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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSMENT*				
BTME301	DCS	MATERIAL SCIENCE	60	20	20	0	0	3	0	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

(A) To acquaint students with the basic concepts and properties of Material Science. (B) To impart a fundamental knowledge of Materials Processing. (C) Selection and application of different Metals & Alloys. (D) To understand the structure of Engineering Materials.

Course Outcomes (COs):

1. An ability to apply advanced science (such as Chemistry and Physics) and engineering principles to material systems.
2. An integrated understanding of the scientific and engineering principles underlying the four major elements of the field of Metallurgical and Materials Engineering, namely structure, properties, processing and performance related to materials systems appropriate to the field.
3. An ability to apply and integrate knowledge from each of the four elements of the field (structure, properties, processing and performance) to solve materials selection and design problems.
4. An ability to design a system, component or process to meet desired needs.

Syllabus

Unit-I

Introduction: Importance of materials, Historical perspective, Classification of materials, Properties of materials, Types of Steels and C.I., Effect of alloying elements on the Mechanical properties of Steel & C.I., Selection of material.

Unit-II

Crystal Structure, Crystallography and Imperfections: Concept of unit cell space lattice, Bravias lattices, common crystal structures, Atomic packing factor and density, Miller indices, X-ray crystallography techniques. Imperfections, Defects & Dislocations in solids.

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Unit-III

Phase and Equilibrium Diagram: Unitary and Binary phase diagrams, Phase rules, Types of equilibrium diagrams: Solid solution type, eutectic type and combination type, cooling curve behavior of solid solution & alloys, Iron-Carbon Diagram.

Unit-IV

Heat Treatment: Various types of heat treatment, Annealing, Normalizing, Quenching, Tempering (Austempering, Martempering), and various case hardening processes, Time Temperature Transformation (TTT) diagrams, Diffusion, Diffusion of Solids.

Unit-V

Mechanical Properties and Testing: Stress strain diagram of Ductile & brittle materials, Stress Vs strength. Toughness, Hardness, Fracture, Fatigue and Creep. Testing of materials, Overview of Destructive Testing and Non-Destructive testing (NDT).

Reference Books:

1. *"Science of Engineering Materials" Smith, Prentice-Hall*
2. *"Materials Science and Engineering" Callister W. D., John Wiley*
3. *"Engineering Metallurgy" Higgins R. A., Viva books Pvt. Ltd., 2004.*
4. *"Material Science & Engg." Raghvan V., Prentice Hall of India, New Delhi. 2003.*
5. *Introduction to Physical Metallurgy , Avner, S.H., Tata McGraw-Hill, 1997.*
6. *"Mechanical Metallurgy", Dieter, G.E., McGraw-Hill, 1988.*
7. *Material Science & Metallurgy for Engineers". Dr. V.D. Kodgire & S. V. Kodgire, Everest Publication.*
8. *Mechanical Behavior & Testing of Materials, A.K. Bhargava, C.P. Sharma, PHI Learning Pvt. Ltd.*
9. *"Material Science and Metallurgy" , U. C. Jindal, Pearson Edu., 2012.*

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSMENT*				
BTME302	DCS	PRODUCTION PROCESS	60	20	20	30	20	3	0	2	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

The purpose of the Production Process course is to aware students about cutting tools and various production processes. The course will help students to:
(A) Use and understand the verbal and symbolic language used to describe production systems and phenomenon. (B) Develop and present creative solutions to present and future production problems. (C) Identify and investigate potential career opportunities in the area of production. (D) Understand the evolution of production processes and its influence on our culture.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. An ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;
2. Able to describe different casting processes
3. Able to describe and apply different welding techniques.
4. Able to describe and apply different operations in lathe machine. Milling machine, shaper and planner machines.

Syllabus

Unit - I

Introduction: Introduction to manufacturing process and importance of manufacturing for humankind, machine tools and their parts, types of cutting tools and tool materials, tool signature, Mechanisms of formation of chips, types of chips formed, chip Breakers, Factors causing wear, tool life, variables affecting tool life.

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Unit - II

Metal Casting Processes: Introduction to casting and foundry; basic principles of casting processes; Casting types sequence in foundry operations; Pattern making, material and allowances of pattern, Molding practice; ingredients of molding sand and core sand, Properties of sand. Sand testing; different molding processes. Defects in casting

Unit - III

Metal Cutting Processes: Importance of material removal, elements of metal machining, General principles working and commonly performed operations in the following machines: Lathe, Shaper, Planer, Horizontal milling machine Universal drilling machine, Cylindrical grinding machine, Capstan and Turret lathe, Economics of machining.

Unit - IV

Metal Joining Process: Introduction to metal joining process; Types of welding processes. Arc Welding & Gas Welding Processes, TIG Welding, MIG Welding, Spot Welding, resistance welding, submerged arc welding, plasma arc welding, thermit welding, electron beam welding, laser beam welding, Defects & Inspection of Welding Joints, Electrodes, weldability of Metals, Welding equipment's, Differentiate between welding, soldering and brazing.

Unit - V

Metal Forming Processes: Fundamental of hot and cold working processes. Types and operation of processes: -Forging, press working, extrusion, rolling. process of shearing, punching, piercing, blanking, trimming, perfecting, notching, lancing, embossing, coining, bending, forging and drawing; press, tool dies, auxiliary equipment, safety devices, stock feeders, scrap cutters, forces, pressure and power requirements

Reference Books:

1. *Workshop Technology By W. A. J. Chapman, part I, II & III, CBS Publishers & Distributors Pvt. Ltd.*
2. *Manufacturing processes by P. N. Rao, Vol. 1 and 2,* Mcgraw Hill
3. *Elements of Workshop Technology Hazra Chaudhary Vol I, II., Media Promoters and Publishers Pvt.*
4. *Metal cutting Theory & Cutting Tool Designing by V. Arshinov, G Alekseev.*
5. *Principle of Metal cutting by Sen & Bhattacharya*
6. *R.K. Jain and S.C. Gupta, "Production Technology", Khanna Publishers. 16th Edition, 2001.*

List of Experiments

1. To study various types of cutting tool and their geometry.
2. To study different types of patterns.
3. To study properties of casting sand and casting defects.
4. To study the characteristic features of lathe.

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5. To perform various lathe operations such as facing, plain turning, step turning and taper turning on a given material made of Mild steel.
6. To study the characteristic features of shaper and milling machine.
7. To study the characteristic features of universal drilling machine.
8. To study various types of welding and welding defects.
9. To make a lap joint with the help of electric arc welding.
10. To make the lap joint with the help of TIG welding.
11. To study various farming tools & operations.
12. To perform various farming operations on given specimen.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSMENT*				
BTME303	DCS	STRENGTH OF MATERIALS	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

(A)To gain knowledge of different types of stresses, strain and deformation induced in the mechanical components due to external loads. (B)To study the distribution of various stresses in the mechanical elements such as beams, shafts etc. (C) To study effect of various loading conditions of column and gain knowledge of theories of failure.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes. The students will be able to

1. Define and memorize mechanical properties of material & select appropriate material for a given working Conditions.
2. Explain simple stresses, bending stress, shear stress, torsion stress, principle stresses, thin and thick cylinder, shaft, springs, columns and theories of failures.
3. Calculate and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behavior of materials.
4. Design of shaft and pressure vessels.
5. Justify bending equation and torsion equation and use it to solve the numerical.

Syllabus

Unit- 1

Introduction: Stress-Strain, uni-axial, bi-axial and tri-axial stresses, tensile & compressive stresses, shear stress, Stress Strain Diagram, Poisson's Ratio, Modulus of elasticity, Modulus of rigidity, Bulk modulus, Factor of safety.

Unit- II

Simple & Compound Stresses: Definition, Deformation due to self-weight, bars of varying

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sections, composite sections, principle of superposition, strain energy, Transformation of stress and strain, principal stresses, normal and shear stress, Mohr's circle and its application to two and three dimensional analyses, Thermal Stress.

Unit–III

Bending and Deflection: Symmetric member, Deflection of beams, deformation and stress, bending of composite sections, Macaulay's method and Area moment method for deflection of beams.

Unit–IV

Torsion: Torsion of circular shafts-solid and hollow, Strength of Shaft and composite shaft, combined bending and torsion, strain energy due to torsion.

Unit–V

Columns and Theories of Failure: Buckling load, types of end conditions for column, Euler's column theory and its limitations, Rankine- Gordon Formula, Theories of failures: Maximum principal stress theory, Maximum principal strain theory, maximum shear stress theory; maximum strain energy theory, maximum shear strain energy theory; Application of theories to different materials and loading conditions.

Reference Books:

1. *Strenght of Materials, Dr. R.K. Bansal, Lakshmi Publications, New Delhi.*
2. *Strength of Materials, Basavarajaiah and Mahadevappa, Khanna Publishers, New Delhi.*
3. *Mechanics of Materials, James M. Gere (5th Edition), Thomson Learning*
4. *Strength of Materials—S. Ramamrutham, Dhanpat Rai Pvt. Ltd.*
5. *Mechanics of Materials—S. S. Rattan, TMH Pvt. Ltd.*
6. *Strength of Materials, Subramanyam, Oxford University Press, Edition 2005*
7. *Elements of Strength of Materials, Timoshenko and Young Affiliated East-West Press*
8. *Strength of Materials, Singer Harper and Row Publications*
9. *Mechanics of Structures—S. B. Junnarkar, Charotar Publication.*
10. *Mechanics of Materials, B.C Punmia Ashok Jain, Arun Jain, Lakshmi Publications, New Delhi.*
11. *Strength of Materials—W. Nash, Schaum's Outline Series, McGraw Hill Publication.*
12. *Strength of Materials, S.S. Bhavikatti, Vikas Publishing House Pvt Limited.*

List of Experiments

1. Perform Brinell and Rockwell Hardness tests to find BHN and RHN for given specification.
2. Perform Izod/ Charpy impact test.
3. Perform Fatigue test.
4. Perform Torsion test.
5. To find tensile strength of given specimen by tensile test on MS and CI using UTM.
6. Perform Direct/cross Shear test on MS and CI by UTM.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSMENT*				
BTME304	DCS	ENGINEERING THERMODYNAMICS	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

(A)To gain knowledge of Basic Concepts of thermodynamics. (B)To study of First law of Thermodynamics. (C)To gain knowledge of Second law of thermodynamics. (D)To gain knowledge of Entropy and Entropy. (E)To study of Gas Power cycles. (F)To study of Properties of gases and gas mixtures.

Course Outcomes (COs):

After learning the course, the students should be able to

1. Understand basic terms used in thermodynamics.
2. Understand laws of thermodynamics and its applications.
3. Comprehend the concept and applications of energy, entropy and exergy.
4. Understand various gas and vapor power cycles.
5. Understand the properties of gas mixtures.

Syllabus

Unit - 1

Basic Concepts: Microscopic & macroscopic point of view, thermodynamic system and control volume, thermodynamic properties, processes and cycles, work and heat, Thermodynamic equilibrium, Quasi-static process, work transfer and heat transfer processes.

First law of Thermodynamics: First law for a closed system undergoing a cycle and change of state, energy, PMM1, first law of thermodynamics for steady flow process, steady flow energy equation applied to nozzle, diffuser, boiler, turbine, compressor, pump, heat exchanger and throttling process, filling and emptying process.

Unit – II

Second law of thermodynamics: Limitations of first law of thermodynamics, Kelvin-Planck and Clausius statements and their equivalence, PMM2, causes of irreversibility, Carnot theorem, corollary of Carnot theorem, thermodynamic temperature scale.

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Unit - III

Entropy: Clausius theorem, property of entropy, inequality of Clausius, entropy change in an irreversible process, principle of increase of entropy, entropy change for non-flow and flow processes, third law of thermodynamics.

Unit - IV

Energy: Energy of a heat input in a cycle, exergy destruction in heat transfer process, exergy of finite heat capacity body, exergy of closed and steady flow system, irreversibility and Gouy-Stodola theorem and its applications, second law efficiency.

Unit - V

Gas Power cycles: Recapitulation of Carnot, Otto and Diesel cycle, Dual cycle, Comparison of Otto, Diesel and Dual cycles, air standard efficiency, mean effective pressure, brake thermal efficiency, relative efficiency, Brayton cycle, effect of reheat, regeneration, intercooling and turbine and compressor efficiency on Brayton cycle.

Properties of gases and gas mixtures: Avogadro's law, equation of state, ideal gas equation, Vander Waal's equation, reduced properties, law of corresponding states, compressibility chart, Gibbs-Dalton law, internal energy; enthalpy and specific heat of gas mixtures.

Reference Books:

1. *Engineering Thermodynamics by P.K. Nag, McGraw-Hill Education.*
2. *Fundamentals of Thermodynamics by Borgnakke & Sonntag, 7th Ed. Wiley India (P) Ltd.*
3. *Thermodynamics – Engineering Approach by Yunus Cengel & Boles, McGraw-Hill Education.*
4. *Engineering Thermodynamics by Gordon Rogers and Yon Mayhew, Pearson Education Ltd.*
5. *Engineering Thermodynamics by Krieth, CRC Press.*
6. *Engineering Thermodynamics by Jones and Dugan, PHI Learning Pvt. Ltd.*

List of experiments

1. Study of positive displacement work (PdV work) and Heat transfer for various processes.
2. Study of First Law of Thermodynamic.
3. Study of second Law of thermodynamic.
4. Determination of efficiency of Otto cycle.
5. Determination of efficiency of Diesel cycle.
6. Study of Properties of gases and gas mixtures.
7. Study of entropy of system.
8. Study of steady flow energy equation applied to nozzle, diffuser, boiler, turbine, compressor, pump, and heat exchanger and throttling process.

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SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSMENT*				
BTME305	DCS	MACHINE DRAWING	0	0	0	30	20	0	0	4	2

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

This course provides comprehensive knowledge of (A) production drawing, (B) assembly drawings and (C) orthographic Sectional views and use of (D) computer applications in production drawing.

Course Outcomes (COs):

On completion of the course the students will be able to:

1. Understand all drawing conventions, symbols and concepts of machine drawing Creation.
2. Convert functional specification of mechanical engineering parts and assembly requirements into manufacturing drawing in a manner consistent with standards.
3. Interpret manufacturing and assembly drawings and acquire skill in preparing production drawings pertaining to various designs.
4. Acquire knowledge of the applications of computers in design, parts creation, assembling and production drawing creation, mechanism and manufacturing activity.

Syllabus

Unit – 1

Introduction of Machine Drawing and Drawing Conventions: Introduction, classification of machine drawings, principles of drawing, elements of drawing, types of machine drawing, Drawing standards, Drawing Instruments, sheet layout and title block, Application of types of lines, lettering and numbering, Sketching, Dimensioning, screw threads, screw fastening bolt, nut, washer, screw, locking arrangements of nuts, foundation bolts, keys, cotter-joints and pin joint, pipe joint and valves, Riveted joints and welded joints, shaft bearings, brackets and hangers, shaft coupling, clutches and brakes.

Drawing Conventions and Symbols: Conventional materials, Conventional breaks, Convention of rivets and bolts, welding conventions, Convention of roughness of surface, Convention of

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machine operation and parts, Convention of gear and gear transmission, convention of springs, Symbolic Representation of fasteners, Holes and bolts, profile section, pipe fittings and valve symbols, Electric symbols.

Unit – II

Production Drawing Elements and Assembly Drawings: Introduction, geometric tolerance types and representation, dimensional tolerance types and representation, Limits and fits, hole basis and shaft basis system of fits, surface roughness, indication of surface roughness, roughness value and grade symbol, Assembly concepts, introduction, types, sequence of preparing the assembly drawing, sectional views, convention in sectioning, bill of materials, plotting techniques.

Assembly drawing

Shaft joints: knuckle joint, cotter joints and types etc.

Keys & Shaft coupling: Muff, Flanged, Flexible, Universal and Oldham's coupling etc.

Pipe joint: Flanged joint, Socket and Spigot joint, Hydraulic joint, Union joint, Gland & Stuffing Box etc.

Bearing: Plummer block, Pedestal bearing etc.

Engine Parts: Steam engine, Piston, connecting rod, Stuffing box, cross head, crank shaft etc.

Unit - III

Orthographic Conversion, Sectional and Interpretation of Views: Principle and method of projection, orthographic projection, first angle, third angle, isometric, oblique and perspective projection, conversion of pictorial views into orthographic views illustrative problems,

Sectional views and Interpretation: Types of sectional views, full section, half section, partial section, removed section, revolved section, offset section, sectioning conventions. Reading of orthographic views, blue print reading, missing lines and views, identification of planes, illustrative problems.

Unit – IV

Production and Assembly Drawing Creation through CAD: Introduction to CAD, Why CAD Software, Scope, objective, benefit and limitations, CAD Interface, Coordinate system, Create Objects and Modify Object. Layers & Blocks, Text, Table & Dimensions, Introducing Printing, Plotting, and Layouts.

Drawing practice sheet: Indicate the surface roughness symbols, welding symbols, tolerances, all production drawing symbols and conventions in drawing practice sheets of AutoCAD Mechanical.

Parts Assembly, Visualization & Graphics standards: Assembly Creation methods, Parts Modeling & Representation, Assembly Constraints, Mechanism & Mechanism Analysis, Mass Properties, Data exchange standards; IGES STEP CALS DXF STL.

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Reference Books:

1. *Machine drawing- N.D. Bhatt. & V.M. Panchal, published by Charotar publishing house.*
2. *Machine Drawing & Design, Dr. K.K. Dwivedi & Dr. M. Pandey, Dhanpat Rai Publications.*
3. *Machine drawing – P.S. Gill S.K. Kataria & Sons Delhi.*
4. *Fundamentals of Machine Drawing by Sadhu Singh & Shah, PHI*
5. *Machine drawing – T. Jones.*
6. *Machine Design by-J.E. Shigly-McGraw Hill Publications.*
7. *Design of Machine Elements from V.B. Bhandari, TMH Publications.*
8. *Introduction to Engineering Design, McGraw Hill.*
9. *Mastering CAD George Omura with Brian Benton Autodesk.*
10. *Machine Design – P.C. Sharma & D.K. Agrawal-Kataria & Sons Publications.*
11. *Principles of Mechanical Design - R. Phelan – McGraw Hill Pub.*
12. *Machine Design - An Integrated Approach Robert-L-Norton Published by Addison Wesley Longman*
13. *Machine Design, Theory & Practice – J. Michels Walter, E. Wilson Charles – Add MacMilan Publishers, New York.*

List of Experiments

Drawing problems as per given syllabus.

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			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM UNIVERSITY EXAM	TWO TERM EXAM	TEACHER ASSESSTMENT*	END SEM UNIVERSITY EXAM	TEACHER ASSESSTMENT*				
BTME307	DCS	MECHANICAL MEASUREMENT LAB	0	0	0	30	20	0	0	2	1

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 20 marks.

Course Educational Objectives (CEOs):

1. Develop fundamental understanding of mechanical measurements
2. Impart knowledge of measurement concepts and their practice.
3. Develop knowledge of measurement errors and their causes.

Course Outcomes (COs):

After learning the course the students should be able to:

(1). Students will describe basic concepts of mechanical measurement
(2). Students will select linear measuring instrument for measurement of various components
(3). Students select angular and taper measurement devices for measurement of various components
(4). Students will be able to measure various parameters such as force, torque, strain, velocity etc.

Syllabus

Unit - I

Mechanical Measurement:

Need of mechanical measurement, Basic definitions: Hysteresis, Linearity, Resolution of measuring instruments, Threshold, Drift, Zero stability, loading effect and system response. Measurement methods, Generalized Measurement system, Static performance characteristics, Errors and their classification.

Unit - II

Linear and angular measurements:

Linear Measurement Instruments, Vernier calliper, Micrometer, Interval measurements: Slip gauges, checking of slip gauges for surface quality, Optical flat, Limit gauges, Problems on measurements with gauge.

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Unit - III

Measurement of Force, Torque and Strain:

Force measurement: load cells, cantilever beams, proving rings, differential transformers.

Measurement of torque: Torsion bar dynamometer, servo controlled dynamometer, absorption dynamometers. Power Measurements.

Measurement of strain: Mechanical strain gauges, electrical strain gauges, strain gauge: materials, gauge factors, theory of strain gauges and method of measurement, bridge arrangement, temperature compensation.

Unit - IV

Displacement, Velocity/Speed, and Acceleration, Measurement:

Working principal of Resistive Potentiometer, Linear variable differential transducers, Electro Magnetic Transducers, Mechanical, Electrical and Photoelectric Tachometers, Piezoelectric Accelerometer, Seismic Accelerometer.

Unit - V

Temperature Measurement:

Temperature Measuring Devices: Thermocouples, Resistance Temperature Detectors, Thermistor, Liquid in glass Thermometers, Pressure Thermometers, Pyrometer, Bimetallic strip. Calibration of temperature measuring devices, Numerical Examples on Flow Measurement

Reference Books:

1. *Engineering Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press,*
2. *Metrology and Measurement, Anand Bewoor & Vinay Kulkarni McGraw-Hill*
3. *Instrumentation, Measurement and Analysis, B.C. Nakra, K.K. Chaudhry McGraw-Hill*
4. *A course in Mechanical Measurements and Instrumentation, A K Sawhney, Dhanpat Rai Publications.*
5. *Mechanical Measurements and Instrumentations, Er. R K Rajput, Kataria Publication(KATSON).*
6. *Mechanical Measurement and Metrology by R K Jain, Khanna PublisherMechanical Measurement & Control by D.S. Kumar.*

List of Experiments:

1. Basic understanding of measurements: concepts, application, advantage and future aspects
2. Linear measurement of various objects and check different characteristics of measurements.
3. Angular measurement of various objects and check different characteristics of measurements.

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4. Temperature measurements and check different characteristics of measurements and also do calibration
5. Temperature measurements and calibration of thermocouple.
6. Performance on Stress, strain and force measurements and check different characteristics of measurements and also do calibration
7. Performance on Speed/Velocity, acceleration measurements.

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ML-301 ENVIRONMENT AND ENERGY STUDIES

SUBJECT CODE	CATEGORY	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
ML-301	Compulsory	Environment and Energy Studies	60	20	20	0	0	4	0	0	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
***Teacher's Assessment** shall be based upon following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives :

1. Understand sources of information required for addressing environmental challenges.
2. Identify a suite of contemporary tools and techniques in environmental informatics.
3. Apply literacy, numeracy and critical thinking skills to environmental problem-solving.

Course Outcomes

1. Apply the principles of ecology and environmental issues that apply to air, land and water issues on a global scale.
2. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
3. Demonstrate ecology knowledge of a complex relationship between predators, prey, and the plant community.

Unit I: Environmental Pollution and Control Technologies - Environmental Pollution & Control: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and industrial pollution, Ambient air quality standards. Water pollution: Sources and types, Impacts of modern agriculture, degradation of soil. Noise Pollution: Sources and Health hazards, standards, Solid Waste management composition and characteristics of e - Waste and its management. Pollution control technologies: Wastewater Treatment methods: Primary, Secondary and Tertiary.

Unit II: Natural Resources - Classification of Resources: Living and Non - Living resources, water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problem, Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy resources:

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Growing energy needs, renewable energy source, case studies.

Unit III: Ecosystems: Definition, Scope and Importance ecosystem. Classification, Structure and function of an ecosystem, Food chains, food webs and ecological pyramids. Energy flow in the ecosystem, Biogeochemical cycles, Bioaccumulation, Ecosystem Value, Devices and Carrying Capacity, Field visits.

Unit IV: Biodiversity and its Conservation - Introduction - Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - . Biodiversity at global, National and local levels. - . India as a megadiversity nation - Hot-sports of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man wild life conflicts; Conservation of biodiversity: In-situ and Ex-situ conservation. National Biodiversity Act.

Unit V: Environmental Policy, Legislation & EIA - Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio- economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP)

Recommended Readings:

1. Agarwal, K.C. (2001). ***Environmental Biology***. Bikaner: Nidi Pub. Ltd.
2. Brunner, R.C. (1993). ***Hazardous Waste Incineration***. New Delhi: McGraw Hill Inc.
3. Clank, R.S. (2001). ***Marine Pollution***. New York: Oxford University Press.
4. De, A.K. (2001).***Environmental Chemistry.*** New Delhi: Wiley Western Ltd.
5. Bharucha , Erach (2005). ***Environmental Studies for Undergraduate Courses.*** New Delhi: University Grants Commission.
6. Rajagopalan, R. (2006). ***Environmental Studies***. New York: Oxford University Press.
7. AnjiReddy, M. (2006).***Textbook of Environmental Sciences and Technology***. BS Publication.
8. Wright, Richard T. (2008). ***Environmental Science: towards a sustainable future*** .New Delhi: PHL Learning Private Ltd.
9. Gilbert M. Masters and Wendell P. Ela .(2008).***Environmental Engineering and science***. University Kindom:PHI Learning Pvt Ltd.
10. Botkin ,Daniel B. & Edwards A. Keller(2008).***Environmental Science.*** New Delhi: Wiley INDIA edition.
11. Kaushik ,Anubha (2009).***Environmental Studies***. New Delhi: New age international publishers.

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