawal Patni & Dr. Pratap Deshmukh, Fusion Books, 2006
- How to Success by Brian Adams, Better Yourself books, Mumbai, 1969

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering**
Subject: **Industrial Hydraulics**
(Professional Elective – I)

Semester: **VI**
Code: **337671(37)**

Total Theory Periods: **40** Total Tutorial Periods: **10**
No. of class Tests to be conducted: **2 (Minimum)** No. of assignments to be submitted: **2 (Minimum)**
ESE Duration: **Three Hours** Maximum Marks in ESE: **80** Minimum Marks in ESE: **28**

Course Objective

- To Learn basic concepts and terminologies of hydraulics
- To understand construction and working of various hydraulic power system
- To understand the constructional details of pumps and actuators
- To understand various valves and auxiliaries & rectification of their problems.
- To understand the hydraulic circuits & develop Hydraulic Circuits
- To understand accumulators and intensifiers

COURSE OUTCOMES:

- Acquire knowledge and hands-on competence in applying the concepts of industrial hydraulics in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

UNIT I Fluidics: Technology, Terminology, types of fluid logic elements, amplifiers, logic states, methods of obtaining input signals and power outputs, application of fluidics, third generation fluidics.

UNIT II Hydraulic Fluid: Types of hydraulic fluids, properties of fluid, selection of fluids, JIC/ISO symbols for hydraulic circuits.

Fluid Power System: Components, advantages, applications in the field of Machine Tools, material handling, presses, mobile and stationary machines, clamping & indexing devices etc., transmission of power at static and dynamic states.

UNIT III Pumps: Types, classification, principle and working of vane, gear, radial and axial plunger pumps, power and efficiency calculations, selection of pumps for hydraulic transmission.

Actuators: Linear and rotary actuators, hydraulic motor types & construction methods of control of acceleration, types of cylinder and mountings, calculation of piston velocity, thrust under static and dynamic application.

UNIT IV Control of Fluid Power: Principle, working types of the following valves, pressure control, direction control, flow control, relief valves, sequence valves etc.

UNIT V Hydraulic Circuits: Meter in, meter out circuits, Pressure control for cylinders, Flow divider circuits, Circuit illustrating use of pressure reducer valves, sequence valve, counter balance valves, unloading valves with the use of electrical control, accumulators etc.

Accumulators and Intensifiers: Types, function, application, selection and design procedure.

TEXT BOOKS

1. Hydraulic Machines including fluidics – Dr. Jagdish Lal, Metropolitan Book Company, New Delhi
2. Introduction to Fluid Power – Sahastrabadhe, Nirali Prakashan, Pune

REFERENCE BOOKS

1. Industrial Hydraulics manual by Vickers
2. Industrial Hydraulics – Pipenger & Hicks, Mc Graw Hill Company, New York
3. Hydraulics Vol. 1 & 2 by Rexroth
4. Fluid Power – Goodwin

Name of the Programme: Bachelor of Engineering :::: Duration of the programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering**
Subject: **Control Engineering**
(Professional Elective – I)

Semester: **VI**
Code: **337672(37)**

Total Theory Periods: **40** Total Tutorial Periods: **10**
No. of class Tests to be conducted: **2 (Minimum)** No. of assignments to be submitted: **2 (Minimum)**
ESE Duration: **Three Hours** Maximum Marks in ESE: **80** Minimum Marks in ESE: **28**

Course Objectives:

- To understand the fundamental and types of control system.
- To know the basic theories of automatic control system.
- To acquire the knowledge of basic control system like hydraulic, pneumatic and electrical control system in detail.
- To understand the concept of logic controllers.
- To know the basic control system particular reference to mechanical system.

Course Outcomes:

- Acquire knowledge and hands-on competence in applying the concepts of control engineering in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

- UNIT I** **BASIC CONTROL SYSTEM:** System differential equation of electrical, mechanical, thermal, hydraulic and electromechanical network, analogy.
- UNIT II** **THEORY OF AUTOMATIC CONTROL:** Concept of feedback referred to linear control systems in general, e.g. displacement and speed control, process control, definition and terminology, open loop and closed loop systems and its advantages. Block diagrams and single flow graph representation of a physical system, block diagram algebra, transfer function from a block diagram. Basic control actions and controllers on off. Proportional, derivative and integral controllers, steady – state analysis.
- UNIT III** **HYDRAULIC SYSTEM:** Characteristic of hydraulic components control valves, sources of hydraulic power hydraulic meters, pistons and transmission, elements of circuit design, Accumulation control circuit such as position control and speed control circuit.
Hydraulic Systems: Reciprocating Pump, pressure intensifier, cranes, ram, press, lift, coupling and hydraulic controls. Maintenance of hydraulic system: Fire Foam resistance oxidation and corrosion of hydraulic pipe sealing devices, Filters regulator, problems caused by gas in hydraulic circuit cooling of power pack
- UNIT IV** **PNEUMATIC SYSTEMS:** Pneumatic power supply, Amplifiers with different controlling actions, Pneumatic valves and cylinders, theory of four way and pilot valves.
ELECTRICAL SYSTEMS: Speed control of D.C. motors, Remote center positional serve mechanism (including effect of gearing between motor and load).
- UNIT V** **PROGRAMMABLE LOGIC CONTROLLERS:** Introduction, Micro PLC, Programming a PLC, Logic Functions, input & output Modules, PLC Processors, PLC Instructors, Documenting a PLC System, Timer & counter Instructions.
CONTROL COMPONENTS: Pneumatic relays, control mechanisms for liquid level, boiler feed control, pressure regulation, throttle valve, temperature regulations and industrial process regulation.

Text Books:

1. Modern Control Engineering, By Ogata K, Pearson Education
2. Control Systems Engineering By Nagrath & Gopal, New Age International Publishers
- 3 Process Control and Instrumentation / Technology – C.D. Johnson – Prentice Hall of India, New Delhi.

Reference Books:

1. Automatic Control System By Kuo, Benjamin.C, Prentice Hall
2. Control Systems Engineering By Nise, Norman S John wiley & Sons, New York
3. Control Systems Engineering By S K Bhattacharya , Pearson Education
4. Control Engineering By D.Ganesh Rao, K. Chennavenkatesh ,Pearson Education

Name of the Programme: Bachelor of Engineering :::: Duration of the programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering/Mechatronics Engineering**

Semester: **VI**

Subject: **Engineering Economics (Professional Elective – I)**

Code: **337673(37)**

Total Theory Periods: **40** Total Tutorial Periods: **10**
No. of class Tests to be conducted: **2 (Minimum)** No. of assignments to be submitted: **2 (Minimum)**
ESE Duration: **Three Hours** Maximum Marks in ESE: **80** Minimum Marks in ESE: **28**

Course Objectives

- To prepare engineering student to analyze cost/revenue data and carry out economic analyses in the decision making process to justify or reject alternatives/projects on an economic basis.
- To prepare engineering students to function in the business and management side of professional engineering practice.

Course Outcome:

- Be able to make intelligent comparisons of project alternatives during the planning and implementation phases.
- Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
- Be able to perform and evaluate payback period and capitalized cost on one or more economic alternatives.
- Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.

UNIT I Introduction & Scope: Engineers and Economics, Utility of its study, Managerial Economics, Nature and scope, basic terms and concept of economics like goods, kinds of goods, utility, value and wealth. Theory of Demand and supply, Elasticity of demand. Meaning, Characteristics, Objectives of Firm, Managerial and behavioral theories of a firm.

UNIT II Pricing and Market Competition: Industrial Establishments, various types of industrial establishments, Sole traders, partnership, joint stock company, types of shares, financial goals of organization. Pricing Perspective approach: Pricing policy and price influencing factors, Basic data for price fixation. Market forms & Competition – Pure and perfect competition, monopoly, monopolistic competition, price determination under perfect and monopolistic competition.

UNIT III Economy, Monetary & Fiscal Policy: Balance of payments – money and monetary policy, fiscal policy, Inflation, measuring employment and unemployment. Credit policies Concept and measurement of national income. Working Capital, Factors deciding Working capital, Return on investment, Financial Planning.

UNIT IV Cost and Costing Factors: Cost Analysis – Types and Elements of cost, cost planning and control. Relationship between Average cost & Marginal cost, Short run and long run average cost curves.

UNIT V Depreciation & Capital Budgeting: Depreciation and its methods of calculation, marginal costing, break – even analysis, profit planning and forecasting, Capital budgeting, cost of capital, Appraising projects profitability.

TEXT BOOKS:

1. Managerial Economics – P.L. Mehta – S. Chand and sons
2. Economics Michael Parkin, Addison Wesley Longman Publication, International Edition.
3. Elementary Economics Theory – K.K. Dewett – S. Chand & Company

REFERENCE BOOKS:

1. Economics – Samuelson, Pauls & W.D. Nordhan – McGraw Hill
2. Advanced Cost Accounting – Nigam, Sharma – Himalaya Publishing House
3. Managerial Economics – Mote and Paul - TMH
4. Macro Economics for management Students – A. Nag - Macmillan India Ltd
5. Cost Accounting – Jain & Narang - Kalyan Publishers
6. Managerial Economics - G.S. Gupta – TMH
7. Engineering Economics – J.L. Riggs, D.D. Bedforth , Randhawa – TMH
8. Essentials of Managerial Economics – Reddy & Ganesh – Himalaya Publishing Hosue
9. Managerial Economics – Joel Dean - PHI

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering/Mechatronics Engineering**

Semester: **VI**

Subject: **Composite Materials (Professional Elective – I)**

Code: **337674(37)**

Total Theory Periods: **40**

Total Tutorial Periods: **10**

No. of class Tests to be conducted: **2 (Minimum)**

No. of assignments to be submitted: **2 (Minimum)**

ESE Duration: **Three Hours**

Maximum Marks in ESE: **80**

Minimum Marks in ESE: **28**

Course objective

- To be familiar with classification & characteristics of composite material and their application.
- To gain the knowledge about manufacturing methods, testing and environmental issue related with composite material.
- To train students to be able to design composite structures, select composite materials, conduct stress analyses of selected practical applications using laminated plate theories appropriate strength criteria.
- To be familiar with the properties and response of composite structures subjected to mechanical loading under static and cyclic conditions.

Course outcome

- Acquire knowledge and hands-on competence in applying the knowledge of composite materials in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components in the field of engineering.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

UNIT I Introduction to Composites: Definition, classification/ types and characteristics of composite materials; Basic composite constituents – fiber and matrix; Properties of unidirectional long fiber and short fiber composites; Polymeric materials and polymeric composites; Honeycomb and Sandwich Composite Structure; Application areas of composites.

UNIT II Manufacturing, Testing and Environmental Issues: Moulding, pultrusion, filament winding, other advanced manufacturing techniques; Quality inspection and testing – uniaxial tension test, uniaxial compression test, shear test, fracture toughness testing of composites. Environmental Issues related with composite manufacturing and their applications.

UNIT III Material Properties: Orthotropic and Anisotropic materials; properties relating stress to strain, properties relating temperature to strain, properties relating moisture to strain, properties relating stress (or strain) to failure, Failure Criterion – Maximum Stress and Maximum Strain; Review of force tensors, stress tensors, strain tensors.

UNIT IV Elastic Response Analysis: Hooke's law for orthotropic and anisotropic materials; Linear Elasticity for Anisotropic Materials; Unidirectional composite laminates; Rotations of Stresses, Strains; Residual Stresses; Stress and environmental effects on composites behaviour.

UNIT V Composite Laminates: Thin-plate theory, classical lamination theory; Angle-ply and cross ply laminates; Static, dynamic and stability analysis for simple cases of composite plates; Interlaminar stress behaviour; Composite Joints; Design with Composites.

TEXT BOOKS

1. Agarwal, B. D., and Broutman L. J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York.
2. Mallick, P. K., "Fiber Reinforced Composites: Materials, Manufacturing and Design", Marcel Dekker Inc.
3. Mukhopadhyay, M., "Mechanics of Composite Materials and Structures", University Press, India.

REFERENCE BOOKS

1. Halpin, J. C., "Primer on Composite Materials, Analysis", Techomic Publishing Co.
2. Mallick, P. K. and Newman, S., "Composite Materials Technology: Processes and Properties", Hansen Publisher, Munich.
3. Hyer, M. W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw-Hill, New York.
4. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press-2006, First Indian Edition – 2007.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering**
Subject: **Power Plant Engineering**
(Professional Elective – I)

Semester: **VI**
Code: **337675(37)**

Total Theory Periods: **40** Total Tutorial Periods: **10**
No. of class Tests to be conducted: **2 (Minimum)** No. of assignments to be submitted: **2 (Minimum)**
ESE Duration: **Three Hours** Maximum Marks in ESE: **80** Minimum Marks in ESE: **28**

Course Objectives

- To impart knowledge on sources of energy and types of power plants
- To understand construction and working of Steam Power Plants, Hydro Electric power station, diesel power station, and Nuclear Power Station.
- To impart knowledge about various performance characteristics and its analysis
- To impart knowledge about variable load problem
- To impart knowledge about terms and factors associated with power plant economics

Course Outcome:

- Demonstrate a basic understanding of various types of power plants.
- Acquire knowledge and hands-on competence in the design and development of mechanical systems associated with power plants.
- Compare different energy resources and choose the most appropriate based on local conditions
- Perform simple techno-economical assessments of energy resources
- Design power plant that meet specific energy demands, that are economically feasible and have a minimal impact on the environment

- UNIT I** **Elements of Power Plant:** General Sources of power, Importance of Central Power Stations, types of power stations – steam, nuclear, diesel and hydro – Elements of modern power stations (Steams only) brief layout and arrangement of elements and complements, sitting of different power stations, foundation. Elements of Electric power systems primary and secondary distribution substations (in brief)
- UNIT II** **Steam Power Plant:** Steam power plants, selection of working medium, Heat Balance in steam cycles, Heat rates, comparison of efficiencies gas loop, fuels and fuel handling. Equipments, fuel gas cleaning and ash handling. Air pre-heater, feed water pre-heaters, steam re-heaters, deaerators, feed water treatment, pumping and regulation water walls, modern developments in steam boilers, Important instrumentation and piping of gas and water loop. Factors to be controlled from maximum efficiency and variable output.
- UNIT III** **Hydro Electric power station** – Potential power with reference to rainfall and catchments area, Water storage, equipment used in hydro electric power stations. Characteristics of hydraulic turbines. Comparison of the factors governing the cost of hydro steam and diesel power stations.
Diesel power station – Suitability of diesel engines for bulk power, advantages and limitations of diesel, power stations, efficiency and heat balance.
- UNIT IV** **Nuclear Power Station:** Evolution of nuclear energy from atoms by fission and fusion. Chain reactions, fission materials, types of reactors, gas cooled, boiling water liquid, metal cooled and fast reactor, arrangements of various elements in a nuclear power station, stem cycles and boilers coolant heat exchangers, Reactor control, Reactor shielding and safety methods.
- UNIT V** **Variable load problems** – Idealized and realized load curves, effect of variable load on plant design and operation variable load operation and load dispatch.
Power station Economics – Source of income, cost of plant and production, elements of cost, depreciation and replacement theory of rates.

TEXT BOOKS:

1. Power Plant Engineering – P.K. Nag – Tata McGraw-Hill Pub. Com., New Delhi
2. A Course in Power Plant Engineering – S.C. Arora, S.Domkundwar – Dhanpat Rai & Co.

REFERENCE BOOKS:

1. Text Book of Power Plant Engineering – R.K. Rajput – Laxmi Publications
2. Power Plant Engineering – P.C. Sharma – S.K. Kataria & Sons
3. Power Plant Engineering – G.R. Nagpal – Khanna Publishers
4. Steam and gas turbine and power plant engineering- R. Yadav-CPH Allahabad

Name of the Programme: Bachelor of Engineering :::: Duration of the programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bilai

Branch: **Mechanical Engineering**
Subject: **Maintenance & Reliability Engineering**
(Professional Elective – I)

Semester: **VI**
Code: **337676(37)**

Total Theory Periods: **40** Total Tutorial Periods: **10**
No. of class Tests to be conducted: **2 (Minimum)** No. of assignments to be submitted: **2 (Minimum)**
ESE Duration: **Three Hours** Maximum Marks in ESE: **80** Minimum Marks in ESE: **28**

Course Objectives

- To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To provide the concept of various types of maintenance system used in industries.
- To impart knowledge on reasons for failure and the corrective and preventive measure adopted to reduce them.
- To make the students to be familiar with the concept of reliability engineering
- To make the students to understand the various maintenance and logistics means or the execution of various services.
- To impart knowledge on creating various tools for maintainability of mechanical system.

Course outcome

Application of concepts of the course leads to the optimization of equipment, procedures, and departmental budgets to achieve better maintainability, reliability, and availability of equipment.

- UNIT I Maintenance Engineering:** Objective and functions, organization and administration, economics and maintenance policies. Types of maintenance systems-planned, unplanned, preventive, predictive, conditional monitoring, total predictive maintenance.
- UNIT II Failure Analysis:** Analysis of source, identification, classification and selectivity of failures, catastrophic, wearout and cumulative failures, failure rate Mortality distribution, statistical and reliability concept of failure analysis, equipment replacement policy.
- UNIT III Reliability Engineering:** Concept, bath tub curve, elements, Hazard Models- constant, linearly increasing, weibull. System Reliability - Series configuration, parallel configuration, mixed configuration, reliability improvement – Improvement of components, Redundancy – element, unit, standby, repairable and non repairable systems, reliability, availability, maintainability, MTBF, MTTR, reliability allocation for simple series system.
- UNIT IV Maintenance Management:** Maintenance planning, maintenance scheduling, work orders, work measurement, maintenance cost budgeting, store and spare control, maintenance planning and control techniques, Incentives for maintenance work.
- UNIT V Maintenance of Mechanical System:** Introduction, Bearings, Friction Clutches, Couplings, Fastening Devices, Chains, Gear Drives, Support Equipment, Cooling Towers.

TEXT BOOKS:

1. Maintenance Engineering & Management – R.C Mishra, K. Pathak – Prentice Hall of India, New Delhi
2. Maintenance Engineering – S. Shrivastava – S. Chand & Sons – New Delhi

REFERENCE BOOKS:

1. Industrial Maintenance – H.P. Garg – S. Chand Publication, New Delhi
2. Maintenance Planning & Control – A. Kelly – TMH, New Delhi
3. Concept in Reliability – LS. Srinath – Affiliated East-West Press, New Delhi

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Branch: **Mechanical Engineering**
Subject: **Computer Graphics**
(Professional Elective – I)

Semester: **VI**
Code: **337677(37)**

Total Theory Periods: **40** Total Tutorial Periods: **10**
No. of class Tests to be conducted: **2 (Minimum)** No. of assignments to be submitted: **2 (Minimum)**
ESE Duration: **Three Hours** Maximum Marks in ESE: **80** Minimum Marks in ESE: **28**

Note: All the algorithms are to be practiced in the computer Programming Laboratory and practice any computer aided drafting software.

Course Objective:

- To get familiar with Computer input and Output devices
- To introduce fundamental techniques and methods for two-dimensional and three-dimensional computer graphics.
- To recognize geometric and graphical elements of engineering design problems
- To understand the algorithms and models for geometric projections, transformations, coordinate systems, parametric curves, hidden surface determination, colour theory, texture mapping, shading and lighting.

Course Outcome:

- students will learn how to develop interactive programs that use effectively the graphics functionalities available in contemporary personal computers,
- students will learn the fundamental principles and technologies upon which these functionalities, and possibly their future evolutions, are based
- The skills for designing and implementing practical graphic solutions to challenging problems in different application domains.
- Proficiency in engineering design and ability to conduct an engineering project.
- Understanding of the business environment & Ability to manage information and documentation.
- Capacity for creativity and innovation & ability to demonstrate professional attitudes.

- UNIT I Input and Output Devices:** Keyboard, Mouse, Z mouse Trackball, Joysticks, Data Glove, Digitizers, Light pen, Touch Panels, Image scanners, Printers and Plotters. **Video Display device:** Refresh Cathode ray Tubes, Random Scan and Raster Scan monitors, Colour CRT Monitors, Flat panel display: LED and LCD Monitors & plasma display, Direct view Storage Tubes, Continuous Refresh and Storage display.
- UNIT II Output Characteristics:** Aspect ratio; Aliasing and Anti-aliasing. **Graphic primitives:** Points & Lines, Line drawing Algorithm, DDA and Bresenham's Algorithm. Circle Generation Algorithm: Midpoint circle algorithm. Ellipse Generation Algorithm: Mid-point ellipse algorithm. **Attributes of primitives:** Line style, Type, Width, Colour, Character Attributes, Area Filling: Inside-outside test; **Fill Algorithm:** Scan-Line Polygon Fill algorithm, Boundary Fill Algorithm - 4 and 8 connected area; Flood Fill Algorithm.
- UNIT III Analytical & Synthetic curve:** C0, C1 & C2 Continuity, Convex hull, Parametric & non Parametric representation of curves. **Analytic curves:** Parabola, Hyperbola, **Splines:** linear, quadratic, cubic, hermite, Bezier curves: single and multiple segments, Parametric forms of cubic splines, **Synthetic Curves:** Circle and ellipse drawing,
- UNIT IV 2D Geometric Transformation: Window and View port:** Window definitions, View port definitions, Window and View port relationship; World co-ordinates; Normalized device co-ordinates and Homogenous co-ordinates. **Basic transformation-** Translation, Scaling, Rotation, Reflection, Twist, Matrix Representation, Composite Transformations. **3D Geometric Transformation:** Basic Transformations, 3D Display parallel & perspective projection.
- UNIT V Viewing:** Viewing, Device co-ordination system, Image co-ordination system, Viewing transformation. **Clipping:** Point clipping, Line clipping, Cohen- Sutherland clipping, Mid point clipping method, Sutherland and Hodgeman Clipping.

Text Books:

1. Computer Graphics-Donald hearn and M.Pauline Baker-Prentice Hall of India Pvt Ltd.
2. Introduction to Computer Graphics – N. Krishnamurthy - TMH Publication.

Reference Books:

1. Computer Graphics –Harrington S. – TMH Publication.
2. CAD-CAM Theory and Practice-Ibrahim Zeid- TMH Publication.
3. Xiang and Plastok - Schaum's Outlines Computer Graphics - TMH, 2nd Edition, 2002.
4. Rogers, "Procedural Elements for Computer Graphics – TMH

Name of the Programme: Bachelor of Engineering :::: Duration of the programme: Four Years

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

SCHEME OF TEACHING & EXAMINATION

B.E. VII SEMESTER MECHANICAL ENGINEERING

S. No.	Board of Study	Sub. Code	SUBJECT	PERIODS PER WEEK			SCHEME OF EXAM Theory/Practical			Total Marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1.	Mech. Engg	337731(37)	Automobile Engineering	3	1	-	80	20	20	120	4
2.	Mech. Engg	337732(37)	Refrigeration & Air-conditioning	4	1	-	80	20	20	120	5
3.	Mech. Engg	337733(37)	Computer Aided Design & Manufacturing	4	1	-	80	20	20	120	5
4	Mech. Engg	337734(37)	Machine Tool Technology	4	1	-	80	20	20	120	5
5	Refer Table - II		Professional Elective-II	4	1	-	80	20	20	120	5
6	Mech. Engg	337761(37)	Automobile Engineering Lab	-	-	3	40	-	20	60	2
7	Mech. Engg	337762(37)	Refrigeration & Air-conditioning Lab	-	-	3	40	-	20	60	2
8	Mech. Engg	337763(37)	Computer Aided Design and Manufacturing Lab	-	-	3	40	-	20	60	2
9	Mech. Engg	337764(37)	Minor Project	-	-	3	100	-	40	140	2
10	Management	337765(76)	Innovative & Entrepreneurial Skills	-	-	2	-	-	40	40	1
11	Mech. Engg	337766(37)	** Practical Training Evolution/ Library	-	-	1	-	-	40	40	1
Total				19	5	15	620	100	280	1000	34

L – Lecture,

ESE – End Semester Exam,

T – Tutorial,

CT – Class Test,

P – Practical,

TA – Teacher's Assessment

**To be completed after VI semester and before the commencement of VII Semester.

Table – II
Professional Elective - II

S.No.	Branch	Subject Code	Subject
1	Mechanical	337741(37)	Quality Control & Total Quality Management
2	Mechanical	337742(37)	Energy Management & Audit
3	Mechanical	337743(37)	Applied Elasticity & Plasticity
4	Mechanical	337744(37)	Product Design & Development
5	Mechanical	337745(37)	Numerical Control of Machines Tools
6	Mechanical	337746(37)	Thermal System Design
7	Mechanical	337747(37)	Cyber Security/Information Security

Note: (1) 1/4th of total strength of students subject to minimum of 20 students is required to offer and elective in the college in a particular academic session.

Note: (2) Choice of elective course once made for an examination cannot be changed in future examinations.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Automobile Engineering**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VII**

Code: **337731(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80

Minimum Marks: 28

Course Objectives

- Understand the basic structure of an automobile
- Understand construction of suspension system
- Understand transmission system and its elements
- Understand braking system, steering system and electrical system

UNIT-I

Vehicle structure :Type of automotive vehicles, general layout, vehicle construction-chassis, frame and body, types of frames, frameless and unitary construction, position of power unit.

Suspension system :Objects & principles of suspension, system, types, rigid axle suspension & Independent suspension for front & rear ends, simple & double arm parallel & perpendicular type of suspension system. Gas filled suspension system.

Springs - Purpose, types viz. leaf, coiled, rubber, air, suspension system, torsion bar, stabilizer, telescopic damper.

UNIT – II

Clutches :Characteristics, functions, principles of operation of clutch, friction clutch, single-plate, multi-plate, centrifugal clutch, positive clutch, friction plate clutch lining materials. Torque transmitted and related problems.

Fluid flywheel :Construction, working principles & characteristics.

UNIT – III

Gear Box - Object of Gear Box, air, rolling & gradient resistance, tractive effort variation with speed, performance curve.

Types of Gear Boxes - Sliding mesh, constant mesh, synchromesh device, automatic transmission, overdrive, lubrication of gear box.

Torque Converter - Principles of working, characteristics, Torque converter with direct drive.

Testing of Automobiles

UNIT – IV

Universal Joint - Types, propeller shaft, slip joint.

Differential – Functions, single & double reduction differential, limited slip differential.

Front Axle - Live & dead axle, stub axle.

Back Axle – Hotchkiss drive, torque tube drive.

Tyres - Types specification, causes of tyre wear & rim.

Brakes & Braking system - Purpose, principles, layout of braking system. Classification, mechanical, hydraulic, master cylinder, Tandem master cylinder, wheel cylinder, self energizing & self adjusting brakes, disc brakes, antiskid brakes, power operated brakes.

UNIT – V

Steering system:- Gear & links, types of steering gears, reversibility of steering, center point steering, steering geometry viz. castor, camber, king pin inclination toe in, toe out, cornering power, under-over steer; power steering, effect of shimmy, condition of true rolling, calculation of turning radius. Correct steering equation and related problems.

Electrical System: Battery: construction, maintenance, testing and charging. Cut-out, lighting circuit, horn, signals etc.

TEXT BOOKS

1. Automobile Engineering – Kripal Singh – Standard Publications, New Delhi
2. Automobile Mechanics - N. K. Giri – Khanna Publishers, New Delhi

REFERENCE BOOKS

1. Automobile Engineering – G.B.S. Narang – Khanna Publishers, New Delhi
2. Automotive Mechanics: Principles and Practices- W.H.Crouse, and D.L. Anglin, TMH
3. Automobile Engineering – K. R. Govindan – Anuradha Agencies
4. The Automobile-Harbans, Reyat Singh- S.Chand , New Delhi
5. Automotive Mechanics – Joseph Heitner-CBS Pub., New Delhi
6. Motor Vehicle – Newton & Steeds – Life & Sons Limited.

Course Objectives

- Graduates will gain a strong foundation in core automobile engineering, both in theoretical and applied concepts.
- Acquire knowledge and hands-on competence in the design and development of automobile.
- Graduates will demonstrate the ability to identify and solve automobile engineering maintenance problems.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: **Bachelor of Engineering**
Branch: **Mechanical Engineering**
Subject: **Refrigeration And Air Conditioning**
Total Theory Periods: **40**
Class Tests: **Two (Minimum)**
ESE Duration: **Three Hours**

Semester: **VII**
Code: **337732(37)**
Total Tutorial Periods: **10**
Assignments: **Two (Minimum)**
Maximum Marks: 80
Minimum Marks: 28

Course Objectives

- Analyze vapour compression cycles
- Analyze alternative systems such as gas cycle refrigeration and vapour absorption etc.
- Understand psychrometry and psychrometric processes
- Select/ design equipment for refrigeration and air-conditioning systems.
- Carry out air conditioning calculations

UNIT – I

Introduction :Refrigeration and second law of Thermodynamics, Refrigeration effect and unit of Refrigeration, Heat pump, reversed Carnot cycle. Vapour Compression Refrigeration System, Analysis of simple vapour compression Refrigeration cycle by p-h and T-S diagram. Effect of operating conditions, liquid vapour heat exchangers, actual refrigeration cycle. Introduction to Multiple Evaporator and compound compression systems.

UNIT – II

Gas cycle Refrigeration : Limitation of Carnot cycle with gas, reversed Brayton cycle, Brayton cycle with regenerative H.E.

Air cycle for aircraft. Necessity of cooling of aircraft, Basic cycle, boot strap, regenerative type air craft refrigeration cycle.

UNIT – III

Vapour Absorption System :Simple vapour absorption system, Electrolux Refrigerator, Analysis of Ammonia absorption refrigeration system, Lithium Bromide Absorption Refrigeration System.

Refrigerants : Classification, Nomenclature, selection of Refrigerants, global warming potential of CFC Refrigerants.

Refrigeration Equipments :Compressor, condenser, evaporator, expansion devices – types & working.

UNIT – IV

Psychrometry :Psychrometric properties, psychrometric relations, psychrometric charts, psychrometric processes,cooling coils, By-pass factor and air washers. Human Comfort Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.

UNIT – V

Cooling load calculations :Internal heat gain, system heat gain, RSHF, ERSHF, GSHF, cooling load estimation, heating load estimation, psychrometric calculation for cooling, selection of air conditioning, apparatus for cooling and dehumidification,

Air conditioning system :Central, split and window air conditioning system.

TEXT BOOKS

1. Refrigeration and Air Conditioning –C. P. Arora – TMH,Delhi
2. Refrigeration and Air Conditioning – Manohar Prasad – New Age - Delhi

REFERENCE BOOKS

1. Refrigeration and Air Conditioning – Arora & Domkundwar – Dhanpat Rai, Delhi
2. Refrigeration & Air Conditioning-R.K.Rajput-S.K. Kataria, Delhi
3. Refrigeration and Air Conditioning – P.L. Ballaney – Khanna Pub.,Delhi
4. Refrigeration & Air Conditioning – Ahmadul Ameen - PHI, Delhi
5. Refrigeration and Air Conditioning- Stocker & Jones, McGraw Hill, Delhi
6. Basic Refrigeration and Air-Conditioning- P.N.Ananthanarayanan, TMH, Delhi
7. Principles of Refrigeration-Roy J.Dossat , -Pearson,Delhi
8. Refrigeration and Air Conditioning –R.C.Arora -PHI, Delhi

Course Outcomes

- Apply knowledge of Refrigeration and Air-Conditioning for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts in analysis and design of refrigeration and air-conditioning systems.
- Demonstrate creativeness in designing new systems, components and processes in the field of engineering in general and mechanical engineering in particular.
- Identify, analyse, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Computer Aided Design and Manufacturing**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VII**

Code: **337733(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80

Minimum Marks: 28

Course Objective:

- To introduce the student to be familiar with CAD/CAM terminology & its capabilities.
- To become familiar with CAD/CAM software, Graphical user interface & basic tools.
- To recognize geometric and graphical elements of engineering design problems
- To apply a “hands-on” understanding of the basic concepts of computer-aided manufacturing and prototyping through group and individual projects
- To study Basic features of CAM so as to be capable of accepting professional responsibilities and to understand the associativity between design and manufacturing.
- Integrate the CAD system and the CAM system by using the CAD system for modeling design information and converting the CAD model into a CAM model for modeling the manufacturing information.

UNIT-I

Introduction: Introduction of CAD/CAM, Definition of CAD & CAM tools, the influence of computers on manufacturing environment, Benefits of CAD/CAM. The product cycle, product engineering, concurrent engineering.

Window and View port: Window definitions, View port definitions, Window and View port relationship; World co-ordinates; Normalized device co-ordinates and Homogenous co-ordinates.

UNIT – II

Geometric Modeling: Requirement of Geometric Modeling, Geometric models, Geometric construction Methods, other modeling methods, 2D & 3D Transformations, Perspective and Parallel Projection, Viewing transformation.

Geometric Modeling of Curves: Parametric and Non parametric, Explicit and Implicit, Representation of curves. *Analytical Curve:* Line, Circle, Conics. *Synthetic curve:* Hermite Cubic Splines, Bezier Curves, B-Spline Curves. C0, C1 & C2 Continuity, Convex hull.

UNIT –III

Representation of Surface: Parametric Representation of surfaces, Equation of surface, Tangent vector, Normal vector, Twist vector, parametric patches and surfaces, Analytical surfaces: Ruled surface, surface of revolution, Tabulated cylinder. Synthetic surface: Hermit bi-cubic surface, Bezier bi-cubic surface, B spline bicubic surface, Coon’s surface.

Solid Modeling: Solid modeling techniques, Geometric and Topology, Valid solid, Types of solid modeling, Algorithms, Basic set theory, Solid Representation Schemes. CSG representation, 3D base primitives, Unary Operation, Boolean Operation, Sweeping Operation and CSG tree.

UNIT – IV

Numerical Control

Introduction to Numerical Control, Basic components of an NC system, the NC procedure, NC coordinate systems, NC motion control systems, applications of Numerical Control, Introduction to Computer Control in NC, problems with conventional NC, Computer Numerical Control, Direct Numerical Control, Combined DNC/CNC system, Adaptive control machining system,

NC Part Programming

Introduction to NC Part Programming, Manual part programming, Computer assisted part programming, the APT (Automatically Programming Tool) language, MACRO statement in APT, Advantages of CAD/CAM in NC programming.

UNIT –V

Group Technology

Introduction to group technology, part families, parts classification & coding, three parts classification & coding system, group technology machine cells, benefits and Limitation of group technology

Computer integrated manufacturing (CIM) system

Introduction of CAPP, Flexible Manufacturing System, Benefits.

Text Books:

1. CAD/CAM Theory and Practice- Zeid, Ibrahim & Sivasubramanian, TMH, Delhi
2. CAM/CAD principle & Applications-P.N.Rao- TMH, New Delhi

Reference Books:

1. CAD/CAM-Milkell P. Groover, Emory W. Zimmer-Pearson Education, Delhi
2. Computer Aided Design & Manufacturing – Lalitnarayan – PHI, Delhi
3. Introduction to Computer Graphics- N. Krishnamoorthy, TMH, Delhi
4. Computer Numeric Control-T.Jeyapoovan, Robert Quesada-Pearson Education
5. CAD/CAM – Surendra Kumar & A.K. Jha – Dhanpat Rai , New Delhi

Course Outcome:

- Understand the various CAD/CAM and CNC processes.
- Generate and verify the tool path and NC programs for milling and drilling manufacturing processes.
- Recognize various types of Curves, surface and Solid and their application as used in geometric modeling.
- Appreciate the concept of parametric modeling which is the mainstay of most of the 3D modeling system.
- Write and prove sample part programs for CNC machining centres in planar milling operations using the word address format.
- Understand the needs of master production schedule and methods to develop it.
- Plan and execute the production activity control, which actually deals with operations in the shop floor.
- Skillfully use modern engineering tools and techniques for mechanical engineering design, analysis and application.

Chhattisgarh Swami Vivekanand Technical University, Bilai (C.G.)

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Machine Tool Technology**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VII**

Code: **337734(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80

Minimum Marks: 28

Course objectives:

- To impart knowledge about cutting tool geometry, tool material, mechanics of metal cutting, machinability and importance of cutting fluid.
- To understand the kinematics drive of machine tool.
- To design speed gear box and feed gear box
- To understand the procedure of acceptance test of machine tool

UNIT - I

Cutting Tool – Types, requirements, specification & application

Geometry of Single Point Cutting Tool - tool angle, Tool angle specification system, ASA, ORS and NRS and inter-relationship.

Mechanics of Metal Cutting

Theories of metal cutting, chip formation, types of chips, chip breakers, Orthogonal and Oblique cutting, stress and strain in the chip, velocity relations, power and energy requirement in metal cutting.

UNIT - II

Machinability :Concept and evaluation of Machinability, Mechanism of Tool failure, Tool wear mechanism, Tool life, Tool life equation, Machinability index, factors affecting machinability.

Thermal Aspects in Machining and Cutting Fluid

Source of heat in metal cutting and its distributions, temp measurement in metal cutting, function of cutting fluid, types of cutting fluid.

UNIT – III

Design of Machine Tool Elements :Design of Lathe bed - Material and construction feature, various bed section, analysis of force under headstock, tail stock and saddle, torque analysis of lathe bed, bending of lathe bed, designing for torsional rigidity, use of reinforcing stiffener in lathe bed.

Design of Guide ways, Material and construction features, over turning diagram, Antifriction guide ways.

UNIT – IV

Design of Speed Gear Box :Drives in Machine Tool, classification, selecting maximum and minimum cutting speeds, speed loss, kinematic advantage of Geometric progression, kinematic diagrams, design of Gear Box of 6,9,12 and 18 speed.

UNIT – V

Design of Feed Gear Box :Elements of feed gear box, classification-Norton drive, draw key drive, Meander's drive, Design of feed gear box for longitudinal and cross feed and for thread cutting.

Acceptance Test of Machine tool :Testing, Geometrical checks, measuring equipment for testing, acceptance test for Lathe and Radial drilling machines.

TEXT BOOKS

1. Machine Tool Engineering – G.R. Nagpal – Khanna Publishers, New Delhi
2. Fundamentals of Metal Cutting & Machine Tool – B.L. Juneja, G.S. Sekhan, Nitin Sethi – New Age Publishers – New Delhi

REFERENCE BOOKS

1. Production Engineering – P. C. Sharma – S. Chand & Company – New Delhi
2. Production Technology – R.K. Jain – Khanna Publisher – New Delhi
3. Principle of Metal Cutting -Sen, Bhattacharya – New Central Book Agency, Calcutta
4. Machine Tool Practices – Kibbe Richard R – PHI, New Delhi
5. Manufacturing Technology Vol.-II – P. N. Rao - TMH Delhi
6. Manufacturing Engineering & Technology – Serope Kalpakjian- Pearson, Delhi

Course Outcomes:

1. Graduates will gain a strong foundation in machine tool engineering
2. Acquire knowledge and hands-on competence in design and development of machine tool.
3. Develop an ability to identify, analyze and solve technical problems related to machine tools.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Quality Control & Total Quality Management**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VII**

Code: **337741(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objectives

- Define and understand various terms associated with quality control
- Enhance the students understanding of the complexity of statistical analysis and interpretation.
- Provide an introduction to the fundamental concept of SPC, total quality management, six sigma, quality function deployment and applications of these concepts.
- Understanding the philosophies of TQM in order to better evaluate the TQM implementation proposals.
- Assess exactly where an organization stands on quality management with respect to ISO 9000 quality management.

UNIT-I Basic Concept of Quality

Quality and quality control, concept of quality, quality characteristics, Quality of design and quality of conformance ,History of quality control, Quality policy and objectives, Economics of quality.

Statistical Concept of Variation

Concept of variation frequency distribution, continuous and discrete, probability distributions viz. Normal, Exponential and Weibull distribution, pattern of variation, significance tests, Analysis of variance, statistical aids in limits and tolerances.

UNIT-II Quality Assurance

Concept, advantages, field complaints, quality rating, quality audit, inspection planning, quality mindness, quality budget, vendor quality rating (VQR), vendor rating (VR), manufacturing planning for quality, Quality function deployment (QFD).

Statistical Quality Control

Objectives, Growth and applications of S.Q.C., S.O.C, Techniques in manufacturing planning. Process capability analysis, Control charts for variables and attributes and their analysis, process capability, concept of six sigma.

UNIT III ACCEPTANCE SAMPLING

Fundamental concept in acceptance sampling, operating characteristics curve. Acceptance plans, single, double and introduction of multiple plans.

UNIT -IV Total Quality Management

Total Quality Control (TQC), Concept of Total Quality Management (TQM), TQM philosophies, Deming approach to TQM, Juran ten steps to Quality Management, Taguchi Philosophy, Crosby fourteen steps, TQM models, Tools and techniques of TQM,

UNIT V Quality system

Quality system, need for quality system, ISO 9000 Quality Management Standards, ISO 9000:2000 requirement, Quality Auditing, ISO 14000, Benefits of ISO 14000.

TEXT BOOKS

1. Quality Planning and Analysis - Juran & Gryana – McGraw Hill, New York
2. Statistical Quality Control – R.C. Gupta – Khanna Publishers, Delhi

REFERENCE BOOKS

1. Statistical quality control – Grant and Leavenworth – McGraw Hill, New York
2. Engineering Statistics and Quality Control – I. W. Burr- McGraw Hill, New York
3. Managing for Total Quality - Logothetis – PHI Delhi
4. Statistical Quality Control – M. Mahajan – Dhanpat Rai – New Delhi
5. Total Quality Management – Suganthi & Samuel - PHI, Delhi
6. Total Quality Management - Charantimath, Poornima – Pearson, Delhi
7. Total Quality Management – K.C. Arora - S.K. Kataria- New Delhi

Course Outcomes

- Explain the importance of quality & role of statistical quality control
- Apply methods and techniques of statistical quality control, to studies and interpret the results in business.
- Demonstrate motivation and responsibility to advocate for quality in business
- Develop an understanding on quality management philosophies and frameworks
- Develop in-depth knowledge on various tools and techniques of quality management

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Energy Management and Audit**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VII**

Code: **337742(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objectives:

To impart knowledge on Sources of Energy, Energy Utilization and Energy Conversion System, energy balance, energy action planning to identify and evaluate opportunities to reduce client operating cost through energy conservation and planning

UNIT – I : Energy Sources

Introduction, Sources of energy – conventional and non-conventional, elasticity of demand and application, concepts to energy, Indian energy scene, energy storage, solar energy, water, battery and mechanical storage Systems.

UNIT – II :Energy Utilization and Conversion System

Classification of furnaces, controlled atmosphere in furnaces, furnace fuels, efficient use of energy in furnaces, thermal efficiency, reducing heat losses.

Combined Power and Heating System

Characteristics of prime movers, heat and Power requirements, economics of a CHP System.

UNIT – III : Material and Energy balance

Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

Energy Action Planning

Key elements, force field analysis, energy policy purpose, perspective, contents, formulation, ratification, organizing –location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability, motivation, Information system – design barriers, strategies, marketing and communicating-training and planning.

UNIT – IV : Energy Audit

Energy Management information system, thirty nine steps for energy management, types of energy audit, preliminary energy audits, technical assistance in energy audit, energy accounting and analysis, Instruments used in Energy auditing.

UNIT – V :Economics and Finance

Introduction, economics, discounted cash flow, loans, investments, option identification and analysis, optimization, conflict correction, constructing the optimal target investment schedule, project management, monitoring against the target financial schedule.

TEXT BOOKS

1. Engineering Economics & Engineering Management – R. Raju – Anuradha Agencies.
2. Energy Engineering & Management - Chakrabarti – PHI, Delhi.

REFERENCE BOOKS

1. Energy Management – W.R. Murphy, G. Mckay – Elsevier, Gurgaon.
2. Energy Management – Paul O’Callaghan – McGraw Hill – New Delhi.
3. Principles of Energy Conversion – Archie W. Culp — McGraw Hill, Delhi.
4. Energy Management in illuminating System – Kao Chen – CRC Publishers.
5. Industrial Energy Recovery - D.A. Reay – Wiley Publishers.
6. Thermal Energy Recovery – T.L. Boyer – Wiley Publishers.
7. Energy Conservation through Control – E.G. Shinsky – Academic Press.
8. Economics of Solar Energy & Conservation Systems, Vol-I & II – F. Kreith & R.E. West – CRC Press

Course Outcomes:

- Application of concepts of the course leads to achieve and maintain optimum energy procurement and utilization, throughout the organization
- Minimize energy costs / waste without affecting production & quality
- Minimize environmental effects.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Applied Elasticity and Plasticity**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VII**

Code: **337743(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objective

- To study the classical theory of linear elasticity for two and three dimensional state of stress and obtain solutions for selected problems.
- To understand the plastic stress strain relations, criteria of yielding and elasto- plastic problems.

Unit-I :Theory of Elasticity

Introduction: Definition of stress and strain at a point, components of stress and strain at a point in cartesian and polar co-ordinates, constitutive relations, equilibrium equations, compatibility equations and boundary conditions in 2-D and 3-D cases.

Transformation of stress and strain at a point, principal Stresses and principal strains, invariants of stress and strain, hydrostatic and deviatoric stress, spherical and deviatoric strains, maximum shear stress, maximum shear strain.

Unit-II : Plain stress and plain strain

Airy's stress function approach to 2-D problems of elasticity, simple problems of bending of beams, solution of axis-symmetric problems, stress concentration due to the presence of a circular hole in planes.

Unit-III : Elementary problems of elasticity in three dimensions, stretching of a prismatic bar by its own weight, twist of circular shafts, torsion of non-circular sections, membrane analogy, Propagation of waves in solid media. Applications of finite difference equations in elasticity

Unit-IV :Theory of Plasticity:

Stress-strain diagram in simple tension, Perfectly elastic, Rigid - Perfectly plastic, Linear work - hardening, Elastic Perfectly plastic, Elastic Linear work hardening materials, Failure theories, yield conditions, stress - space representation of yield criteria through Westergard stress space, Tresca and Von-Mises criteria of yielding.

Unit-V :Plastic stress-strain relations

Saint Venant's Theory of Plastic flow, Elastic plastic Deformations, Prandtl's stress equations, Levy - Mises equation, Reuss theory of elastic - plastic deformation, Hencky's theory of small plastic deformations, Plastic potential, Flow Rule.

TEXT BOOKS:

1. Theory of elasticity – Sadhu Singh – Khanna Publisher, New Delhi
2. Theory of Plasticity – Sadhu Singh - Khanna Publisher, New Delhi

REFERENCE BOOKS

1. Theory of elasticity -Timoshenko and Goodier - McGraw Hill
2. Theory of Plasticity - J. Chakrabarthy - McGraw Hill
3. Plastic Analysis of Structures-P. S. Hodge-John Wiley and Sons.
4. Plastic Methods of Structural Analysis-Neal B. G.-Chapman and Hall, 1977, III Edition.
5. Plasticity for Mechanical Engineers-W. Johnson and P. B. Mellor-D.Van Nostrand
6. Introduction to the Theory of Plasticity for Engineers-Haffman & Sachs-Mc,Graw Hill.
7. Theory of Inelastic structures-T. H. Lin-John Wiley and sons.
8. Plastic Analysis and Design of Plates, Shells and Discs- Massonnet-North Holland.
9. Plastic Design of Steel Frames-Beedle L. S.-John wiley.
10. Foundations of Solid Mechanics- Y. C. Fung- Prentice-Hall.
11. Continuum Mechanics fundamentals- S. Vallappan-Oxford and IBH.
12. Theory of Plasticity-M. Kachanov-Mir publishers, Moscow.

Course outcomes:

- Apply knowledge of applied elasticity and plasticity for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: **Bachelor of Engineering**
Branch: **Mechanical Engineering**
Subject: **Product Design and Development**
Total Theory Periods: **40**
Class Tests: **Two (Minimum)**
ESE Duration: **Three Hours**

Semester: **VII**
Code: **337744(37)**
Total Tutorial Periods: **10**
Assignments: **Two (Minimum)**
Maximum Marks: 80 Minimum Marks: 28

COURSE OBJECTIVES

- To introduce design concepts and techniques to develop design ability in a product design.
- To provide knowledge about estimating and evaluating the feasible manufacturing design.
- To make aware of legal issue pertaining to product design.
- To provide knowledge of management of product development projects

UNIT-I :Product Development Process

Background for design, design theory, design materials, human factors in design applied ergonomics, product development processes and organization, identifying customer needs, establishing product specifications, concept generation and selecting product architecture.

UNIT-II :Product Design Methods

Generating concepts, selection of a concept, Testing of concept, product architecture, Creative and rational clarifying objectives- the objective trees methods, establishing functions – the function analysis methods, setting requirement- requirements specification methods determining characteristics – the QFD method, generating alternatives-the morphological chart method, evaluating alternatives-the weighted objectives methods, improving details-the value engineering method and design strategies.

UNIT –III : Design for Manufacture

Estimating manufacturing costs, reducing component, assembly and support cost design for assembly, design for disassembly, design for environment, design for graphics and packaging, effective prototyping – principle and planning.

UNIT –IV :Industrial Design

Its need - Ergonomic needs, Aesthetic needs, impact, accessing the quality, steps involved in Industrial design process, Management of Technology & user driven products.

UNIT – V :Patents, Product Development & Project Management

Legal issues in product design, trademarks, trade-secret, copy rights, patents – types, steps for disclosure, design resources, economics – quantitative & qualitative analysis, management of product development projects, Design Structure Matrix, Gantt Chart, Project schedule, budget, risk plan, accelerating project, execution, assessing and correction, Intellectual property rights.

TEXT BOOKS

1. Product Design & Development - Karl. T. Ulrich and Steven D. Eppinger – TMH,Delhi.
2. Product Design – Kevin Otto and Kristin wood - Pearson Education.

REFERENCE BOOKS

1. Product Development - Chitale & Gupta - Tata McGraw Hill.
2. Product Design and Manufacturing – Chitale & Gupta – PHI, Delhi.
3. Product Design: Creativity, Concepts and Usability – Kumar – PHI, Delhi .
4. Concurrent Engineering in Product Design and Development- Imad Moustapha – New Age.
5. Operations Management- Monks, J.G - McGraw Hill.
6. Product Design and Development - Ulrich & Eppinger – TMH Delhi.
7. Facility Layout and Location - Francis, R. L., and White, J. A. - Prentice Hall of India

Course Outcomes

- The course enhance students understanding of new product development processes as well as useful tools, techniques and organizational structures that support new product development practice.
- Understands the legal issue pertaining to patent of product design.
- Understand professional, ethical and social responsibilities resulting in a commitment to quality, timeliness, and continuous improvement.

Chhattisgarh Swami Vivekanand Technical University, Bilai (C.G.)

Name of program: **Bachelor of Engineering**
Branch: **Mechanical Engineering**
Subject: **Numerical Control of Machine Tools**
Total Theory Periods: **40**
Class Tests: **Two (Minimum)**
ESE Duration: **Three Hours**

Maximum Marks: 80

Semester: **VII**
Code: **337745(37)**
Total Tutorial Periods: **10**
Assignments: **Two (Minimum)**
Minimum Marks: 28

Course Objectives

- Understand the emergence and development of numerical control machine, characteristics and application areas.
- Master basic knowledge of transmission of machine, numerical control machine tool working principle and composition.
- Master CNC machinery structure and NC machining system technology and equipment.
- Understand all kinds of typical numerically-controlled machine tool, in order to adapt to the needs of the development of the modern industry.

UNIT - I : Introduction

Fundamentals of numerical control, advantages limitations of N.C systems -classification of N.C systems.

Computer Numerical Control

Nomenclature, types and features of CNC machine tools, machine control unit, position control and its significance, engineering analysis of NC positioning systems, open loop and closed loop systems, precision in NC positioning systems-control resolution, accuracy and repeatability. Actuators: servomotors, stepper motors, transducers and feedback elements.

UNIT - II :Features of N.C. Machine tools

Design consideration of N.C machine tools - increasing productivity with N.C machines, tooling for CNC machine.

System Device

Feed back system-counting devices digital analog converters

Interpolations

DDA integrators, simple and symmetrical DD reference word CNC interpolators.

UNIT - III : Part Programming

Process planning and flow chart for part programming, systems nomenclature and tool geometries, Tool presetting & modular tooling. Selection of tools based on machining capacity, accuracy and surface finish, elements of programming for turning and milling, part programming. Preparatory codes G, miscellaneous functions M, Interpolation, tool compensations, cycles for simplifying programming, typical part programming

Control Loops for N C Systems

Introduction-control loops for point and counting systems.

UNIT - IV :Computerized Numerical Control

CNC concepts-advantage of CNC reference planes, sampled data techniques, microcomputers in CNC.

Adaptive Control Systems

Adaptive control with optimization and constraints-variable gains AC systems.

UNIT - V : Modern CNC machines

CNC lathes, turning centers, machining centres, automatic pallet changers, automatic tool changers, direct numerical control and applications, CNC machine design features.

TEXT BOOKS

1. Numerical control of machine tool – Koren & Ben Uri – Khanna Publisher, Delhi
2. Automation, Production Systems and Computer Integrated Manufacturing - Groover – PHI.

REFERENCE BOOKS

1. CNC Programming - S.K. Sinha - Galgotia
2. Mechatronics - HMT –TMH, Delhi
3. Numerical Control and Computer Aided Manufacturing -Tewari, Rao, Kundra- TMH, Delhi
4. Machine Tool Design and Numerical Control – N.K.Mehta – TMH Delhi
5. Fundamentals of Computer Numerical Control – NIIT – Prentice Hall, Delhi

Course Outcomes:

- Acquire knowledge and hands-on competence in applying the concepts in the design and development of machine tool.
- Demonstrate creativeness in designing efficient processes in the field metal cutting.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Thermal System Design**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VII**

Code: **337746(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objectives

- To enable the students to understand the concepts of thermal system design
- To provide knowledge about economics of thermal system
- Be familiar with modeling, simulation optimization techniques of thermal systems

UNIT-I

Introduction to Thermal System Design - Thermal system design, concept and major applications, categories of thermal system design.

Designing A Workable Thermal System - Introduction, Workable vs. Optimum system, various design basis, design of a food freezing plant and several other examples.

UNIT-II

Economics of Thermal Systems - Introduction, Major and minor costs, Interest, present and future worth, economic evaluation of thermal system design, Life cycle costing (LCC) method of economic evaluation, Effect of inflation, Present worth of yearly installment taking inflation into account, Preliminary cost estimation, equipment cost estimating parameter, effect of time factor on costs, energy costs, Taxes, Depreciation.

UNIT-III

Modeling of Thermal Systems - Introduction, curve fitting or equation fitting for one, two and polynomial independent variable, Example of curve fitting for thermal systems, Best fit equation, least square method with example, Some example of mathematical modeling of thermal systems.

UNIT-IV

Thermal System Simulation - Introduction, classes of systems, information flow diagrams, Sequential and simultaneous calculations, Formulation of information flow diagram of thermal systems some example like water pumping systems, waste heat utilization systems.

Methods of Simultaneous Calculations- Successive substitution method and Newton-Raphson method, Newton-Raphson method for multiple functions, Simulation of Gas turbine system.

UNIT - V

Optimization of Thermal Systems - Introduction, Mathematical representation of optimization problem with example of water chilling system, Lagrange multipliers, Heat exchanger optimization with Lagrange multipliers

TEXT BOOKS:

1. Design of Thermal Systems - Stoecker W.F. - McGraw Hill
2. Advanced Thermodynamic for Engineers - Wark K. - John Wiley

REFERENCE BOOKS:

1. Advanced Engineering Thermodynamics - Bejan A. - John Wiley
2. Advanced Engineering Thermodynamics - Annamalai K. & Puri - CRC Press
3. Thermal Design & Optimization - Bejan A., Tsatsarones G. & Moran M - John Wiley
4. Fundamentals of Engineering Thermodynamics - Moran M.J. & Shapiro H.N - John Wiley

Course Outcomes

- Demonstrate a basic understanding of concepts of thermal system design.
- Acquire knowledge and hands-on competence in the design and development of thermal systems that meet specific energy demands, are economically feasible and have a minimal impact on the environment.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: **Bachelor of Engineering**
Branch: **Mechanical Engineering**
Subject: **Cyber Security /Information security**
Total Theory Periods: **40**
Class Tests: **Two (Minimum)**
ESE Duration: **Three Hours**

Semester: **VII**
Code: **337747(37)**
Total Tutorial Periods: **10**
Assignments: **Two (Minimum)**
Maximum Marks: 80
Minimum Marks: 28

Course objectives

Introduce students to cyber security concepts and techniques and foster their abilities in designing and implementing solutions for real-world problems, As in today's networked world, most of the organizations and enterprises depend on different kinds of Information Technology solutions, say e-commerce, e-governance, e-learning, e-banking etc. All communications must be secured and under control since the information stored and conveyed is ultimately an invaluable resource of the business.

UNIT-I :Security Policies and Management

Security Policy Design, Designing Security Procedures, Risk Assessment Techniques, Security standards. Security Models - Biba Model, Chinese Wall, Bell La Pedula Model, Physical and Environmental Security, Server Room Design, Firefighting equipment, Temperature/humidity Control etc

UNIT-II :Application Security

Databases, Email and Internet etc, Communications and Operations Management: Network Architecture, Network Operations Security Devices (Firewalls, IDS/IPS, Antivirus etc), Routers/Switches.

UNIT-III :Business Continuity Planning and Management - Business Impact Analysis, Business Continuity/Disaster Recovery Plans, Access Control - Logical and physical access Control

UNIT-IV :Software development, maintenance and support

Security in development methodology ,Security testing, Segregation of duties

UNIT-V : Cyber Forensics

Introduction to forensic tools, Evaluation of crime scene and evidence collection, Usage of tools for disk imaging and recovery processes. Introduction to Information Security Standards - ISO 27001, PCI DSS .Compliance - IT Act, Copy Right Act, Patents etc

Bibliography:

1. *Security Engineering: A Guide to Building Dependable Distributed Systems* - Ross J. Anderson - John Wiley, New York, NY, 2001. ISBN: 0471389226.
2. *Computer Security: Art and Science* - Matt Bishop - Addison Wesley, Boston, MA,2003. ISBN: 0-201-44099-7.
3. *Security for Ubiquitous Computing* - Frank Stajano - John Wiley, 2002. ISBN: 0470844930.

Internet Web Sites:

1. Online Textbook Materials www.securityplusolc.com

Course outcomes:

Acquire knowledge and hands-on competence in applying cyber security solutions to work professionally in the areas of information security.

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Automobile Engineering Lab**

Total Lab Periods: **24**

Maximum Marks: **40**

Semester: **VII**

Code: **337761(37)**

Batch Size: **30**

Minimum Marks: **20**

STUDIES TO BE CARRIED OUT (MINIMUM TEN EXPERIMENTS)

1. Study of frame and chassis.
2. Study of clutches – single plate, multi plate and centrifugal
3. Study of gear boxes – sliding mesh, constant mesh, synchro-mesh.
4. Study of differential, universal joints, axles and slip joints.
5. Study of brakes – mechanical, hydraulic, air brake and disc brake.
6. Study of steering system used with rigid axle suspension and independent suspension system, power steering
7. Study of different types of springs used in automobiles.
8. Study of rigid axle suspension system.
9. Study of front independent suspension system.
10. Study of independent suspension system.
11. Study of battery, starting and generating system and battery charging system.
12. Study of automotive electrical system.
13. Study of educational car model.

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Working model of single plate, multi-plate & centrifugal clutch
2. Working model of actual differential system
3. Working model of universal joint, axles & slip joints
4. Working model of mechanical, hydraulic and air brake
5. Working model of steering system used with rigid axle suspension system
6. Working model of steering system used with independent suspension system
7. Different types of springs used in automobiles
8. Working model of rigid axle suspension system
9. Working model of front independent suspension system
10. Working model of rear independent suspension system
11. Working model of battery, starting and generating system along with charging unit
12. Working model of electrical system
13. Cut section of actual master cylinder of hydraulic brake system
14. Educational car model

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Refrigeration & Air Conditioning Lab**

Total Lab Periods: **24**

Maximum Marks: **40**

Semester: **VI**

Code: **337762(37)**

Batch Size: **30**

Minimum Marks: **20**

EXPERIMENTS TO BE PERFORMED (MINIMUM SEVEN NUMBERS)

1. To study Domestic Refrigerator.
2. To study the Hermetically Sealed Compressor.
3. To study Refrigeration Tutor and to determine the following:-
 - a. Theoretical coefficient of Performance
 - b. Actual Coefficient of Performance.
 - c. Theoretical capacity of the plant
 - d. Actual capacity of the plant.
4. To Study the Mechanical Heat Pump and to determine the following:-
 - a. Theoretical coefficient of Performance
 - b. Actual Coefficient of Performance.
 - c. Theoretical capacity of the plant
 - d. Actual capacity of the plant
5. To study the Air and Water Heat Pump and to determine the following:-
 - a. Theoretical coefficient of Performance of the system as a refrigerator and as a heat pump.
 - b. Actual Coefficient of Performance of the system as a refrigerator and as a heat pump.
 - c. Capacity of the system in tons as a refrigerator.
 - d. Capacity of the system in kW as a heat pump under the following conditions of operation:-
 - i. Water cooled condenser and water-cooled evaporator.
 - ii. Water-cooled condenser and air-cooled evaporator.
 - iii. Air-cooled condenser and air-cooled evaporator.
 - iv. Air-cooled condenser and water-cooled evaporator.
6. To study the following processes on the Air Conditioning Test Rig.
 - a. Sensible Heating
 - b. Sensible Cooling
 - c. Sensible Cooling/cooling dehumidification
 - d. Humidification and cooling
7. To Find the Efficiency of Cooling Tower Test Rig.
8. To Study the Simple Vapor Absorption System.
9. To study the AC Simulator and to determine the following:-
 - a. Sensible Heating
 - b. Sensible Cooling
 - c. COP of R-22
 - d. Air Washer Efficiency
 - e. Sensible heat load applied
 - f. Latent heat load applied
 - g. RSHF
 - h. ESHF
 - i. Creation of different climatic conditions in AC simulator

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Domestic Refrigerator
2. Cut Section of Hermitically Sealed Compressor
3. Refrigeration Tutor Test Rig
4. Mechanical Heat Pump Test Rig
5. Air & Water Heat Pump Test Rig
6. Air Conditioning Test Rig
7. Simple Absorption System Test Rig
8. Cooling Tower Test Rig
9. Air Conditioning Simulator Test Rig

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Computer aided design and manufacturing Lab**

Total Lab Periods: **2 4**

Maximum Marks: **40**

Semester: **VII**

Code: **337763(37)**

Batch Size: **30**

Minimum Marks: **20**

Total TEN Experiments are to be carried out. FIVE Experiments each from CAD and CAM.

A. CAD Experiments

1. Line Drawing or Circle Drawing experiment: Writing and validation of computer program.
2. Geometric Transformation algorithm experiment for translation/rotation/scaling: Writing and validation of computer program.
3. Design of machine component or other system experiment: Writing and validation of computer program.
4. Understanding and use of any 3-D Modeling Software commands.
5. Experiment: Solid modeling of a machine component using Advanced-modeling software.
6. Root findings or curve fitting experiment: Writing and validation of computer program.
7. Numerical differentiation or numerical integration experiment: Writing and validation of computer program.

B. CAM Experiments

1. To study the characteristic features of CNC machine
2. Part Programming (in word address format) experiment for turning operation (including operations such as grooving and threading) and running on CNC machine
3. Part Programming (in word address format or ATP) experiment for drilling operation (point to point) and running on CNC machine
4. Part Programming (in word address format or ATP) experiment for milling operation (contouring) and running on CNC machine

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

Name of program: **Bachelor of Engineering**

Branch: **Common to All Branches**

Subject: **Innovative and Entrepreneurial skills**

Total Lab Periods: **24**

Maximum Marks: **40**

Semester: **VII**

Code: **337765(76)**

Batch Size: **30**

Minimum Marks: **24**

Unit I

Innovation

Innovation- an abstract concept; creativity, innovation and imagination; types of innovation - classified according to products, processes or business organizations.

Unit II

Entrepreneurship

Who is an entrepreneur? Entrepreneurship- A state of Mind, Emergence of entrepreneur; Role of Entrepreneur; A Doer not a Dreamer- Characteristics of an entrepreneur; Factors affecting entrepreneurial growth – Social, cultural, personality factors, psychological and Social Factors. Impact of entrepreneurship for sustainable development.

Unit III

Difference between entrepreneur and entrepreneurship

Difference between entrepreneur and entrepreneurship, Common Entrepreneurial competencies/Traits; Entrepreneurship stimulants, Obstacles inhibiting entrepreneurship; Types of entrepreneurs, Functions of an entrepreneur.

Unit IV

Identification of Business Opportunities

Introduction, Sources of Business of Product Ideas, Steps in Identification of Business opportunity and its SWOT Analysis.

UNIT-V

Techno-Economic Feasibility of the project

Introduction, Techno- Economic feasibility of the Project, Feasibility Report, Considerations while preparing a Feasibility Report, Proforma of Feasibility Report, Role of Institutions and entrepreneurship.

Text and Reference Books:

1. Competing through Innovation-Bellon & Whittington - Prentice Hall of India
2. A Guide to Entrepreneurship – David Oates- JAICO Publishing House.
3. Entrepreneurship- Robert D Hisrich, Peters, Shepherd- TMH
4. Entrepreneurship in Action- Coulter - Prentice Hall of India
5. Entrepreneurship Management and Development – Ajith Kumar - HPH
6. Fundamentals of entrepreneurship- Mohanty - PHI
7. Patterns of Entrepreneurship- Jack M Kaplan – Wiley
8. Innovation and Entrepreneurship Practice And Principles- Drucker, Petere- East West Press

Chhattisgarh Swami Vivekanand Technical University, Bhilai (C.G.)

SCHEME OF TEACHING AND EXAMINATION

B.E. VIII SEMESTER MECHANICAL ENGINEERING

S. No.	Board of Study	Sub. Code	SUBJECT	PERIODS PER WEEK			SCHEME OF EXAM Theory/Practical			Total Marks	Credit L+(T+P)/2
				L	T	P	ESE	CT	TA		
1.	Mech. Engg	337831(37)	Robotics	4	1	-	80	20	20	120	5
2.	Mech. Engg	337832(37)	Finite Element Methods	4	1	-	80	20	20	120	5
3.	Mech. Engg	337833(37)	Industrial Engineering & Management	4	1	-	80	20	20	120	5
4	Refer Table - III		Professional Elective-III	4	1	-	80	20	20	120	5
5	Refer Table - IV		Open Elective-IV	4	1	-	80	20	20	120	5
6	Mech. Engg	337861(37)	Robotics Lab	-	-	2	40	-	20	60	1
7	Mech. Engg	337862(37)	Finite Element Methods Lab	-	-	2	40	-	20	60	1
8	Mech. Engg	337863(37)	Industrial Engineering & Management Lab	-	-	2	40	-	20	60	1
9	Mech. Engg	337864(37)	Major Project	-	-	6	100	-	80	180	3
10	Mech. Engg	337865(37)	Report Writing & Seminar	-	-	2	-	-	40	40	1
11			Library	-	-	1	-	-	-	-	-
Total				20	5	15	620	100	280	1000	32

L – Lecture,

ESE – End Semester Exam,

T – Tutorial,

CT – Class Test,

P – Practical,

TA – Teacher’s Assessment

Table – III
Professional Elective - II

S.No.	Branch	Subject Code	Subject
1	Mechanical	337841(37)	Mechatronics
2	Mechanical	337842(37)	Vibration & noise control
3	Mechanical	337843(37)	Optimization Techniques
4	Mechanical	337844(37)	Computational Fluid Dynamics
5	Mechanical	337845(37)	Soft Computing Techniques
6	Mechanical	337846(37)	Environment Pollution & Control
7	Mechanical	337847(37)	Mechanical Handling System & Equipments

Note: (1) 1/4th of total strength of students subject to minimum strength of 20 students is required to offer and elective in the college in a particular academic session.

Note: (2) Choice of elective course once made for an examination cannot be changed in future examinations.

Table - IV

Open Elective –IV		
S.No. Board of Studies	Code	Name of Subject
1 Management	300851(76)	Enterprise Resource Planning
2 Information Technology	300852(33)	E-Commerce & strategic IT
3 Management	300853(76)	Technology Management
4 Information Technology	300854(33)	Decision Support & Executive Information system
5 Computer Science & Engg.	300855(22)	Software Technology
6 Management	300856(76)	Knowledge Entrepreneurship
7 Management	300857(76)	Finance Management
8 Management	300858(76)	Project Planning, Management & Evaluation
9 Mechanical Engg.	300859(37)	Safety Engineering
10 Computer Science & Engg.	300801(22)	Bio Informatics
11 Mechanical Engg.	300802(37)	Energy Conservation & Management
12 Nanotechnology	300803(47)	Nanotechnology
13 Management	300804(76)	Intellectual Property Rights
14 Mechanical Engg.	300805(37)	Value Engineering
15 Civil Engg.	300806(20)	Disaster Management
16 Civil Engg.	300807(20)	Construction Management
17 Civil Engg.	300808(20)	Ecology and Sustainable Development
18 Chem. Engg.	300809(19)	Non Conventional Energy Sources
19 Electrical Engg.	300810(24)	Energy Auditing and Management
20 Mechanical Engg.	300811(37)	Managing Innovation & Entrepreneurship
21 Information Technology	300812(33)	Biometrics
22 Information Technolgy	300813(33)	Information Theory & Control
23 Computer Science & Engg.	300814(22)	Supply Chain Management
24 Computer Science & Engg.	300815(22)	Internet & Web Technology
25 Electrical Engg.	300816(24)	Electrical Estimation and Costing
26 Electrical& Electronics Engg.	300817(25)	Non Conventional Energy Sources

Note (1)-1/4th of total strength of students subject to minimum

Note -1/4th of total strength of students is required to offer an elective in the college in a particular academic session.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Robotics**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VIII**

Code: **337831(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objectives:

- To acquire the knowledge of basics of robotics and their importance.
- Understand fundamental theory of robot design.
- To acquire the knowledge on advanced algebraic tools for the description of motion.
- To develop the ability to analyze and design the motion for articulated systems.
- To acquire the knowledge of sensors, actuators and vision system used in robotics.

UNIT – I : Introduction

Fixed & flexible automation, evolution of robots and robotics, laws of robotics, progressive, advancement in robots, manipulator anatomy, arm configuration & work space, human arm characteristics, design and control issues, manipulation and control, actuators, sensors and vision, programming of robots, applications – material handling, processing applications, assembly applications, inspection applications etc, the future prospects, notations.

UNIT – II : Coordinate Frames, Mapping and Transforms

Coordinate frames, description of objects in space, transformation of vectors, inverting a homogeneous transform, fundamental rotation matrices. mechanical structure and notations, description of links and joints, kinematic modeling of the manipulator, Denavit – Hartenberg notation, kinematic relationship between adjacent links, manipulator transformation matrix.

UNIT – III : Kinematic Modeling of Robots

Position analysis - direct and inverse kinematic models of robotic manipulators, various examples. velocity analysis – Jacobian matrix, introduction to inverse kinematic model.

UNIT – IV : Robotic Sensors and Vision

Introduction regarding sensing technologies, sensors in robotics, classification, characteristics, internal sensors – position, velocity, acceleration sensors, force sensors, external sensors – proximity, touch and slip sensors. robotic vision, process of imaging, architecture of robotic vision systems, image acquisition, components of vision system, image representation, image processing.

UNIT – V : Motion Planning and Control of Robot Manipulators

Trajectory planning of robotic manipulator: joint space and Cartesian space techniques. open and close loop control, linear control schemes, examples of control models.

Robot applications

Industrial applications, material handling, processing applications, assembly applications, inspection application, principles for robot application and application planning, justification of robots, robot safety, non-industrial applications, robotic application for sustainable development.

Text Books:

1. Robotics & Control – R.K. Mittal & I.J. Nagrath – TMH Publications.
2. Introduction to Robotics Analysis, Systems Applications - Saced B. Niku, Pearson

Reference Books:

1. Principle of Robot Motion- Choset – PHI, Delhi
2. Kinematics and Synthesis of linkages – Hartenberg and Denavit – McGraw Hill.
3. Robotics Control Sensing - Vision and Intellgence – K.S. Fu, McGraw Hill.
4. Robotic Engineering – An Integrated Approach - R.D. Klafter – PHI. Delhi.
5. Introduction to Robotics - S.K. Saha – Mc Graw Hill.
6. Introduction to Robotics – Mechanics and Control - John J. Craig

Course Outcomes:

- Apply knowledge of robotics for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts in the design and development robots
- Demonstrate creativeness in designing and development of robotics.
- Identify, analyze and design of robots useful to the society.
- Work effectively with multidisciplinary robots.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Finite element methods**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VIII**

Code: **337832(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course objective

- Understand the fundamental concepts of FEM.
- Understanding the use and knowledge of fundamental stiffness matrix.
- Know the behaviour and usage of each type of elements covered in this course.
- Be able to prepare a suitable FE model for structural mechanical analysis problems.
- Can interpret and evaluate the quality of the results
- Be aware of the limitations of the FEM.

Unit-I : Formulation of Finite Element Equation starting from governing differential equation, Domain residual and minimization, Weighted residual method, Weak form of weighted residual method, solution of weak form using trial function, piecewise continuous trial function solution, formulation of one dimensional bar element using weak form of weighted residual element

Minimization of potential energy, Rayleigh-Ritz method, Piece-wise continuous trail function, finite element form of Rayleigh-Ritz method, finite element formulation derived from a functional, formulation of bar element and heat transfer element using Rayleigh-Ritz method

Unit-II : One dimensional finite element analysis, generic form of total potential for one dimensional case, determination of shape functions for linear bar finite element and quadratic bar finite element, stiffness matrix, one dimensional problems of structure mechanics and heat conduction

Unit-III : Stiffness matrix formulation for beam and frame element, Determination of shape functions and element matrices, Application problems

Unit-IV : Two dimensional finite element analysis, simple three node triangular elements, four node rectangular element, six node triangular element, natural coordinates, coordinate transformation, simple two dimensional problems, Gauss Quadrature Technique

Unit-V : Finite element analysis for plane stress and plane strain problem, Strain displacement matrix for 2-D elements, two-dimensional integrals. Application problems, Scalar field problems including heat conduction and flow problems.

TEXT BOOKS

1. Textbook of Finite Element Analysis – Seshu P – Prentice Hall of India.
2. Fundamentals of Finite Element Analysis - David Hutton – TMH, Delhi

REFERENCE BOOKS

1. Finite Element Method: Basic concepts & Applications- Alavala – PHI, Delhi
2. Finite Element in Engineering - T.R. Chandrupatla and Belegundu, Pearson, Singapore
3. Concepts and Applications of Finite element analysis - Cook, Robert – John Wiley
4. The Finite Element Method, A Practical Course - Liu and Quek. – McGraw Hill
5. The Finite Element Method in Engineering - S.S. Rao.
6. An Introduction to the Finite Element Method – J.N. Reddy – TMH, Delhi
7. Finite Element Method – Zienkiewicz. O C - TMH, Delhi
8. Finite Element Analysis: Theory And Programming – Krishnamoorthy C.S.- TMH, Delhi
9. Finite Element Procedure – K.J.Bathe – Prentice Hall of India
10. A First Course in The Finite Element Method – Logan – Cengage Learning

Course Outcome

- Apply knowledge of finite element method for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts finite element method in the analysis of structural and thermal systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary problems.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Industrial Engineering & Management**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VIII**

Code: **337833(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objectives:

1. To impart capability of successfully planning, controlling, and implementing projects.
2. Understand and apply the principles of maths, science, technology and engineering, involving industry-relevant problems.
3. Contribute to the profitable growth of industrial economic sectors by using IE analytical tools, effective computational approaches, and systems thinking methodologies.
4. Maintain high standards of professional and ethical responsibility.
5. Flourish and work effectively in diverse, multicultural environments emphasizing the application of teamwork and communication skills.
6. Practice life-long learning to sustain technical currency and excellence throughout one's career.

Unit-I : Introduction

History & development, objective, place of Industrial Engineering in an organization, relation with other department, system approach

Plant Location

Need for a suitable location, Plant location problems factors affecting location, quantitative method for evaluation of plant location.

Plant Layout

Objective & Principles, factors affecting layout, types of layout.

Unit-II : Work Study

Purpose, objectives and applications of work study, Productivity and work study.

Method Study

Introduction, procedure, flow process charts, Multiple activity chart, motion economy principles, Therbligs, cycle graph and chronocyclegraph.

Work Measurement

Definition, types, Time Study- selection & timing the job, rating, allowances, Numerical on Normal and standard time calculation.

Unit-III : Job Evaluation and Merit Rating

Definition, objectives, methods.

Wages and Incentives

Terminology, characteristics, factors, types of incentives, wage incentive plan, Rowan plan, Taylor's differential piece rate system, Emerson's efficiency plan, Halsey's 50-50 plan, Bedaux plan, Group task & Bonus system.

Unit-IV : Basic concepts and Functions of management

Nature, Purpose and Objectives of basic functions of management, Authority and Responsibility, social responsibility of manager, ethics and management.

Human Resource Management

Nature and Scope of Human Resource Planning, Recruitment and Selection, Training and Development, Career Growth, Grievances, Motivation – needs and types, Maslow hierarchy of needs theory, Herzberg two factor theory, Need-want-satisfaction chain, Quality of working life, job enrichment and job enlargement.

Unit-V :

Marketing Management

Marketing Environment, Marketing Mix, Advertising and Sales Promotion, Channels of Distribution.

Financial Management

Book keeping, financial statement Analysis, Financial Ratios, Capital Budgeting, Break-Even Analysis.

TEXT BOOKS

1. Industrial Engineering and Production Management -Martand Telsang - S.Chand.
2. Industrial Engineering & Management - S. Dalele & Mansoor Ali - Standard Publishers.

REFERENCE BOOKS

1. Industrial Engineering & Management ,A new perspective- Philip E Hicks - Mcgraw Hill
2. Company Essential of Management - H. Koonz and H. Wehrich – Mcgraw Hill
3. Marketing Management- Kotler Philip- Prentice Hall of India
4. Flexibility in Management - Sushil, Vikas publication - New Delhi
5. Human Resource Management - Luthans Fred - McGraw Hill, Inc.
6. Financial Management - M.Y. Khan and P.K. Jain - Tata Mc-Graw Hill
7. Fundamentals of Business Organizations and Management -Y.K. Bhusan - S. Chand
8. Industrial Management - K.K. Ahuja - Khanna Publishers
9. Introduction of work study - ILO, Geneva - Universal Publishing Corporation, Bombay
10. Motion and Time Study - Ralph M. Bannes - John Wiley & Sons
11. Work Study and Ergonomics - H.S. Shan - Dhanpat Rai & Sons

Course Outcomes:

- Ability to apply mathematics and science in Industrial engineering.
- Ability to design and conduct experiments, as well as to analyze and interpret data
- Ability to identify, formulate, and solve engineering problems
- Ability to use the techniques, skills, and modern engineering tools necessary for industrial engineering practice
- Ability to design, develop, implement and improve integrated systems that include people, materials, information, equipment, and people

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Mechatronics**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VIII**

Code: **337841(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objectives:

- To acquire the knowledge of basics of mechatronics and their scope.
- To acquire the knowledge of sensors and transducers.
- Understand fundamental of hydraulic and electrical actuators.
- To acquire the knowledge of data acquisition system and control system.
- To develop the ability to analyze and design mechatronics system.

UNIT – I : Introduction about Mechatronics, scope of Mechatronics, application, process control automation and N/c Machines.

UNIT – II : Sensors and Transducers

Introduction, classification, specification, characteristics of transducers, type of transducers displacement, strain, vibration pressure, flow, temperature, force & torque, tactile.

UNIT – III : Hydraulic Pneumatic & Electrical actuators

Pumps & Compressors, control valves & accessories, actuators, fluid power symbols, fluid power systems, switching devices, solenoids, motors.

UNIT – IV : Data Acquisition and Control System

Introduction, Quantizing theory, Analog to Digital Conversion, Digital to Analog (D/A) conversation, transfer function, transient response & frequency response & frequency response, stability criteria.

UNIT – V : Design of Mechatronics systems

Introduction, Automatic front and back and cutting in steel rolling mill, lift control system, CNC lathe, temperature control of a heat treatment furnace, EOT crane control panel, Grey grain separators, electrode arm control in electric arc furnace.

TEXT BOOKS

1. Mechatronics – N. Shanmugam – Anuradha Agencies
2. Mechatronics – HMT Limited – Tata McGraw hill, New Delhi

REFERENCE BOOKS

1. Mechatronics - Singh and Joshi – PHI New Delhi
2. Mechatronics :A Multi Disciplinary Approach– W. Bolton – Pearson Education - Singapore
3. Mechatronics System Design - Shetty D, Kolk Ra – PWS Publications, Boston
4. Mechatronics - Kamm, Lawrence J – Prentice Hall Of India
5. Mechatronics & Measurement Systems – Alciator David & Histan Michael – TMH Dehi
6. Mechatronics - Necsulescu D – Pearson, Singapore
7. Mechatronics Source Book – N.C.Braga – Cenegage Learning, Delhi
8. Mechatronics System Design – Devdas Setty & Richrd Kolk - Cenegage Learning, Delhi
9. Analytical Robotics and Mechatronics - Stadler W – Mcgraw Hill, New Delhi
10. Mechatronics: Electronics in Products & Processes- Bradley, D A; Dawson, D And Burd, N C Loader, A J - Taylor And Francies - Boca Raton

Course outcomes:

- Apply knowledge of mechatronics for understanding and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts of mechatronics in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.
- Identify, analyze and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

Chhattisgarh Swami Vivekanand Technical University, Bilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Vibration & Noise Control**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VIII**

Code: **337842(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objective:

- Introduce students to the Fundamentals of vibrations.
- Introduce students how to mathematical model the vibration and acoustics system.
- Introduce students to vibration system with single degree of freedom
- Introduce students to vibration system with multi-degree of freedom
- Enable students to analysis and measurements of sound.
- Introduce students to the noise and noise control.

UNIT- I : Fundamentals of vibrations

Simple harmonic motion, combination of two simple harmonic motions, beats, Fourier analysis Single degree of freedom system: Free un-damped vibrations: Equivalent systems linear and torsional, natural frequency estimation, energy methods
Damped vibrations : Damping models, structural, coulomb, and viscous damping, critically, under and over-damped system, logarithmic decrement

Forced vibrations : Harmonic excitation, support motion, vibration isolation, critical speeds of shafts in bending

UNIT- II : Two degree of freedom system

Free vibrations of spring coupled system, general solution, torsional vibrations, two degree of freedom mass coupled system, bending vibrations in two degree of freedom system, forced vibrations of an undamped two degree of freedom system, dynamic vibration absorber, forced damped vibrations

UNIT- III : Multi-degree of freedom system

Free un-damped analysis.

Numerical methods: Dunkerley's, Rayleigh, Holzer methods.

Experimental methods in vibration analysis:

Vibration measurement devices and analyzers, balancing of rigid rotors

UNIT- IV :Analysis and measurement of sound

One dimensional wave in a gas, sound perception and the decibel scale, the ear, combining sound levels in decibels, octave bands, loudness, weightings, directionality of acoustic sources and receivers, directivity index

UNIT- V : Noise control

Noise criteria, sound absorption and insulation, noise barriers, acoustic enclosures, silencers

TEXT BOOKS

1. Mechanical Vibrations –Thomson W T- Prentice Hill of India
2. Theory & Practice of Mechanical Vibrations – J.S. Rao, Gupta - New Age International.

REFERENCE BOOKS

1. Mechanical Vibrations and Noise Engineering – A G Ambekar – PHI, Delhi
2. Mechanical Vibrations – G.K. Grover - S. Chand & CO.
3. Acoustics for Engineers - Turner & Pretlove - Macmillan
4. Acoustics and Noise Control - Smith, Peters & Owen - Addison-Wesley-Longman.
5. Industrial Noise Control: Fundamentals and Applications - Bell and Bell, Marcel-Dekker
6. Vibration And Noise For Engineers – Kewal Pujara – Dhanpat Rai, Delhi
7. Environmental Noise Pollution and its Control – G R Chhatwal – Anmol Publications, Delhi
8. Noise Pollution and Control – Singal S P – Narosa Publications, Delhi
9. Mechanical Vibrations and Noise Controls – Sadhu Singh – Khanna Publisher, New Delhi
10. Fundamentals of Noise and Vibration - Fahy FJ, Walker JG - E&Fnspon – New York

Course Objectives:

- Apply knowledge of Vibration & Noise Control for understanding, formulating and solving engineering problems.
- Acquire knowledge and hands-on competence in applying the concepts in the design and development of mechanical systems.
- Demonstrate creativeness in designing new systems components and processes in the field of engineering
- Identify, analysis, and solve mechanical engineering problems useful to the society.
- Work effectively with engineering and science teams as well as with multidisciplinary problems.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Optimization Techniques**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VIII**

Code: **337843(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objectives:

This course aims to introduce students to use advanced quantitative methods and techniques for effective decisions-making; model formulation and applications that are used in solving business decision problems.

UNIT – I : Optimization Technique

Classification of optimization, problems, single variable and multivariable optimization with equality constraints and Inequality constraints. Convex programming problem.

UNIT – II : Linear Programming - II

Duality in Linear programming, dual simplex method, decomposition principle, sensitivity analysis, quadratic programming, changes in cost coefficient, golden section method.

UNIT – III : Non-Linear Programming – I

Rate of convergence, Design variables, Random search methods, Chrivariate methods, Powell's method, Newton's method, Marquard Method, Test function.

UNIT – IV : Geometric Programming

Unconstrained minimization problem, primal dual relationship, geometric programming with mixed Eerie quality, application and complementary function.

UNIT- V : Dynamic Programming

Multistage Decision processes. principles of optimality, continuous dynamic programming.

TEXT BOOKS

1. Optimization Techniques – C.S. Rao – Dhanpat Rai & Sons, New Delhi
2. Optimization methods for Engineering Design – R.L. Fox - Addison Wesley

REFERENCE BOOKS

1. Engineering Optimization Theory and Practice – S.S. Rao – New Age Publishers.
2. Introduction to optimum Design – J.S. Arora – Mc. Grawhill publishers
3. Optimization Methods for Engineering – Raju – PHI, Delhi
4. Foundation of Mathematical optimization – Pallaschke – Kluwer Academic Publishers
5. Optimization Methods in Operations Research and System Analysis–K V Mittal–Wiley, Delhi
6. Engineering Optimization: Theory And Practice - Singiresu S Rao – New Age
7. Optimization For Engineering Design- Deb, Kalyanmoy-Prentice Hall
8. Optimization Methods – Mohan & Deep- New Age, Delhi
9. An Introduction to Optimization- Chang, Edwin& Zak Stanislaw -John Wiley, New York
10. Optimization Concepts And Applications In Engineering – Belegundu & Chandrupatla-Pearson, Singapore

Course Objectives:

- Ability to understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively.
- Knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry.
- Skills in the use of Operations Research approaches and computer tools in solving real problems in industry.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Computational Fluid Dynamics**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VIII**

Code: **337844(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objective:

1. To introduce the student to widely used techniques in the numerical solution of fluid equations, issues that arise in the solution of such equations, and modern trends in CFD.
2. To acquire core knowledge of the fundamentals of CFD for engineers, and an introduction to the methods and analysis techniques used in CFD.
3. By studying a variety of flow situations students will develop a better intuition of fluid mechanics more quickly than is possible with traditional analytical approaches.
4. Quantify and analyze the numerical error in CFD discretization schemes.
5. Develop finite difference and finite volume forms of the CFD equations and important model systems
6. Formulate explicit and implicit algorithms for solving the Navier-Stokes equations..
7. Understand and apply verification strategies for evaluating CFD code.

UNIT I

Fundamental Concepts

Introduction- Governing Equations of Fluid Dynamics. Mathematical Behavior of Partial Differential Equations - Elliptic, Parabolic and Hyperbolic equations. Physical Classification of fluid dynamics problems, Well-posed problems.

UNIT II

Finite Element and Finite Difference Method

Overview of Finite Element and Finite difference Techniques in Computational Fluid Dynamics. Strong and Weak Formulations of a Boundary Value Problem.

UNIT III

Finite Volume Schemes

General Discretisation Methodologies: Cell Centered Formulation- Lax-Vendoroff Time Stepping, Runge-Kutta Time Stepping, Multi-stage Time Stepping. Cell Vertex Formulation - Multistage Time Stepping. Discretisation of convective fluxes: Flux-vector splitting formulation, Flux-difference splitting formulation. Up-wind formulation.

UNIT IV

Discretization

Boundary layer Equations and methods of solution -Implicit time dependent methods for inviscid and viscous compressible flows - Concept of numerical dissipation --Stability properties of explicit and implicit methods - Conservative up-wind discretization for Hyperbolic systems - Further advantages of upwind differencing.

UNIT V

Principles of Grid Generation

Structured grid: C-, H- and O-Grid topology. Algebraic, Elliptical and Hyperbolic Grid Generation, *Unstructured grid:* Delaunay Triangulation, Advancing-Front Method, Generation of Anisotropic Grids, Mixed-Element/Hybrid Grids, Assessment and Improvement of Grid Quality,

TEXT BOOKS

1. Introduction to computational fluid dynamics: the finite volume method - Versteeg, & Malalasekera - Addison-Wesley.
2. Introduction to Computational Fluid Dynamics – Niyog & Chakraborty – Pearson ,Singapore

REFERENCES

1. Computational Techniques for Fluid Dynamics, - Vols. I and II - Fletcher C.A.J. – Springer, Verlag, Berlin, 1988.
2. Computational Fluid Dynamics:An Introduction - John F. Wendt (Editor) – Springer, Verlag, Berlin.
3. Numerical Computation of Internal and External Flows, Vols. I and II - Charles Hirsch - John Wiley & Sons, New York.
4. Computational Fluid Dynamics for Engineers, Vols. I & II - . Klaus A Hoffmann and Steve T. Chiang - Engineering Education System, W. Wichita, K.S., 67208 – 1078 USA.
5. Fundamentals of Aerodynamics - Anderson, Jr.D - McGraw Hill.

Contribution to Outcome:

- Develop an understanding for the major theories, approaches and methodologies used in CFD.
- Build up the skills in the actual implementation of CFD methods for mechanical engineering design, analysis and application.
- Work effectively with engineering and science teams as well as with multidisciplinary designs.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Soft computing techniques**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VIII**

Code: **337845(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objectives:

- To familiarize with concepts of soft computing
- To introduce the ideas of neural networks, fuzzy logic and use of heuristics based on human experience.
- To introduce the concepts of Genetic algorithm and its applications to soft computing using some applications.

UNIT – I : Introduction - Introduction to soft computing; introduction to biological and artificial neural network, introduction to fuzzy sets and fuzzy logic systems.

UNIT – II : Artificial neural networks and applications - Different artificial neural network models, learning in artificial neural networks, neural network applications in control systems.

UNIT – III : Fuzzy systems and applications - Fuzzy sets; fuzzy reasoning, fuzzy inference systems, fuzzy control, fuzzy clustering, applications of fuzzy systems.

UNIT – IV : Neuro-fuzzy systems - Neuro-fuzzy modeling, Neuro-fuzzy control.

Genetic Algorithms- Simple GA, crossover and mutation, genetic algorithms in search and optimization.

UNIT – V : Applications- Pattern Recognitions, Image Processing, Biological Sequence Alignment and Drug Design, Robotics and Sensors, Information Retrieval Systems, Share Market Analysis, Analysis language processing.

TEXT BOOKS

1. Fuzzy Logic And Soft Computing – Chen, Guoging, Ving, Mingsheng & Cai, Kai Yuan Ed - Kluwar Academic Publications, Usa
2. Soft Computing and Intelligent Systems Design Theory Tools and Applications – Karray F O & Desilva C – Pearson, New Delhi

REFERENCE BOOK

1. A Computational intelligence: principles, techniques, and applications - Konar - Springer.
2. Introduction to pattern recognition: statistical, structural, neural, and fuzzy logic approaches: Friedman, M & Kandel, A. - World Scientific.
3. Neuro-fuzzy and soft computing: a computational approach to learning and machine intelligence - Jang, J S R, Sun, C T, & Mizutani E - Prentice Hall.
4. An introduction to genetic algorithms- Mitchell M - MIT press.
5. Fuzzy Logic with Engineering Applications - Ross T J - John Wiley & Sons

Course Outcomes:

- Identify and describe soft computing techniques and their roles in building intelligent machines
- Recognize the feasibility of applying a soft computing methodology for a particular problem
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems
- Apply genetic algorithms to combinatorial optimization problems
- Apply neural networks to pattern classification and regression problems
- Effectively use existing software tools to solve real problems using a soft computing approach
- Evaluate and compare solutions by various soft computing approaches for a given problem.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Environmental Pollution & Control**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VIII**

Code: **337846(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objectives:

- To provide an introduction to Environmental Pollution.
- To develop an understanding of the causes, chemistry and effects of pollution.
- To build awareness of the strategies used to control and manage pollution.
- To make aware of Environmental Laws & Acts

UNIT-I

Environmental Pollution – Introduction & Classification

Sources and classification of air pollutants, aerosols, primary and secondary air pollutants, effect of air pollution on human health, effect of SO₂, CO₂, NO₂ H₂S and lead, economic effect of air pollution, mechanism of deterioration in polluted atmosphere. Factors influencing atmospheric deterioration, effect of air pollution on building materials, paints, textiles, rubber, leather, paper and electronic industry.

UNIT – II

Environmental Pollution - Sources

Air pollution due to automobiles, exhaust, Crankcase and evaporative emissions and their control, effect of various parameters of I.C. engines on air pollution, photochemical air pollution, air pollution from ferrous metallurgical operations and thermal power plants.

UNIT – III

Chemistry of Pollution

Definition of pollutant concentrations, mass concentration, volume concentration, mass-volume concentration and relationship between these concentrations, smoke and its control. Ningalmam smoke chart, smoke prevention and control of air pollution by process change, elementary ideas of control of gaseous contaminants for combustion and absorption.

UNIT – IV

Pollution Control

Control of air pollution by equipment, objectives of using control equipment, objectives of using control equipment, settling chambers, inertial separators, cyclones, principle of electrostatic precipitators, descriptive study of the above equipment only, merits and demerits of the equipment, choice of equipment.

UNIT – V

Environmental Laws & Acts

Air pollution indices, definition of air pollution index, type and use of air pollution indices, criteria for a standardized index, acid rain, causes of acid rain and its remedy, green house and its effect, air pollution legislation and regulations, constitution of the Board, functions of the central board and state boards, classification of pollution sources under Air Act 1981 and 1986.

TEXT BOOKS

1. Environmental Chemistry and Pollution Control - S S Dara – S Chand , New Delhi
2. Air Pollution - M.N. Rao and H.V.N. Rao – TMH, New Delhi.

REFERENCE BOOKS

1. Air Pollution Control Theory - Martin Crawford.- TMH, New Delhi
2. Encyclopaedia of Environment Control Technology & Air Pollution Control – Cheremisinott P N – Gulf Publication, London
3. Pollution Control Hand Book - Utility Publication,Securndarabad
4. Environmental Pollution Conservation And Planning - Pashupatinath & Siddh Nath - Chugh Publications, Allahabad
5. Environmental Air Pollution and Its Control - Chhatwal, Mehra & Katyal - Anmol Publications, New Delhi
6. Environmental Pollution Control Engineering – Rao C S –Wiley, New Delhi
7. Environmental Pollution Analysis – Khopkar S M- Wiley, New Delhi
8. Air Pollution Control Technology - R.W. Bethewaven - Van Nostrans.
9. Air Pollution & Control – KVSG Murali Krishnan – Kaushal & Company
10. Air Pollution & Control Technologies – Y. Anjaneyulu – Allied Publishers
11. Water & Air Pollution & Environmental Protection Laws, Vol. - II – M C Mehta – Delhi Law House

Course Outcomes

- Understand contemporary pollution issues.
- Have insight into specific examples of environmental pollution.
- Understand the causes and effects of key types of environmental pollution.
- Appreciate different pollution control strategies.
- Awareness of Environmental Laws & Acts

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Mechanical Handling System and Equipments**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VIII**

Code: **337847(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objectives:

- To introduce to the importance of proper material handling and storage techniques.
- To introduce to selection of material handling equipment
- To introduce to design considerations of mechanical handling equipment and load lifting attachments

UNIT – I

Elements of Material Handling System

Importance, Terminology, objectives and benefits of better Material Handling, Principles and features of Material Handling System, Interrelationships between material handling and plant layout, physical facilities and other or organizational functions, Classification of Material Handling Equipment.

UNIT – II

Selection of Material Handling Equipment

Factors affecting for selection, Material Handling Equation, Choices of Material Handling Equipment, General analysis Procedures, Basic Analytical techniques, the unit load concept Selection of suitable types of systems for applications, Activity cost data and economic analysis for design of components of Material Handling Systems, functions and parameters affecting service, packing and storage of materials.

UNIT – III

Design of Mechanical Handling Equipment

Design of Hoists, Drives for hoisting, components, and hoisting mechanisms, rail traveling components and mechanisms, hoisting gear operation during transient motion, selecting the motor rating and determining breaking torque for hoisting mechanisms. Design of Cranes, Hand-propelled and electrically driven E.O.T overhead traveling cranes, Traveling mechanisms of cantilever and monorail cranes, design considerations for structures of rotary and cranes with fixed radius, fixed post and overhead traveling cranes, Stability of stationary rotary and traveling rotary cranes.

UNIT – IV

Design of load lifting attachments

Load chains and types of ropes used in Material Handling System, Forged, Standard and Ramshorn Hooks, Crane Grabs and Clamps, Grab Buckets, Electromagnetic Design consideration for conveyor belts, Application of attachments.

UNIT – V

Study of systems and Equipment used for Material Storage

objectives of storage, Bulk material handling, Gravity flow of solid through slides and chutes, Storage in bins and hoppers, Belt conveyors, Bucket-elevators, Screw Conveyors, cabin vibratory Mobile racks etc.

Text Books:

1. Material Handling Equipments - N. Rudenko - Peace Publishers, Moscow.
2. Material handling System Design - James M. Apple, John-Wiley Publication, New York.

Reference Books:

1. Materials Handling Principals and Practice - Allegri T H - CBS Publication, New Delhi
2. Material Handling - John R. Immer - McGraw Hill Co. Ltd., New York.
3. Material Handling in Machine shops - Machinery Publication Co. Ltd., London.
4. Material Handling Equipment - M. P. Nexandr - MIR Publication, Moscow.
5. Bulk Solid Handling - C. R. Cock and J. Mason - Leonard Hill Publication Co. Ltd. U.S.A.
6. Material Handling Hand Book - Kulwiac R. A - John Willy Publication, New York.

Course outcomes

- The students will be able to identify material handling equipment requirements for a specific process and for various locations and working conditions
- The students will be able to understand the benefit of an efficient material handling system
- The students will be able to recognize the importance of material storage equipments.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Safety Engineering**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VIII**

Code: **300859(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objectives:

- To Know safety philosophy and principles of accident prevention
- To know the safety rules, regulations, standards and codes
- To achieve an understanding of principles of safety management.
- To learn about various functions and activities of safety department.
- To study various mechanical machines and their safety importance.

UNIT – I

Safety philosophy and principles of accident prevention

Introduction, accident, injury, unsafe act, unsafe condition, reportable accidents, need for safety, break down of accidents, hazardous industries. Theories & principle of accidents casualty, cost of accident, computation of cost, utility of cost data.

Accident reporting & Investigation, Identification of the key facts, corrective actions, classification of facts.

Regulation- American (OSHA) and Indian Regulation.

UNIT – II

Safety Management

Division of responsibility, location of Safety function, size of safety department, qualification, for safety specialist, safety committee – structure and functions.

UNIT – III

Safe working condition and their development

Standard Operating Procedure (SOP) for various mechanical equipments, incidental safety devices and methods, statutory of provisions related to safeguarding of Machinery and working condition.

UNIT – IV

Safety in Operation and Maintenance

Operational activities and hazards, starting and shut down procedures, safe operation of pumps, compressor, heaters, reactors, work permit system, entry into confined spaces.

UNIT – V

Safety in Storage and Emergency Planning

Safety in storage, handling of chemicals and gases, storage layout, ventilation, safety in chemical laboratories, emergency preparedness on site plan, off site plan, toxic hazard control.

TEXT BOOKS

1. Safety Management : Strategy And Practice - Pybus R - Butterworth Heinmann, Oxford
2. Safety and Accident Prevention in Chemical Operation – H.H. Fawcett and Wood

REFERENCE BOOKS

1. Industrial Safety Management- Trafdar N K, Tarafdar K J – Dhat Rai, New Delhi
2. Safety Management In Industry- Krishna, N V- Jaico Publication House; New Delhi
3. Industrial Safety And Pollution Control Hand Book - Nagraj, J N & Rameshchandar, R V - Associate Publisher, Securdabad
4. Fire and Safety Manual Refineries and Petrochemical Panel - National Safety Council, Bombay
5. Safety in Use of Compressed Gas Cylinders - National Safety Council, Bombay
6. Encyclopaedia of Occupational Health and Safety - Stallman I M, Mccann M, Warshaw L, Brabant C - International Labour Office, Geneva
7. Industrial Safety Environmental Pollution Health Hazard And Nuclear Accidents - A Chand - Mittal Publication, New Delhi
8. Personal Protective Equipment – National Safety Council, Bombay
9. Accident Prevention Manual for Business and Industrial Administration and Programs - Krieger, G R Montgomerji - National Safety Council, Ittenois.
10. Major Hazard Control A Practical Manual – ILO - National Safety Council, Bombay

Course Outcomes:

- Ability to understand the functions and activities of safety engineering department.
- Apply knowledge of safety engineering specialization for hazard identification, risk assessment and control of occupational hazards.
- Communicate effectively on health and safety matters among the employees and with society at large.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Value Engineering**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VIII**

Code: **300805(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objectives:

- The objective of this course is to introduce students with the methodology of Value Engineering and its decision-making process.
- To familiarize students with procedures that provides standards for Value Engineering applications.
- To teach value engineering in a practical, project-based manner.
- During the course student will be engaged in decision-making using Value Engineering tools to ensure quality and value while reducing the cost of projects.
- Student will know about a number of case study applications of the Value Engineering to gain practical experience.

UNIT – I : Basic Concepts

Meaning of the term value, basic kind, reasons for poor value, value addition, origin and history.

Benefits, relevance in Indian scenario.

UNIT – II : Techniques

Different techniques, organizing value engineering study, value engineering and quality.

UNIT – III : Job Plan

Different phases, General phase, Information phase, Functional Phase, Creation Phase, Evaluation Phase, Investigation Phase, Implementation Phase, Audit.

UNIT – IV : Selection of evaluation of VE Projects

Project selection, method selection, value standard, application of methodology.

UNIT – V : Value Engineering Program

VE operations in maintenance and repair activities, VE Cost, life cycle, cost model, training for VE, general value engineering, case studies.

TEXT BOOKS

1. Value Engineering a How to Manul– S.S. Iyer – New Age International Publishers, New Delhi
2. Industrial Engineering & Management – O.P. Khanna – Dhanpat Rai & Sons

REFERENCES

1. Techniques of Value Analysis and Engineering – L.D. Miles – McGraw Hill, New York
2. Value Engineering: A Systematic Approach – A.E. Mudge – McGraw Hill, New York
3. Getting More at Less Cost: The Value Engineering Way - Jagannathan G - TMH, New Delhi
4. Value Engineering a Practical Approach for Owners Designers & Constructors – Zimmerman LW & Gilen HD – CBS, New Delhi.
5. Compendium on Value Engineering – H.G. Tufty – Indo-American Society.

Course Outcome:

- Understand the basics of Value Engineering (VE) to ensure that a standardized method is used for VE applications to projects
- Learn to perform function analysis for projects
- Understand the appropriate time to apply VE for projects

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Managing Innovation & Entrepreneurship**

Total Theory Periods: **40**

Class Tests: **Two (Minimum)**

ESE Duration: **Three Hours**

Semester: **VIII**

Code: **300811(37)**

Total Tutorial Periods: **10**

Assignments: **Two (Minimum)**

Maximum Marks: 80 Minimum Marks: 28

Course Objective

1. The course will provide a thorough coverage of conceptual framework on Entrepreneurship development.
2. Enhances student's innovation skill.
3. Helps to provide a quick understanding of essential concepts and issues.
4. Enhance the students to have an understanding about international entrepreneurship.
5. Understand the problems and prospects related to setting up of any type of business.

UNIT – I

Introduction to Entrepreneurship

Evolution of entrepreneurship from economic theory Managerial and entrepreneurial growth and development.

UNIT – II

Creativity and Innovation

Creativity and Innovation: Concepts shifting composition of the Economy purposeful innovation and the seven sources of innovative opportunity the innovation process. Innovative strategies: Strategies that aim at introducing an innovation. Innovation and entrepreneurship: Can they together? Planning – innovation and entrepreneurship.

UNIT – III

Entrepreneurial Motivation

Need for continuous learning & relearning Acquiring technological Innovation Entrepreneurial motivation (nAch story) Achievement Motivation in Real life. Case Study.

UNIT – IV

International Entrepreneurship

Concepts and nature of international entrepreneurship. The changing international environment. Ethics and international entrepreneurship. Strategic issues in international entrepreneurship.

UNIT – V

Problem identification and problem solving

Problem identification. Problem solving. Innovation and diversification.

TEXT BOOK

1. Managing innovation and entrepreneurship in technology based firm-Martin M J-John Willey
2. Managing technology innovation- Ettlite I E - John Willey & Sons.

REFERENCE BOOKS

1. discipline of innovation - Drucker P F -The Harvard business school press , May-June1985.
2. The innovator's solution: Creating and sustaining successful growth - Christensen, C. M. and Raynor, M.E. (2003) - Boston, M. A.: Harvard Business School Press.
3. Innovation(Collection of articles) - Drucker, P. F. (1985) - Harvard Business School Press(2001).
4. Harvard Business Review on entrepreneurship(Collection of articles) - Harvard Business School Press
- 5) Diffusion of innovations, 5th edition - Rogers, E. M. (2003) - New York: Simon and Schuster.

Course Outcomes

Work effectively with engineering and science teams

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Robotics Lab**

Total Lab Periods: **24**

Maximum Marks: **40**

Semester: **VIII**

Code: **337861(37)**

Batch Size: **30**

Minimum Marks: **20**

List of Experiments:

1. Demonstration of Cartesian/ cylindrical/ spherical robot.
2. Demonstration of Articulated/ SCARA robot.
3. Virtual modeling for kinematics and dynamic verification any one robotic structure using suitable software.
4. Design, modeling and analysis of two different types of grippers.
5. Study of sensor integration.
6. Two program for linear and non-linear path.
7. Study of robotic system design.
8. Programming for forward kinematics problems.
9. Dynamic analysis of manipulators using software.
10. Study and demonstration of actuators and vision system.
11. Study of various robotic applications.
12. Setting robot for any one industrial application after industrial visit.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Finite Element Methods Lab**

Total Lab Periods: **24**

Maximum Marks: **40**

Semester: **VIII**

Code: **337862(37)**

Batch Size: **30**

Minimum Marks: **20**

Minimum eight assignments are to be completed on following area using appropriate Software.

1. Structural Analysis
2. Thermal Analysis
3. Fluid Flow Analysis
4. Coupled Field Analysis
5. Modal Analysis

Minimum four problems shall be solved with Manual calculations in any of area specified above.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**

Branch: **Mechanical Engineering**

Subject: **Industrial Engineering & Management Lab**

Total Lab Periods: **24**

Maximum Marks: **40**

Semester: **VIII**

Code: **337863(37)**

Batch Size: **30**

Minimum Marks: **20**

EXPERIMENTS TO BE PERFORMED (MINIMUM TEN EXPERIMENTS)

1. To prepare the charts & diagrams for a selected problem according to the existing method and an improved method -men type flow process chart.
2. To prepare the charts & diagrams for a selected problem according to the existing method and an improved method -material type flow process chart
3. To prepare the charts & diagrams for a selected problem according to the existing method and an improved method -machine type flow process chart
4. To prepare the charts & diagrams for a selected problem according to the existing method and an improved method – multiple activity chart.
5. Study of principles of fundamentals of hand motion.
6. Study & applications of principles of motion economy.
7. Performance of micro motion study of a job.
8. Problems in assignment of men & machines.
9. Training for a performance rating using walking exercises / audio visual aids.
10. Calculation of allowance for a job.
11. Standard time calculation problems.
12. Problems of wage incentive.
13. Case study of an industrial/service organization using a method study techniques.
14. Stop watch time study of a job.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Engineering**
Branch: **Common to all branches**
Subject: **Report Writing & Seminar**
Total Lab Periods: **24**
Maximum Marks: **40**

Semester: **VIII**
Code: **337865(37)**
Batch Size: **30**
Minimum Marks: **24**

Unit -I

Introduction to Technical Writing

How differs from other types of written communication Purpose of technical writing, Correspondence: prewriting, writing and rewriting Objectives of Technical Writing. Audience Recognition: High-tech audience, Low tech audience, Lay audience, Multiple Audience.

Unit - II

Correspondence

Memos, Letters, E-mails, Its differentiation, types of letters, Document Design, its importance, Electronic Communication: Internet, Intranet, extranet, Writing effective e-mail.

Unit - III

Summary

Report Strategies, Effective style of technical report writing: Structures: content, introduction, conclusions, references, etc., Presentation, Writing first draft, revising first draft, diagrams, graphs, tables, etc. report lay-out.

Unit -IV

Report Writing

Criteria for report writing, Types of Report: Trip report, Progress report, lab report, Feasibility report, project report, incident report, etc. Case studies.

Unit -V

Proposals & Presentation

Title page, Cover letter, Table of Content, list of illustrations, summary, discussion, conclusion, references, glossary, appendix, Case Studies. Oral Presentation/ Seminar:

Text Books:

1. Technical Writing – Process & Product - Sharon J.Gerson & Steven M. Gerson - Pearson.
2. Business Correspondence & Report Writing – Sharma R C & Krishnamohan – TMH

Reference Books:

1. Communication Skills for Engineers - Sunita Mishra - Pearson Education
2. Communication for engineering students - Longman
3. Effective Technical Communication – Eisenbergm- McGraw Hill.
4. Technical Writing & Professional Communication for Non Native Speakers of English – Huckin T N & Olsen L A – Mcgraw Hill
5. Academic Writing: A Guide For Management Students And Researchers - Monippally M M and Pawar B S – Response Books,New Delhi.