UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Metrology & Measurement
Course Code: ME 501
L-T Scheme: 3-1 **Course Credits: 3**

Introduction:

The course is designed to cover the following subjects: Definition and importance of Metrology Measurement , Linear Metrology, Interchangeability, Angular Metrology: , Definition, use and essential features of Comparators, Measuring Instruments, Measurement of Surface Finish, Principle of operation of a few measuring instruments

OBJECTIVES:

1. To provide knowledge on various Metrological equipments available to measure the dimension of the components.
2. To provide knowledge on the correct procedure to be adopted to measure the dimension of the components..

OUTCOMES:

Upon completion of this course, the Students can demonstrate different measurement technologies and use of them in Industrial Components

UNIT I

Introduction: Definition and importance of Metrology Measurement; Methods of measurements – direct, indirect, comparison, substitution, transposition, deflection and null measurement; Errors in measurement – absolute, relative, parallax, alignment, loading, dynamic and calibration error; Units of measurements – SI base and derived units, SI prefixes of units.

UNIT II

Linear Metrology: Vernier scale; construction and use of Vernier calliper, Vernier height and depth gauge, micrometer; slip gauge.

Angular Metrology: Constructional features and use of protractor, Vernier bevel protractor, angle gauges, sine bar and slip gauges
Measurements of : (i) Level using spirit-level; (ii) Flatness using straight edge, interferrometry (Newton's rings) and surface plate; Parallelism, cylindricity and concentricity using dial indicator..

UNIT III

Interchangeability of components; concept of limits, tolerances and fits; Hole basis and shaft basis system of fits; Go and No Go limit gauges; plug, ring, snap, thread, radius and filler gauges.

UNIT IV

Definition, use and essential features of Comparators; working principle and application of (i) dial gauge, (ii) Cook optical comparator, (iii) back pressure Bourdon gauge pneumatic comparator, (iv) optical comparator-profile projector..

UNIT V

Measuring Instruments: Functional elements of an instrument – sensing, conversion & manipulation, data transmission and presentation element; Characteristics – accuracy, precision, repeatability, sensitivity, reproducibility, linearity, threshold, calibration, response, dynamic or easurement error; Transducers – definition, primary and secondary, active and passive.

UNIT VI

Measurement of Surface Finish: Definition; Terminologies – geometrical surface, effective surface, surface roughness, roughness (primary texture), waviness (secondary texture), form, lay, sampling length; Numerical evaluation of surface roughness: peak-to-valley height (Rmax), centre line average (CLA, Ra), average depth (Rm), smoothness value (G) Principle of operation of a Talysurf.

UNIT VII

Principle of operation of a few measuring instruments: displacement by LVDT; force by strain – gauge load cell and piezoelectric load cell; pressure by Bourdon – tube gauge; temperature by liquid-in-glass thermometer, thermocouples, optical pyrometer; liquid velocity by pitot tube; water flow by orifice meter.

TEXT BOOKS:

1. Jain R.K. “Engineering Metrology”, Khanna Publishers, 2005.
2. Gupta. I.C., “Engineering Metrology”, Dhanpatrai Publications, 2005.

REFERENCES:

1. Charles Reginald Shotbolt, “Metrology for Engineers”, 5th edition, Cengage Learning EMEA,1990.
2. Backwith, Marangoni, Lienhard, “Mechanical Measurements”, Pearson Education , 2006.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Heat Transfer
Course Code: ME502
L-T Scheme: 4-0 **Course Credits: 4**

Introduction:

We all know that heat is the form of energy and it can be transfer from one body to another by virtue of temperature difference. The branch of science in which we study about transfer of heat is known as heat transfer.

Objectives:

To understand the fundamentals of heat transfer mechanisms in fluids and solids and their applications in Various heat transfer equipment in process industries. It tells us about the heat transfer rate, so we can calculate the time taken by a system to change in specified temperature.

Learning Outcomes:

Knowledge:

1. Ability to understand and solve conduction, convection and radiation problems.
2. Ability to design and analyze the performance of heat exchangers and evaporators.
3. Ability to design and analyze reactor heating and cooling systems performance.
4. Students should be able to explain in detail the three types of heat transfer, and give examples of each.
5. Students should be able to apply what they have learned about heat transfer and materials to real-world problems.

Application:

1. Heat transfer widely used in automobile for cooling of IC engine.
2. It is widely used in production of electronic equipment such as computer, DVD player, TV etc.
3. It is used in various power plant such as boiler, condenser, steam developer, refrigerators etc.

Course Contents:

Unit 1: Introduction: Heat transfer processes, conduction and radiation. Fourier's law of heat conduction, thermal conductivity, thermal conductivity of solids, liquids and gases, effect of temperature on thermal conductivity. Newton's law of cooling. [2]

Unit 2: Conduction: General 3-Dimensoinal conduction equation in Cartesian, cylindrical and spherical coordinates; one dimensional heat conduction with and without heat generation; electrical analogy; definition of overall heat transfer coefficient. General parameters influence the value of heat transfer coefficient. heat conduction through composite walls; critical thickness of insulation. [6]

Unit 3: Heat transfer from extended surfaces: Governing differential equation of fin, fin efficiency and effectiveness for different boundary conditions. [6]

Unit 4: Introduction to transient heat conduction, Lumped parameter approach, Time constant, Biot number: 1-D transient heat conduction solution without heat generation. [6]

Unit 5: Thermal Radiation: Plank distribution law, Krichoff's law; radiation properties, diffuse radiations; Lambert's law. Radiation intensity, heat exchange between two black bodies heat exchanger between gray bodies. Shape factor; electrical analogy; reradiating surfaces heat transfer in presence of reradiating surfaces. concept of Gray- Diffuse Isotropic (GDI) surface. Radiation exchange between GDI surfaces by radiation network. [9]

Course Description

Unit 6: Heat exchangers: types of heat exchangers, parallel and counter flow types, Introduction to LMTD. Correction factors, fouling factor. E- NTU method for heat exchangers. [6]

Unit 7: Non – dimensional quantities in heat transfer, importance and physical significant order of magnitudes, Analysis for a flow over a flat plate. [5]

Unit 8: Convective heat transfer, Newton's law of cooling and significance of heat transfer coefficients. Momentum and energy equation in 2-D. Natural convection over a vertical plate. 1-D solution for Coutte flow and Poiseullie flow. Hhydrodynamic and thermal boundary layers; laminar boundary layer equations. [10]

Text Books

1. Heat and Mass Transfer -by R k Rajput, S. chand publication.
2. Heat And Mass Transfer -by Dr. D. S. Kumar , Publisher: S K Kataria and Sons.

References

1. Heat and Mass Transfer -by D K Dixit , Mc Graw Hill.
2. Heat Transfer – by J Holman and Souvik Bhattacharyya (SIE)

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

COURSE DESCRIPTION

Subject Name: Design of Machine Elements Subject Code-ME503
L-T Scheme: 3-0 **Course Credits: 3**

Introduction:

Machine Design is the innovation of new and effective machines and improving the existing ones. A new or effective machine is one which is more economical in the overall cost of production and operation.

The design is to formulate a plan for the satisfaction of a human need. In designing a machine component, it is necessary to have a good knowledge of many subjects such as Mathematics, Engineering Mechanics, Strength of Materials, Theory of Machines, Workshop Processes and Engineering Drawing.

The topics to be covered (tentatively) include:

- Basic Introduction, Objectives And Fundamental of Machine Design
- Engineering Materials
- Manufacturing considerations in Design
- Design Against Static Load
- Design Against Fluctuating Load
- Welded Joints
- Threaded Joints
- Shafts, Keys And Couplings
- Power Screws
- Springs

Objectives and Learning Outcomes:

COURSE OBJECTIVE 1: At the end of this course, students will be able to formulate and analyze stresses and strains in machine elements and structures in 3-D subjected to various loads.
- Ability to define the most critically stressed point in a machine component.
- Ability to analyze strains and deflections.

COURSE OBJECTIVE 2: At the end of this course, students will be acquainted with standards, safety, reliability, importance of dimensional parameters and manufacturing aspects in mechanical design.
- Knowledge of standards for machine elements.
- Understanding of safety and reliability concepts in the design of machine elements.
- Ability to minimize the characteristic dimension of a machine element.
- An understanding of the influence of manufacturing processes in the design of machine elements.

COURSE OBJECTIVE 3: At the end of this course, students will be able to do tolerance analysis and specify appropriate tolerances for machine design applications.
- Ability to understand and to interpret tolerance on a dimension.
- Acquaintance with ISO system of tolerances.
- Ability to specify an appropriate tolerance on machine components.
- Ability to specify a fit for mating parts considering functional requirements.

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COURSE DESCRIPTION

Subject Name: Design of Machine Elements Subject Code-ME503
Year: 3rd Year Semester: Fifth

COURSE OBJECTIVE 4: At the end of this course, students will be able to apply multidimensional static failure criteria in the analysis and design of mechanical components.

- Knowledge of various multidimensional static failure criteria for different materials.
- Ability to apply multidimensional static failure criteria in the design and analysis of machine components.
- Ability to analyze and design components with non-uniform cross sections.

COURSE OBJECTIVE 5: At the end of this course, students will be able to apply multidimensional fatigue failure criteria in the analysis and design of mechanical components.

- Knowledge of fatigue failure and load-life relation.
- Knowledge of various multidimensional fatigue failure criteria.
- Ability to apply multidimensional fatigue failure criteria in the design and analysis of machine components under various loading conditions.

COURSE OBJECTIVE 6: At the end of this course, students will be able to analyze and design structural joints.

- Acquaintance with the terminology, and types of permanent and detachable joints.
- Ability to design and analyze permanent joints (riveted, welded, etc.) under concentric and eccentric loading conditions.
- Ability to design and analyze detachable joints (bolts, keys, pins, etc.) under various loading conditions.
- Ability to design and analyze power screws.

COURSE OBJECTIVE 7: At the end of this course, students will be able to analyze and design power transmission shafts carrying various elements with geometrical features.

- Acquaintance with different types of shafts.
- Ability to design and analyze shafts with different geometrical features under various loading conditions.
- Ability to calculate critical speed of shafts and make the design decisions accordingly.

COURSE OBJECTIVE 8: At the end of this course, students will be able to analyze and design mechanical springs.

- Acquaintance with spring terminology and different types of springs.
- Ability to design and analyze springs (compression, tension, torsion) under various loads.

COURSE OBJECTIVE 9: At the end of this course, students will be able to improve their technical report writing skills.

- Ability to justify a design project in a formal report.
- Ability to perform and present design calculations in a neat and organized manner.
- Ability to present the outcomes of the design in the form of engineering drawings.

Course Contents:

Unit 1: Objective and scope of Mechanical Engineering Design; Design considerations; Review and selection of materials and preferred sizes; codes and standards;

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COURSE DESCRIPTION

Subject Name: Design of Machine Elements Subject Code-ME503
L-T Scheme: 3-0 **Course Credits: 3**

Unit 2: Design/allowable stress; Stress-Strain Diagrams; Mechanical Properties Of Engineering Materials; Cast Iron; Heat Treatment Of Steels; Case Hardening Of Steels; Aluminium And Copper Alloys; Plastics And Ceramics;

Unit 3: Selection Of Manufacturing Method; Design Considerations of Castings And Forgings;Hot And Cold Working of Metals; Design for Manufacturing and Assembly(DFMA); Tolerances; Types of Fits; Selection Of Fits; Selective Assembly;

Unit 4: Modes of failure; Stress-Strain Relationship; Factor of safety (FoS); Theories of failure – maximum normal stress theory, maximum shear stress theory, Distortion energy theory. Choice of Failure criteria; Design for stability; Design of (i) Cotter joint; (ii) Knuckle joint

Unit 5: Fatigue in metals; S-N curve; Endurance limit and fatigue strength; Stress concentration factors – effect of discontinuity, fillets and notches; Effect of size, surface finish, stress concentration and degree of reliability on endurance limit; Design for finite and infinite life; Goodman, modified Goodman and Soderberg diagrams with respect to fatigue failure under variable stresses; Cumulative fatigue damage – Miner's equation; Gerber Equation;

Unit 6: Welded Joints; Welding Processes; Stress Relieving Of Welded Joints; Butt Joints; Fillet Joints; Strength Of Butt And Fillet Welds; Maximum Shear Stress In Parallel And Transverse Fillet Welds; Axially Loaded Unsymmetrical Welded Joints; Welded Joints Subjected To Bending Moment; Strength Of Welded Joints; Welded joints Subjected To Fluctuating Forces; Welding Symbols;

Riveted Joints- joints : Unwin's formula; Brief discussion on single, double and triple row lap joints, butt joints with single or double strap / cover plate;; Types Of Rivet Heads; Rivet Materials; Types Of Failure; Strength Equations; Efficiency Of Joints; Caulking And Fullering;

Unit 7: Bolted joints : Metric thread, standard sizes, use of lock nuts and washers; Applications in structures including brackets, turn buckle; Pre-stressed bolts;

Unit 8: Design of : (i) Solid and hollow shafts, strength design of shafts, design based on torsional rigidity; (ii) Shaft coupling-rigid, pin-bush and geared flexible type, alignment of coupling; (iii) Belt drives-geometrical relations, derivation of torque and power transmission by flat and V-belt drives, selection of belt from manufacturers' catalogues, pulley (iv) Chain drives – roller chains, polygonal effect, power rating, sprocket wheel, silent chain;

Unit 9: Design of: (i) Transmission screw, Screw jack, (ii) Helical compression spring - stress and deflection equations, stiffness, curvature effect: Wahl's factor, springs in parallel and series; (iii) Multi-leaf springs: load-stress and load-deflection equations, Nipping.

Text Book:

1. V. B. Bhandari, Design of Machine Elements, TMH.

Reference Books:

2. Shigley and Mischke, Mechanical Engineering Design, TMH.
3. V.B. Bhandari, Machine Design Data Book TMH

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Dynamics of Machines
Course Code: ME504
L-T Scheme: 3-0 **Course Credits: 3**
Course Objectives

- To impart students with the knowledge about motion, masses and forces in machines.
- To enable students to apply fundamental of mechanics to machines which include engines, linkages etc.,
- To give basic knowledge on kinematic and dynamic design of machinery.
- To facilitate students to understand the function of flywheels, the concept of balancing of rotating and reciprocating masses
- To give awareness to students on the phenomenon of vibration and its effects.
- To Introduce the approaches and mathematical models used in kinematic and dynamic analysis of machinery.

Course Outcomes

- The students will be able to determine velocities & accelerations of various planar
- mechanisms.
- Students will have an understanding of static force relationships and inertia forces and
- their effect that exist in machines
- Students will demonstrate the dynamics of flywheel and their motion
- Students will be able to perform balancing, vibration and critical speeds with respect to machine dynamics

Course Contents:

Module 1:

Vibration: Definition & types of vibration; Differential equations of vibratory motions (longitudinal & torsional); Natural frequency of free longitudinal vibration-Equilibrium method, Energy method (Rayleigh's maximum energy principle); Effect of inertia in longitudinal vibration; Natural frequency of free transverse vibration of a beam due to point loads - Rayleigh's method.
Whirling of shaft, synchronous whirling; critical speed - Dunkerley's method.

Module 2:

Free damped vibration; Damping factor; Logarithmic decrement.

Module 3:

Forced vibration, concept of under damped, critically damped and over damped system; Dynamic magnifier (magnification factor); Vibration isolation and transmissibility.

Module 4:

Inertia force and inertia torque in reciprocating engine; Equivalent dynamical system; correction couple (torque); Turning moment diagram and flywheel design.

Module 5:

Balancing: Static balancing; Dynamic balancing of rotating masses - graphical and analytical methods; Balancing of inline single cylinder and four cylinder engine; Balancing of symmetric two cylinder V-engine; Swaying couple; Hammer blow.

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Course Description

Module 6:

Governors: Use and classification; Study and analysis of Porter, Proell and Wilson-Hartnell governors; Sensitiveness, stability, isochronism, hunting, effort and power of governors; Controlling force diagram and stability criteria analysis; coefficient of insensitiveness..

Module 7:

Gyroscope: Gyroscopic couple and precessional motion; Effect of gyroscopic couple on aeroplane and ship; Stability of two wheel and four wheel vehicles taking turn.

Text Books:

1. S.S. Rattan, Theory of Machines, Tata McGraw Hill.
2. R. S Kurmi, Theory of Machines, S. Chand Pub.

References:

1. W.T. Thomson, Theory of vibration with Applications, McGraw Hill.
2. Uicker, Pennock & Shigley, Theory of Machines and Mechanisms, Oxford University Press.
3. A. Ghosh & A.K. Mallik, Theory of Mechanisms and Machines, Affiliated East-West Publication.
4. Rao & Dukkipati, Mechanism and Machine Theory, New Age Int. Pub.
5. J.S. Rao, The Theory of Machines Through Solved Problems, New Age Int. Pub.

UNIVERSITY OF ENGINEERING AND MANAGEMENT, JAIPUR

Course Description

Title of Course: Industrial Management
Course Code: ME505
L-T Scheme: 3 **Course Credits: 3**

Introduction:

Engineering and Management is complementary to each other. This is necessary to learn management for an engineering student.

Objectives:

Engineering students can be better managers by learning management**.**

Learning Outcomes:
Knowledge:

Engineers can be better professionals by learning management.

Course Contents:

Unit 1: **Management**

Definition, nature, importance, evolution of management thoughts–pre & post scientific era, contributions made by Taylor, Fayol, Gilbreth, EltonMayo,McGregor,Maslow–covering Time & Motion Study, Hawthrone Experiments; Is management science or art? Functions of manager, ethics in managing and social responsibility of managers.

Unit 2: Planning &Control

Why Management process start s with planning, steps in planning, planning premises, types of planning, barriers to effective planning, operational plan, strategic planning, Mckinsey's 7's.

Unit 3: Decision Making & Organizing

Nature, process of decision making, decision making under Certainty and Uncertainty, decision-Tree, group-aided decision, brain-storming.
Organizing– concept, nature and process of organizing, authority and responsibility, delegation and empowerment, centralization and decentralization, concept of departmentalization.

Unit 4: Staffing &Motivation

Concept, Manpower planning, Job design, recruitment & selection, training and development, performance appraisal, motivation, motivators and satisfaction, motivating towards organizing objectives, morale building.

Unit 5: Leadership & Communication

Defining leadership and its role, should managers lead, leadership style, leadership development, Leadership behavior. Communication- Process, Bridging gap-using tools of communication, electronic media in Communication.

Unit 6: Financial Management

Financial functions of management, Financial Planning, Management of Working Capital, Sources of Finance.

UNIVERSITY OF ENGINEERING AND MANAGEMENT, JAIPUR

Course Description

Unit 7: Marketing Management

Functions of Marketing, Product Planning & Development, Marketing Organization, Sales Organization, Sales Promotion, Consumer Behavior, Marketing Research and Information.

Text Books

1. Robbins & Caulter, Management, Prentice Hall of India.
2. John R.Schermerhorn, Introduction to Management, Wiley-India Edition.
3. Koontz, Principles of Management, Tata-McGrewHill.
4. RichardL.Daft, New Era of Management, Engage Learning.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Electrical Machines
Course Code: ME506A
L-T Scheme: 3-1 **Course Credits: 4**

Introduction:

This course examines basic operating principle and in depth concept analysis of various electrical machines. The Topics to be covered (tentatively) include:

- Operating principle of DC Machines, 3-phase induction motor&3-phase Transformer
- Parameter estimationof various electrical machines
- Analysis of various operations of electrical machines
- Domestic and industrial applications of electrical machines
- Different control methods and testing of electrical machines

Objectives:

In this course we will be familiarize and study the constructional details, principle of operation, expressions for generated voltage and torque of DC machines and predict performance characteristics and gain knowledge on speed control techniques of DCmotors.Estimationof various losses takes place in D.C. machines and to study the different testing methods. Study the working principles of three phase transformers and appreciate the testing procedures. The constructional details, principle of operation, expressions for generated voltage and torque,prediction of performance equation, torque slip characteristics and gain knowledge on speed control techniques of a 3-phase induction motor will also be familiarized and studied.

Learning Outcomes:

Knowledge:

1. Learn how to employ excitation circuit for DC generator.
2. Become adept at using various methods of reducing the armature reaction.
3. Understand the different types of generator behaviors with their V-Icharacteristics.
4. Develop the capability to analyze the concepts and applications different types of Dc machines.
5. Learn the primitive concepts of different types of speed control & necessity of speed control of DC motor.
6. Know the fundamental concepts of three phase transformer & types based on construction
7. Understand the working of transformer with & without load
8. Learn how to draw equivalent circuits of transformer with respect to primary / secondary
9. Learn about parallel operation of three phase transformer & its requirements
10. Understand why auto transformer (variac) is much used in industries.
11. Learn the primitive concepts of different types of speed control & necessity of speed control for a 3-phase induction motor.
12. Understanding of constructional details and basic operating principle of a 3-phase Induction motor.
13. Development of equivalent circuit diagram and analysis of torque slip characteristics & power slip characteristics of 3-phase induction motor.
14. Explanation of various testing to estimate the different electrical parameter of 3-phase induction motor

Application:

1. To develop, an intuitive understanding of the importance of dc machinefor various industrial purpose
2. To develop, an ability to discriminate between performance of 3-phase and 1-phase transformer with industrial and domestic load.
3. To learn different types of speed control & necessity of speed control for a 3-phase induction motor when used in plants for different types of load profile.

4. To Formulate and solve problems related to DC machines, 3-phase transformers and 3-phase induction motor.

Course Contents:

Unit 1: Electromechanical Energy Conversion Principle, Singly Excited Magnetic System and Doubly Excited Magnetic system. Physical concept of torque production; Electromagnetic torque and Reluctance torque. Concept of General terms pertaining to Rotating Machines: Electrical & Mechanical degree, Pole pitch, Coil, Generated EMF in full pitched coil, Generated EMF in a short pitched coil, EMF polygon, Distribution factor, Pitch factor. MMF produced by Distributed Windings, MMF of a coil, MMF of single phase distributed Winding.

Unit 2: 3-phase Transformers–Determination of polarity and connections ;(Star/star, star/delta, delta/star, star/zigzag, delta/zigzag, open delta), phasor groups. Effects of unbalanced loading, production ofharmonic in transformers and their suppression.3- phase to 2- phase transformation, Scott connection, 3-phase to six phase connections: double star & double delta.
3-winding transformers: parameter estimation, Applications. Parallel operation of transformer. Introduction to tap changers and their functions.

Unit 3: DC Machines – Review of construction, derivation ofEMF equation & types of excitation.Armature reaction and its effect on the performance, methods adopted for compensation of armaturereaction. Characteristics of DC generator: separately excited, shunt, series and compound generators.
Compensating winding, Commutation and function of commutators. Improvement of commutation.
Review of types of DC motors. Torque equation, speed torque characteristics: shunt, series and compound motors.Starting & speed control of DC motors. 3- Point starter & its step calculation. Speed control by controllingarmature resistance, field excitation and armature voltage. Ward- Leonard method of speed control.Losses & efficiency of DC machines, Hopkinson's & Swinburne's test.

Unit 4: 3-phase Induction motor –Types, construction, rotating magnetic field, principle of operation, slip,development of equivalent circuit. Performance equations, torque slip characteristics & power slip characteristics. Parameter estimation. Starting and speed control of Induction motors.
FluxandMMFphasors in Inductionmotors,

Text Books

1. Ashfaq Husain, "Electric Machines", Dhanpat Rai & Co.

References

1. I.J. Nagrath& D.P. Kothari , "Electric Machines", Tata Mc Graw Hill.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Applied Fluid Mechanics
Course Code: ME506B
L-T Scheme: 3-0 **Course Credits: 3**

Introduction:

This course provides an introduction to the principles of fluid mechanics of mechanical systems. The focus is to illustrate practical engineering applications of these principles in relation to simple fluid systems. The learning approach is to apply engineering principles to performance analysis and prediction of simple fluid systems. This will provide a basis for understanding how performance can be improved. You will acquire an understanding of the essential theoretical basis of the fluid mechanic sciences and their application to a range of problems of relevance to practical engineering.

OBJECTIVES:

- Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline
- Knowledge of contextual factors impacting the engineering discipline
- Application of established engineering methods to complex engineering problem solving
- Fluent application of engineering techniques, tools and resources
- Effective oral and written communication in professional and lay domains

OUTCOMES:

Upon successful completion of the course, you should be able to:

1. Analyse and predict performance of idealised forms of fluid systems using fluid mechanics principles;
2. Optimise real mechanical systems using corresponding idealised fluid system models.

UNIT I

Specific energy, Hydraulic Jump

Compressible Flow: speed of propagation of a small disturbance through a compressible fluid, sonic velocity, Mach number, mach cone and Mach wave; isentropic flow, stagnation properties of a compressible flow, isentropic pressure, temperature and density ratios; compressibility correction factor in the measurement of air speed; area – velocity relationship for compressible flow through a variable area duct, mass flow rate through a duct, critical condition and choking; flow through convergent-divergent nozzle.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

UNIT II

Ideal Fluid Flow: rotation of a fluid particle, vorticity, rotational and irrotational motion; velocity potential function, circulation, stream function, flownet; governing equation for two dimensional irrotational motion, simple two dimensional irrotational flows like uniform flow, plane source, plane sink etc; superimposition of simple irrotational flows, combination of a source and a sink

UNIT III

Analysis of flow through propellers and windmills – slip stream theory, actuated disc theory; jet propulsion devices – analysis of thrust and other performance parameters.

UNIT IV

Similarity and model study in turbomachines: dimensional analysis of incompressible flow turbomachines flow coefficient, head coefficient and power coefficient; non-dimensional plot of performance curves; specific speed; Cordier diagram; specific speed as a design parameter of imcompressible flow turbomachines; unit quantities for hydroturbines..

UNIT V

Mechanical, hydraulic and volumetric loss in a turbo-pump; different types of losses in a hydroturbine installation; different efficiencies in turbomachines.

Interaction of a turbomachine with the pipeline system; system head curve and point of operation, surging, series and parallel operation of pumps and fans.

UNIT VI

Testing of hydroturbines, different performance characteristics of hydroturbines like operating characteristics, main characteristics, Muschel curves; speed governing of hydroturbines – different methods.

Torque converter and fluid coupling – function and performance.

TEXT BOOKS:

1. Massey, Mechanics of Fluids, Taylor & Francis.
2. M.M. Das, Fluid mechanics and turbo machines, PHI.
3. S.K. Some & G. Biswas, Introduction to Fluid Mechanics & Fluid Machines, TMH.

REFERENCES:

4. Fox & Mcdonald, Introduction to Fluid Mechanics, Wiley.
5. Bansal, Fluid Mechanics and Machinery, Laxmi.
6. C.S.P. Ojha, R. Berndtsson, P.N. Chandramouli, Fluid Mechanics & Machinery, Oxford University Press.
7. K. Subramanya, Fluid Mechanics & Hydraulic Machines, TMH.
8. Potter & Wiggert, Fluid Mechanics, Cengage Learning.
9. S. Pati, Fluid Mechanics and Machinery, TMH.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Applied Thermodynamics & Heat Transfer Lab
Course Code: ME592
L-T –P Scheme: 3P **Course Credits: 2**

Introduction:
Heat Transfer laboratory provides fundamental and industrial knowledge about modes of heat transfer, like conduction, convection and radiation, and their application.

Objectives:
Heat Transfer is one of the important subjects which is commonly applied in renewable energy, industrial, commercial and domestic systems. The experiments are designed to provide exposure of practical aspects of the various theoretical concepts developed under the course, Heat and Mass Transfer. The laboratory consists of experiments on various conductive, convective, radiative, boiling and condensing mechanisms of heat transfer.

Learning Outcomes:
At the successful completion of course, the student is able to:

1. Practically relate to concepts discussed in the Heat Transfer course.
2. Conduct various experiments to determine thermal conductivity and heat transfer coefficient in various materials.
3. Select appropriate materials & designs for improving effectiveness of heat transfer.
4. Conduct performance tests and thereby improve effectiveness of heat exchangers.
5. Conduct performance tests and thereby improve effectiveness of refrigeration and air conditioning systems.

Course Contents:

Exercises that must be done in this course are listed below:

1. Study and performance test of a single acting reciprocating air compressor.
2. Study of a shell and tube heat exchanger and determination of LMTD..
3. Determination of thermal conductivity of a metal rod.
4. Determination of 'h' for forced convection over a pin fins.
5. Verification of emissivity of a plate.
6. Determination of thermal conductivity of an insulating powder/or an insulating plate.

Text Books:

1. Heat and Mass Transfer -by R k Rajput, S. chand publication.
2. Heat And Mass Transfer -by Dr. D. S. Kumar , Publisher: S K Kataria and Sons.

UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Subject Name: Design Practice-I Subject Code-ME593
L-T-P scheme: 0-0-3 Semester: Fifth

OBJECTIVES:

- Develop and evaluate alternatives for mechanical systems.
- Estimate fatigue strengths of steel parts
- Apply techniques of combined stress and Mohr's circle in machine design situations
- Determine suitable material and size for structural components in machines, including effects of fatigue and stress concentration.
- Apply iterative techniques in design, including making estimate of unknown values for first computation and checking or revising and recomputing.
- Logically choose and defend choice of design factor.
- Select belts, chains, gears, bearings, power screws.
- Design shafting and specify appropriate keys and couplings.
- Design springs, common welded and bolted connections.
- Write business letters and reports describing design work.

LEARING OUTCOMES:

1) Students will be able to identify the elements of the design process.
2) Students will be able to define strict liability, negligence and express and implied warrantee.
3) Students will be able to list the fundamental canons of engineering ethics.
4) Students will be able to identify or define the yield stress and the ultimate stress of a material.
5) Students will be able to calculate the endurance limit of a material with appropriate corrections.
6) Students will be able to identify the stresses acting on a surface and find principal stresses.
7) Students will be able to evaluate loading and stress results using principal shear stress criterion.
8) Students will be able to evaluate loading and stress results using maximum distortion energy criterion.
9) Students will be able to create a Soderberg endurance failure line.
10) Students will be able to calculate stresses and loads involved with fatigue effect.
11) Students will be able to devise a list of concepts for a design application using idea-generation techniques.

Course Contents:

Exercises that must be done in this course are listed below:

- Bolted bracket
- Cotter joint
- Knuckle joint
- Riveted joints
- Screw jack
- Helical compression spring/ Leaf spring
- Turn buckle
- Welded Joints
- Shaft Couplings

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Course Description

Subject Name: Design Practice-I Subject Code-ME593
L-T-P scheme: 0-0-3 Semester: Fifth

Text Book:

1. Shigley and Mischke, Mechanical Engineering Design, TMH.

2. V.B. Bhandari, Machine Design Data Book TMH

Recommended Systems/Software Requirements:

1. Intel based desktop PC or LAPTOP with minimum of 1.4 GHZ or faster processor with at least 2 GB RAM and 40 GB free disk space and AMD READON or NIVIDIA powered at least 1 GB GRAPHICS.
2. Windows XP or Linux Operating System.
3. Auto-CAD, D2S SOLIDWORKS, CATIA, ANSYS, CREO Design Softwares.

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Course Description

Title of Course: Metrology & Measurement Lab
Course Code: ME591
L-T –P Scheme: 2P **Course Credits: 2**

Introduction:
Heat Transfer laboratory provides fundamental and industrial knowledge about modes of heat transfer, like conduction, convection and radiation, and their application.

OBJECTIVES:

1. To provide Practical knowledge on various Metrological equipments available to measure the dimension of the components.
2. To provide Practical knowledge on the correct procedure to be adopted to measure the dimension of the components..
3. Very good knowledge about the all instrument for using measuring purpose
4. To demonstrate the theoretical concepts taught in Mechanical Measurements & Metrology.
5. To understand and use various measuring tools.
6. To understand calibration of various measuring devices

OUTCOMES:

- Upon completion of this course, the Students can demonstrate different measurement technologies and use of them in Industrial Components.

- Error can be easily calculated after performing this lab
- Calibration can easily done
- To demonstrate the theoretical concepts taught in Mechanical Measurements & Metrology.
- To understand and use various measuring tools.
- To understand calibration of various measuring devices.

Course Contents:

At least 6 experiments to be conducted from the following :
1. Taking measurements using following instruments :
(i) Vernier height & depth gauge, (ii) Dial micrometer, (iii) Thread gauge, (iv) Radius gauge, (v) Filler gauge, (vi) Slip gauge.
2. Measurement of angle of a component using :
(i) Vernier bevel protractor, (ii) angle gauges , (iii) Sine-bar and slip gauges.

3. Checking / measuring parallelism, cylindricity and concentricity of components using dial indicator.
4. Measurement of a specific dimension for a lot of components, and prepare a histogram from the data obtained.
5. Measurement of surface finish by a Talysurf instrument.
6. Measurement of micro feature of a product (eg. Thread of a bolt or saw etc.) in a profile projector.
7. Determine natural cooling characteristics of a heated object by using a thermocouple.
8. Measurement of air velocity across an air duct using anemometer.
9. Fixing a strain gauge on a cantilevered flat section of steel. Then calibration of it as a force dynamometer using a Wheatstone bridge
and loading arrangement.
(NB.: This experiment has to be done over two days– one day for fixing and second day for calibration).

Text Books:

1. Jain R.K. "Engineering Metrology", Khanna Publishers, 2005.
2. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.

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Course Description

Title of Course: Applied Fluid Mechanics Lab
Course Code: ME-596B
L-T-P scheme: 0-0-3 **Course Credit: 2**

The Applied Fluid Mechanics Lab focuses on using fundamental fluid mechanics principles integrated within an interdisciplinary framework for tackling problems in the areas of biomechanics, cardiovascular devices and renewable energy.

Objectives:

1. To learn and understand basic principles of fluid mechanics, Fluid properties and fundamentals of Fluid statics and fluid flow
2. To know the application of fluid mechanics by the inclusion of fluid machinery.
3. To provide an understanding of the hydraulic machines design aspects and practical application.
4. To introduce the concepts of flow measurements and flow through pipes .

Learning Outcomes: The students will have a detailed knowledge of the concepts of Fluid mechanics.The purpose of this course is to learn the Fluid properties and fundamentals of Fluid statics and fluid flow and apply them to practical engineering system design and development. The purpose of this course is to learn the Fluid properties and fundamentals of Fluid statics and fluid flow. Student will learn the concepts of flow measurements and flow through pipes, knowledge of the pumps and turbines, knowledge of impact of jets.
. Upon the completion of Fluid mechanics& Hydraulic Lab, the student will be able to:

- **Understand** and implement basic concepts of fluid mechanics.
- Know the definitions of fundamental concepts of fluid mechanics including: continuum, velocity field; viscosity, surface tension and pressure (absolute and gage); flow visualization using timelines, pathlines, streaklines, and streamlines; flow regimes: laminar, turbulent and transitional flows; compressibility and incompressibility; viscous and inviscid.
- Apply the basic equation of fluid statics to determine forces on planar and curved surfaces that are submerged in a static fluid; to manometers; to the determination of buoyancy and stability; and to fluids in rigid-body motion.
- Ability to analyze fluid flow problems with the application of the momentum and energy equations.
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Course Contents:

At least 6 (six) of the following experiments to be conducted.
1. Study of cavitation characteristics of centrifugal pump.
2. Study of the characteristics of submerged jet.
3. Study of characteristics of hydraulic jump.
4. Study of cavitation phenomenon.
5. Verification of Stokes law.
6. Determination of loss through pipes and fittings.
7. Performance test of pumps in series & parallel.

Text books:
1. Fluid Mechanics, Hydraulic and hydraulic machines by **Modi** and **Seth**, Standard book house.

2. Open channel flow by **K.Subramanya** , Tata Mc.Grawhill publishers.
3. Fluid mechanics & fluid machines by Narayana pillai, universities press.

Reference Text Books:-

1. Fluid Mechanics & fluid machines by Rajput , S.Chand &co.
2. Fluid Mechanics and Machinery, CSP Ojha, Oxford Higher Education
3. Fluid Mechanics by Frank.M. White (Tata Mc.Grawhill Pvt. Ltd.)
4. Fluid Mechanics by A.K. Mohanty, Prentice Hall of India Pvt. Ltd., New Delhi
5. A text of Fluid mechanics and hydraulic machines by Dr. R.K. Bansal - Laxmi Pub.(P) ltd., New Delhi.
6. Fluid Mechanics and Machinery by D. Ramdurgaia New Age Publications.

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Course Description

Title of Course: Electric Machine Lab
Course Code: ME596A
L-T-P scheme: 0-0-3 **Course Credit: 2**

Objectives:

1. Observe the Hopkinson's test and found that the efficiency for the both the generator and motor are same.
2. Observe the speed variation of the DC motor by the resistance of the armature and field
3. Perform the blocked rotor and No load test of a three phase induction motor and find out result to compare that with the theoretical one.

Learning Outcomes: By doing this practical students will gain the knowledge about the different parts of the DC machine and Three Phase Induction Motor. Upon the completion of this practical course, the student will be able to:

- Understand the efficiency of the same rated machine will be same for a dc generator and dc motor
- Understand the speed variation of the motor by varying the different resistance of the motor.
- Get a Knowledge about the result of the three phase induction Motor and find out that this results are helpful to find out the equivalent parameter of the motor.

Course Contents:

Exercises that must be done in this course are listed below:

Experiment No.1: Perform the Hopkinson's Test of Two same rated DC Machines
Experiment No. 2: Speed Control of DC Motor using armature resistance control
Experiment No. 3: Speed Control of DC Motor using filed resistance control
Experiment No. 4: Perform the No load test of three phase Induction Motor
Experiment No. 5: Perform the Blocked Rotor test of Three Phase Induction Motor

Text Books:

1. Electrical Machine by Ashfaq Hussain

References:

1. A Text book of Electrical Technology (Volume-2) by B.L.Theraja, A.K. Theraja
2. Electrical Machinery by Dr.P.S. Bimbhra
3. Theory and Performance of Electrical Machine by J.B.Gupta