CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Scheme of Teaching and Examination
B.E. VI SEMESTER MECHANICAL ENGINEEERING

S. No.	Board of Study	Subject Code	Subject	Periods per week			Scheme of Exam			Total Marks	Credit L+(T+P)/2
				L	T	P	Theory/ Practical				
							ESE	CT	TA		
1	Mech. Engg.	337611 (37)	Machine Design - II	4	1	-	80	20	20	120	5
2	Mech. Engg.	337612 (37)	Turbo Machinery	4	1	-	80	20	20	120	5
3	Mech. Engg.	337613 (37)	Energy Conversion Systems	4	1	-	80	20	20	120	5
4	Mech. Engg.	337614 (37)	Machine Tool Technology	4	1	-	80	20	20	120	5
5	Mech. Engg.	337615 (37)	Industrial Engineering	3	1	-	80	20	20	120	5
6	Refer Table		Professional Elective - I	4	1	-	80	20	20	120	4
7	Mech. Engg.	337621 (37)	Machine Design - II Lab	-	-	2	40	-	20	60	1
8	Mech. Engg.	337622 (37)	Energy Conversion Systems Lab	-	-	2	40	-	20	60	1
9	Mech. Engg.	337623 (37)	Industrial Engineering Lab	-	-	2	40	-	20	60	1
10	Mech. Engg.	337624 (37)	Computer Aided Design Lab	-	-	2	40	-	20	60	1
11	Management	300625 (36)	Managerial Skills	-	-	2	-	-	40	40	1
12			Library	-	-	1	-	-	-	-	-
			Total	**23**	**6**	**11**	**640**	**120**	**240**	**1000**	**34**

L – Lecture, T – Tutorial, CT- Class Test,
P – Practical, ESE- End Semester Exam ,
TA – Teacher's Assessment

Note : Industrial Training of twelve weeks is mandatory for B.E. students. It is to be completed in two equal parts. The first part must have been completed in summer after IV sem. The second part to be completed during summer after VI sem. after which students have to submit a training report which will be evaluated by college teachers during B.E. VII sem.

Table - 1
Professional Elective-I

S.No.	Branch	Subject Code	Subject
1	Mechanical	337631 (37)	Fluidics & Hydraulic Control
2	Mechanical	337632 (37)	Automatic Control
3	Mechanical	337633 (37)	Engineering Economics
4	Mechanical	337634 (37)	Composite Materials
5	Mechanical	337635 (37)	Power Plant Engineering
6	Mechanical	337636 (37)	Maintenance and Reliability
7	Mechanical	337637 (37)	Tribology

Note (1) – 1/4th of total strength of students subject to minimum of twenty students is required to offer an 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)

Semester: VI
Subject: Machine Design – II
Total Theory Periods: 50
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 2

Branch: Mechanical Engg.
Code: 337611 (37)
Total Tutorial Periods: 12

Note: 1) Design data book by PSG and ISI data sheets are allowed in the examination.
2) The duration of the paper is 4 (four) hours.

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, Sommerfield number, heat balance, self-contained bearings, bearing materials.

UNIT – V
Clutches
Friction clutches, Friction materials, Torque transmitting capacity, Single & Multiple plate clutch, centrifugal clutches.
Belt and Rope Drive:
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 from V.B. Bhandari, TMH Publications.
2. Machine Design by Shigley – McGraw Hill Pub.
REFERENCE BOOKS
1. Machine Design by Movnin – MIR Publishers
2. Machine Design by Sharma & Agrawal - Katson publications
3. Principles of Mechanical Design by R. Phelan – McGraw Hill Pub.
4. Machine Design by Suderraj Murthy – Khanna Publishers
5. Machine Design, theory & Practice by Michels Walter, J, Wilson Charles E. & Add, MacMilan Publishers, New York.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Semester: VI   Branch: Mechanical Engg.
Subject: Turbo Machinery   Code: 337612 (37)
Total Theory Periods: 50   Total Tutorial Periods: 12
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: **2**

UNIT – I
Impulse Turbine
Steam turbine – Principal of operation of steam turbine, types, 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, gross stage efficiency. Influence of ratio of blade to steam speed 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 section internal losses in steam turbine Nozzle, Losses, blade friction losses, disc friction losses, blade windage losses or partial admission losses, gland leakage or clearance losses, leaving velocity or residual loss, carry loss.

UNIT – III
State Point Locus and Reheat Factor
Factor-Stage, efficiency of impulse turbines, stage point locus of an impulse turbine, state point locus for multistage turbine reheat factor.
Internal efficiency, over all 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. Simple open cycle gas turbine Ideal and actual cycle (Brayton Cycle) for gas turbine Optimum pressure ratio for maximum specific output in actual gas turbine Regneration, 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 – By R. Yadav - Central Publishing House, Allahabad
2. Gas Dynamics with Application: S.K. Kulshrestha
REFERENCE BOOKS
1. Turbine compressors and Fans – S.M. Yahya - TMH
2. Gas Turbine – V. Ganeshan – TMH

Semester: B.E. VI Sem.   Branch: Mechanical Engg.
Subject: Energy Conversion Systems   Code: 337613 (37)

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Total Theory Periods: 50   **Total Tutorial Periods: 12**
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 2

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, earth sun angles, resolution, solar measurement, collection of solar energy, flat plate and focusing collector analysis, calculations and same design parameters. Applications of solar energy.
Introduction to Photovoltaic cell energy conversion techniques.

UNIT – IV

Bio-Mass
Gasifiers, Gobar Gas plant, types of applications, Biomass conversion technologies, biogas Generation.
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, OTEC.
Principle of 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.

High pressure boiler
Modification in Boiler, High Pressure Steam generators – La-Mont, Benson, Velox and Schmidt Hartmann Boilers.

TEXT BOOKS
1. Fundamentals of Compressible Flow with Aircraft and Rocket Propulsion – S.M. Yahya – New Age International Publishers
2. Gas Dynamics & Space Propulsion – N. Shanmugam, M. Palani – Anuradha Agencies
3. Non-Conventional Energy Sources - G.D. Rai – Khanna Publishers
REFERENCE BOOKS
1. Fundamental of Compressible Fluid Dynamics – P. Balachandran – PHI
2. Gas Turbine Theory & Jet Propulsion – J.K. Jain – Khanna Publishers
3. Solar Energy – Garg & Prakash – TMH Pub.
4. Non Conventional Energy Sources – D.S. Chauhan – New Age International Pub.
5. Solar Energy, R Sukhatme,

Semester: VI th   **Branch: Mechanical Engg.**
Subject: Machine Tool Technology   **Code: 337614 (37)**
Total Theory Periods: 50   **Total Tutorial Periods: 12**

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 2

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 Element
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.
Machine Tool Installation and Maintenance
Machine Tool installation, Machine Tool Maintenance, lubrication, reconditioning of machine tool.
Machine Tool Testing
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 - G.C. Sen, A. Bhattacharya – New Central Book Agency (P) Ltd., Calcutta
4. Machine Tool Practices – Kibbe Richard R – PHI, New Delhi
5. Principles of Machine Tool – G.C. Sen, A. Bhattacharya – New Central Book Agency, Calcutta

Semester: B.E. VI Sem.   **Branch: Mechanical Engg.**
Subject: Industrial Engineering   **Code: 337615 (37)**
Total Theory Periods: 40   **Total Tutorial Periods: 12**
Total Marks in End Semester Exam: 80

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Minimum number of class tests to be conducted: 2

UNIT – I
Introduction
History & development, system approach, relationship with other departments. Objective of Industrial Engineering, Place of Industrial engineering in an organization, related discipline, management, OR, statistics, ergonomics, manufacturing engineering.

Plant Location
Need for a suitable location, urban, suburban, systems approach, 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, charts, man-machine, flow process charts, motion economy principles, micro motion study - Therbligs, cyclegraph.

Work Measurement
Definition, types, selection & timing the job, rating, allowances, Normal and standard time determination, work sampling

UNIT -III
Job Evaluation & Merit Rating
Definition, objectives, methods, job rotation, job enlargement, job enrichment.

Wages & 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
Information systems in organizations
Role id IS in Industry, increasing value of Information Technology, Internet worked enterprise, Internet, Intranet and Extranet, Globalization and IT, competitative advantage with IT.

Business Process Re-Engineering
Definition, need & characteristics, Industrial Engineering & Re-engineering, advantages of
re-engineering.

UNIT V
Maintenance Management
Objectives and need for maintenance, types of maintenance, breakdown, predictive and preventive maintenanace

Equipment replacement policy
Reasons for replacement, deterioration, obsolescence, depreciation, method for depreciation calculation

Value Engineering & Value Analysis
Objectives & scope, application & techniques.

TEXT BOOKS
1. Industrial Engineering & Management –A new perspective, Philip E Hicks, Mcgraw Hill
2. Industrial Engineering & Management – O.P. Khanna – Dhanpat Rai & Sons

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

3. Introduction of work study, ILO, Geneva. Universal Publishing Corporation, Bombay

REFERENCE BOOKS
1. Industrial Engineering and Production Management – Martand Telsan – S. Chand & Company
2. Motion & Time Study – Mundel - PHI
4. Motion and Time Study – Ralph M. Bannes – John Wiley & Sons
5. Techniques of Value Engineering – L.D. Miles – Mc GrawHill
6. Work Study and Ergonomics – H.S. Shan – Dhanpat Rai & Sons
7. Industrial Engineering & Management – S. Dalele & Mansoor Ali – Standard Publishers & Distributors
8. Handbook of Industrial Engineering – Grant & Grant – PHI

Semester: B.E. VI Sem. **Branch: Mechanical Engg.**
Subject: Fluidics & Hydraulic Control **Code: 337631 (37)**
Total Theory Periods: 50 **Total Tutorial Periods: 12**
Total Marks in End Semester Exam: 80

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

Minimum number of class tests to be conducted: 2

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

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.

Hydraulic Fluid

Types of hydraulic fluids, properties of fluid, selection of fluids, JIC/ISO symbols for hydraulic circuits.

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 values 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 pvt. Ltd., New Delhi
2. Introduction to Fluid Power – Sahastrabadhe – Nirali Prakashan, Pune

REFERENCE BOOKS
1. Industrial Hydraulics – Pipenger & Hicks, Mc Graw Hill Company, New York
2. Fluid Power – Goodwin

Semester: B.E. VI Sem.   **Branch: Mechanical Engg.**
Subject: Automatic Control   **Code: 337632 (37)**
Total Theory Periods: 50   **Total Tutorial Periods: 12**
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 2

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

UNIT – I
Fundamentals of Instrumentation
Block diagram of automatic control system. Static and dynamic characteristics of instruments. types of errors and sources of errors. Comparison of hydraulic and pneumatic and electronic systems. Servomechanism.

UNIT - II
Transducers
Classification and selection of transducers. Application of transducers for measurement of parameters like displacement, velocity, acceleration, shock, pressure, flow level, Measurement of force and torque. Introduction to noise measurement.

UNIT - III
Fundamentals of control systems
Close loop and open loop control systems. Feed back, feed forward control systems for position, flow and temperature. Delays in process.

UNIT - IV
Control Valves
(a)   Types of control valves, characteristics of proportional control valves(spool valves). Application of control valves.
(b)   Actuators - Principle and types of actuators such as electrical, pneumatic, hydraulic, electro-pneumatic and electro- hydraulic. Study of Hydraulic and pneumatic control systems.

UNIT - V

PLC
Introduction, Micro PLC, Programming a PLC , Logic Functions ,input & output Modules, PLC Processors ,PLC Instructors, Documenting a PLC System, Timer & counter Instructions, Comparison & data Handling instructions, Sequencing Instructions, Mask Data representation, Typical PLC Programming Exercises for Industrial Applications.

TEXT BOOKS
1. Measurement Systems, Aplications and Design - Earnest Deobelin - McGraw Hill Publication.
2. Principles of Industrial Instrumentation - Pattarnabis - (IMH)

REFERENCE BOOKS
1. Process Control and Instrumentation/ Technology – C.D. Johnson - PHI.
2. Process Control hand Book - BG Liptak – Chilton
3. Computer based Industrial control - Krishna Kant – PHI
4. Mechanical Measurements - TG Beckwith and NL Buck - Narosa Publishing House New Delhi.

Semester: B.E. VI Sem.   **Branch: Mechanical Engg.**
Subject: Engineering Economics   **Code: 337633 (37)**
Total Theory Periods: 50   **Total Tutorial Periods: 12**
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 2

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

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

REFERENCES
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

Semester: B.E. VI Sem.   **Branch: Mechanical Engg.**
Subject: Composite Materials   **Code: 337634 (37)**
Total Theory Periods: 50   **Total Tutorial Periods: 12**
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 2

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

UNIT - I

Introduction

Definition of composite and their characteristics, polymeric materials, fiberous materials, polymeric composites, Review of force tensors, stress tensors, strain tensors

UNIT - II

Material Properties:

Anisotropic materials, properties relating stress to strain, properties relating temperature to strain, properties relating moisture to strain, properties relating stress (or strain) to failure

UNIT - III

Elastic Response of Anisotropic Material:

Hooke's Law, stress and environmental effects, unidirectional composite laminates; Hooke's law - referenced to principal material coordinate system; Hooke's law - referenced to arbitrary coordinate system, effective engineering properties

UNIT - IV

Multi-angle Composite Laminates:

Thin-plate theory, classical lamination theory, effective elastic engineering properties

UNIT - V

Manufacturing and testing: Moulding, pultrusion, filament winding, quality inspection methods, uniaxial tension test, uniaxial compression test-in plane shear test, fracture toughness testing of composites

TEXT BOOKS

1. Analysis and Performance of Fiber Composites - B.D. Agarwal and L.J. Broutmen - John Wiley and Sons, New York
2. Fiber reinforced Composite materials: Manufacturing and design – P.K. Mallick - Marcel Dekker Inc

REFERENCE BOOKS

1. Primer on composite Materials analysis – J.C. Halpin - Techomic publishing Co
2. Composite Materials Technology; Processes and Properties – P.K. Mallick and Newman - Hansen Publisher, Munich

Semester: B.E. VI Sem.   **Branch: Mechanical Engg.**
Subject: Power Plant Engineering   **Code: 337635 (37)**
Total Theory Periods: 50   **Total Tutorial Periods: 12**
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 2

UNIT-I

Elements of Power Plant

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C G)

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 stem 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, dearators, 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. A Text Book of Power Plant Engineering – R.K. Rajput – Laxmi Publications
2. A Course in Power Plant Engineering – Arora, Domkundwar – Dhanpat Rai & Co., 2005
REFERENCE BOOKS
1. Power Plant Engineering, 2nd Edn. – P.K. Nag – Tata McGraw-Hill Pub. Com., New Delhi, 2004
2. Power Plant Engineering – P.C. Sharma – S.K. Kataria & Sons, 2003
3. Power Plant Engineering – G.R. Nagpal – Khanna Publishers

Semester: VI th   **Branch: Mechanical Engg.**
Subject: Maintenance & Reliability Engg.   **Code: 337636 (37)**
Total Theory Periods: 50   **Total Tutorial Periods: 12**
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 2

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

Semester: B.E. VI Sem.
Subject: Tribology
Total Theory Periods: 50
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 2

Branch: Mechanical Engg.
Code: 337637 (37)
Total Tutorial Periods: 12

UNIT – I
Introduction

Nature of surfaces and contact, surface topography, friction and wear mechanisms and effect of lubricants, methods of fluid film formation.
Selection of rolling element bearings

Nominal life, static and dynamic capacity, equivalent load, probabilities of survival, cubic mean load, bearing mounting details, preloading of bearings, condition monitoring using shock pulse method.

UNIT - II
Hydrodynamic bearings
Fundamentals of fluid film formation - Reynold's equation; Hydrodynamic journal bearings - Sommerfeld number - performance parameters - optimum bearing with maximum load capacity - friction - heat generated and heat dissipated. Hydrodynamic thrust bearings: Raimondi and Boyd solution for hydrodynamic thrust bearings - fixed and tilting pads, single and multiple pad bearings - optimum condition with largest minimum film thickness.

UNIT - III
Hydrostatic bearings
Thrust bearings - pad coefficients - restriction - optimum film thickness - Journal bearings - design procedures. Aerostatic bearings: thrust bearings and journal bearings, design procedure.
Dry rubbing bearings
Porous metal bearings and oscillatory journal bearings, qualitative approach only.

UNIT - IV
Lubrication
Choice of lubricant type, oil, grease and solid lubricants, additives, lubrication systems and their selection, selection of pump, filters, piping design, oil changing and oil conservation.

UNIT - V
Seals
Different types, mechanical seals, lip seals, packed glands, soft piston seals, mechanical piston rod packing, labyrinth seals and throttling bushes, oil flinger rings and drain grooves, selection   of mechanical seals.
Failure of tribological components
Failure analysis of plain bearings, rolling bearings, gears and seals, wear analysis using SOAP and Ferrography.

TEXT BOOKS
1. Fundamentals of Tribology – S.K. Basu, S.N. Sengupta & B.B. Ahuja – PHI
2. Engineering Tribology – Prasanta Sahoo - PHI

REFERENCES BOOKS
1. Tribology Handbook - Neale M J - Neumann Butterworths, 1975
    Standard handbook of lubrication engineers - J J O' Connor & Boyd - ASLE, McGraw Hill Book Co., 1968
2. Hydrostatic and Hybrid Bearing Design - Rowe W W & O' Dionoghue - Butterworths & Co. Publishers Ltd, 1983

Semester: B.E. VI Sem.   **Branch: Mechanical Engg.**
Subject: Machine Design – II Lab   **Code: 337621 (37)**
Total Practical Periods: 28
Total Marks in End Semester Exam: 40

EXPERIMENTS TO BE PERFORMED

Each student shall submit two-assembly design report along with the drawing for assembly/sub assembly for any mechanical system consisting of not less than four machine elements included in the syllabus.

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Semester: B.E. VI Sem.   **Branch: Mechanical Engg.**
Subject: Energy Conversion Systems Lab   **Code: 337622 (37)**
Total Practical Periods: 28
Total Marks in End Semester Exam: 40

EXPERIMENTS TO BE PERFORMED (MINIMUM TEN Experiments)

1. Determination of Mechanical and volumetric efficiency of Reciprocating Air Compressor.
2. Testing of Reciprocating Air Compressor.

3. Determination of efficiency and Pressure distribution of Axial Flow Compressor.
4. Performance testing of Axial Flow Compressor.
5. Measurement of collector efficiency of a Flat Plate Collector.
6. Performance and Testing of a Flat Plate Collector.
7. Determination of collector efficiency of a Parabolic Focusing Collector.
8. Performance and Testing of a Parabolic Focusing Collector.
9. Solar Cooker: Testing and Performance.
10. Testing and Performance of a Photovoltaic Solar Panel.
11. Study and Performance of La-Mont Boiler
12. Study and Performance of Benson Boiler
13. Study and Performance of Velox Boiler
14. Study and Performance of Simple Steam Turbine

LIST OF EQUIPMENTS/MACHINES REQUIRED

1. Reciprocating air compressor test rig
2. Axial flow compressor with flow discharge tunnel.
3. Flat plate solar collector with solar pump.
4. Focusing type parabolic solar collector.
5. Modified conjugate electrical backup type solar collector.
6. Solar Modules Panels – 20 watt, 40 watt, 110 watt.
7. La-Mont boiler model.
8. Benson boiler model.
9. Velox boiler model.
10. Experimental setup of Simple Impulse Turbine.

Semester: B.E. VI Sem.   **Branch: Mechanical Engg.**
Subject: Industrial Engineering Lab   **Code: 337623 (37)**
Total Practical Periods: 28
Total Marks in End Semester Exam: 40

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

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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.

Semester: B.E. VI Sem.   **Branch: Mechanical Engg.**
Subject: Computer Aided Design Lab   **Code: 337624 (37)**
Total Practical Periods: 28
Total Marks in End Semester Exam: 40

EXPERIMENTS TO BE PERFORMED (MINIMUM TEN NUMBERS)

1. Introduction to integrated development environment of AutoCAD release 2000 or higher version
2. Basic drawing commands example: - LINE, POLYLINE, MULTILINE, POLYGON, CIRCLE, ELLIPSE, etc.
3. Basic editing commands e.g. - COPY, MOVE, ROTATE, MIRROR, CHAMFER, FILLET and array command as well as zoom and pan command.
4. Text command, TEXT, DTEXT, MTEXT.
5. Creation and insertion of blocks

6. Concept of layers and view ports
7. Creation of assembly drawing of stuffing box using above commands.
8. Dimensioning of stuffing box and showing the assembled view and its components in different view ports.
9. View port setting for 3D drawing and use of extrude command.
10. Generation of solid of revolution.
11. Conversion of assembly drawing of stuffing box from 2D to 3D.
12. Placement of 3D assembly drawing of stuffing box and placing views in different view ports

LIST OF EQUIPMENTS/MACHINES REQUIRED

P-IV (IBM) 2.6 GHz, 80 GB HDD,256/512 SD RAM(Compatible with CAD Software), 52 X CD RW, 1.44 MB FDD, 17" Colour Monitor, Laser Scroll Mouse

Semester: VI   Branch: Common to all branches
Subject: Managerial Skills   Code: 300625 (46)
Total Practical Periods: 28   Total Tut Periods: NIL
Total Marks in End Semester Exam: 40
Minimum number of class test to be conducted: 2

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.

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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: Meaning of attitude through example, benefits of positive 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?

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

Text & Reference Books:
1.   Basic Managerial skills for all by E.H. McGrawth, Prentice Hall India Pvt Ltd,2006
2.   How to develop a pleasing personality by Atul John Rego, Better yourself bools, Mumbai, 2006
3.   The powerful Personality by Dr. Ujjawal Patni & Dr. Pratap Deshmukh, Fusion Books, 2006
4.   How to Success by Brian Adams, Better Yourself books, Mumbai, 1969