RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Mechanical Engineering, IV-Semester

Fluid Mechanics

Objectives :
To be familiar with all the basic concepts of fluids and fluid flow phenomenon, conservation equations and their applications to fluid flow problems.
Outcomes : : At the completion of this course, students should be able to
. understand the properties of the fluid.
. understand and solve the fluid flow problems.
understand the mathematical techniques of practical flow problems.
. understand the energy exchange process in fluid machines.

Fluid Static's : Review of Basic concepts &properties of the fluid . Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces ; buoyant force, Stability of floating and submerged bodies, Relative equilibrium.

Kinematics of Flow : Types of flow-ideal & real , steady & unsteady, uniform & non-uniform, one, two and three dimensional flow, path lines, streak-lines, streamlines and stream tubes; continuity equation for one and three dimensional flow, rotational & irrotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flow net & its applications , method of drawing flow nets.

Dynamics of Flow: Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow; momentum correction factor. The moment of momentum equation, forces on fixed and moving vanes and other applications. Fluid Measurements: Velocity measurement (Pitot tube, current meters etc.); flow measurement (orifices, nozzles, mouth pieces, orifice meter, nozzle meter, venturi-meter, weirs and notches).

Dimensional Analysis : Dimensional analysis, dimensional homogeneity, use of Buckingham-pi theorem, calculation of dimensionless numbers
Introduction to boundary layer, Boundary layer development on a flat plate and its characteristics - Boundary layer thickness, displacement thickness, momentum thickness, energy thickness. Momentum equation for boundary layer by Von karman, drag on flat plate, boundary layer separation and its control. Aerofoil theory, lift and drag coefficients, streamlined and bluff bodies.
Flow through Pipes : Reynolds experiment & Reynolds number, laminar & turbulent flow, Introduction to Navier Stokes' Equation, relation between shear & pressure gradient, laminar flow through circular pipes, friction factor, laminar flow between parallel plates, hydrodynamic lubrication.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

References: -

1.Streeter VL, Wylie EB, Bedford KW; Fluid Mechanics; Mc Graw Hills
2FOX , McDonald Pritchard , Fluid Mechanics Wiley students edition
3. White ; Fluid Mechanics ; Mc Graw Hills
4. Cengal; Fluid Mechanics; Mc Graw Hills
5 R Mohanty; Fluid Mechanics; PHI
6 K L Kumar Fluid Mechanics
7 Fluid Mechanics & hydraulic Machines , Modi & Seth
8 CS Jog , Fluid Mechanics Volume II CAMBRIDGE IISc Series , Third Edition

List of Experiments :

1. To determine the local point pressure with the help of pitot tube.
2. To find out the terminal velocity of a spherical body in water.
3. Calibration of Orifice meter and Venturi meter
4. Determination of Cc, Cv, Cd of Orifices
5. Calibration of Nozzle meter and Mouth Piece
6. Reynolds experiment for demonstration of stream lines & turbulent flow
7. Determination of meta-centric height
8. Determination of Friction Factor of a pipe
9. To study the characteristics of a centrifugal pump.
10. Verification of Impulse momentum principle.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Mechanical Engineering, IV-Semester

Machine Drawing & CAD

Objectives :
To enable the students to prepare a detailed assembly drawing for machine components.
Outcomes :
1. Understand Indian standards for machine drawing.
2. Understand Fits and Tolerances in technical drawing.
3. Prepare assembly drawing of joints, couplings and machine elements.
4. Design and prepare Jigs and fixtures for given components.

Drawing conventions; IS codes, sectional views and sectioning, surface finish and tolerances representation of machine parts such as external and internal threads, slotted heads, square ends, and flat radial ribs, slotted shaft, splined shafts, bearings, springs, gears, Rivet heads and Riveted joints, Welded joints, Drawing of Threaded fasteners .
Assembly Drawing : Assembly Machine Drawing ,Basic concept of assembly drawing ,bill of materials, Assembly drawing of Cotter and Knuckle joints, pedestal and footstep bearings, Engine parts- crosshead and stuffing box, IC engines parts - piston and connecting rods; lathe machine parts-Tool post and Tail Stock.

CAD : software and hardware required to produce CAD drawings Software: operating systems; CAD software packages e g AutoCAD, AutoCAD/Inventor, Micro station, Catia, Pro/ENGINEER, Solid works; minimum system requirements. Preparing & interpreting CAD drawing, orthographic projections; Commands: absolute/relative/polar coordinates; features eg line types, grids, snaps, circle, text, hatching, dimensioning, layers/levels, colour; viewing e g zoom, pan; inserting other drawings e g symbols, blocks; modifying e g copy, rotate, move, erase, scale, chamfer, fillet Interpret: determine properties of drawn objects e g list, distance, area, volume use CAD software to produce 2D & 3D assembly drawings and views
3D environment: 3D views e g top, front, side, isometric 3D models: 3D techniques e g addition and subtraction of material, extrude, revolve, sweep, 3D coordinate entry (x, y, z), wire frame drawing, 2D to 3D (thickness, extrusion); surface models; solid

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

References:
1.Bhatt, ND; Machine Drawing; Charotar Publication
2. K C John ,Machine Drawing , PHI
3. Singh A; Machine Drawing; TMH publication
4. Narayana and Reddy; Machine Drawing; New age, Delhi.
5. Shigley JE et al; Mechanical Engineering Design, TMH

List of Experiments:
Assembly Drawing and design problem as per given syllabus

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Mechanical Engineering, IV-Semester

Energy Conversion

Objectives :
On completion of this course, the students are expected to understand the fundamental principle, operation, performance of IC Engines, auxiliary systems, combustion of SI & CI engines, various fuels used and engine emissions.

Outcomes :
Acquire the knowledge of engine components and fuel air cycles
.Understand the working of engine auxiliary systems.
Understand the combustion aspects of SI Engines
Understand the combustion aspects of CI Engines.

Internal Combustion Engine: S.I. and C.I. engines of two and four stroke cycles, real cycle analysis of SI and CI engines, determination of engine dimensions, speed, fuel consumption, output, mean effective pressure, efficiency, factors effecting volumetric efficiency, heat balance, performance characteristics of SI and CI engines, cylinder arrangement, firing order, power balance for multi-cylinder engines .

Combustion in SI engines: Flame development and propagation ,Pressure-Crank Angle diagram , Stages of Combustion ignition lag, effect of air density, temperature, engine speed, turbulence and ignition timings, physical and chemical aspects , abnormal Combustion , effect of engine and fuel variables on abnormal combustion , pre-ignition, its causes and remedy, salient features of various type combustion chambers.

Combustion in C.I. Engines: Times base indicator diagrams and their study, various stages of combustion, delay period, diesel knock, knock inhibitors, salient features of various types of combustion chambers .

I.C. Engine System: Fuels, ignition systems, cooling, exhaust/scavenging and lubrication system. Fuel metering in SI engine: Fuel injection in SI engine (MPFI, TBI,CRDI), Theory of carburetion, Solex Carburetor, simple problems on carburetion. Fuel metering in CI engines: Fuel injection in CI engine ,Working Principle of fuel pump & fuel injectors , types of nozzles , simple numerical problems . Cooling & lubrication of SI & CI Engines

Supercharging & Turbo charging : Methods of supercharging,& turbo charging Effects of super charging and turbo charging . Engine Modifications for supercharging, supercharging of two stroke engines. micro processor controlled supercharging .

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

References:
1. J.B. Heywood. Internal combustion Engines , Wiley
2. Ganeshan V; Internal Combusion engines; TMH
3. Mathur M L & Sharma RP; A. Course in IC engines; DhanpatRai
4. R Yadav , Internal Combustion Engines
5 Halderman JD and Mitchell CD; Automotive Engines theory and servicing; Pearson

6 DomKundwar; Internal Combustion Engines ; Dhanpat Rai Publications
7 Taylor GF; Internal Combustion Engines Theory & Practice; MIT Press
8 Richard Stone; Introduction to IC Engines; Society of Automotive Engr (Palgrave Mc Millan)

List of Experiments :

1. Determination of Valve timing diagram
2. Load test on Petrol Engine
3. Heat Balance of SI engine
4. Heat Balance of CI Engine
5. Study of Battery Ignition system and Electronic Ignition System
6. Study of Diesel fuel pump
7. Study of Diesel fuel injectors
8. Study of a Carburetors
9. Study of Fuel Injection system in SI Engine
10. Study of lubricating system in CI Engine

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Mechanical Engineering, IV-Semester

Machine Design - I

Objectives :
To study the basic design principles and apply the principles to the design of various elements encountered in Mechanical machines and structures.
Outcomes :
To determine the strength of the components
To determine the failure conditions and apply them to real life Problems
To design simple joints, fasteners, levers and springs.

Mechanical Engineering design - Design considerations, Design Procedure Material selection Modes of failure - Theories of failure , causes of stress concentration; stress concentration in tension, bending and torsion; reduction of stress concentration, theoretical stress concentration factor, notch sensitivity, fatigue stress concentration factor, cyclic loading, endurance limit, S-N Curve, loading factor, size factor, surface factor. Design consideration for fatigue, Goodman and modified Goodman's diagram, Soderberg equation, Gerber parabola, design for finite life, cumulative fatigue damage

Design of Fasteners : Design of cotter and knuckle joints.. Fasteners and keys , Design of welded joints , Fillet and butt welds , Design of riveted joints. Design of bolted joints . Power screws .

Selection & Design of bearings : Reynold's equation, stable and unstable operation, heat dissipation and thermal equilibrium, boundary lubrication, dimensionless numbers, Design of journal bearings, Rolling-element Bearings*:* Types of rolling contact bearing, bearing friction and power loss, bearing life; Radial, thrust & axial loads; Static & dynamic load capacities; Selection of ball and roller bearings; lubrication and sealing.

Design of Springs : Design of helical compression & tension spring , design of leaf spring & torsion springs , fatigue loading of springs ,surge in springs ,spiral springs .

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

References :
1Robert C Juvinal, Kurt M Marshek Machine Component design Wiley Student edition
2 C S Sharma & Kamlesh Purohit , Design of machine elements PHI
3 Sharma & Agarwal Machine design .
4 Pandya & Shah , Charottar .
6 J E Shingley Machine design Mc Graw Hills
7 Gope P C , Machine Design , PHI Learning . 2015
8 P Kannaiah , Machine Design , SCITECH .
9 Nortan RL , Machine Design , Pearson , Fifth Edition .

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Mechanical Engineering, IV-Semester

Computer Programming

C language alphabet set, identifiers, Variables and constants Data types, Builtin and user Defined Data types Arrays operators and expressions Simple assignment and Input-output statements, preprocessor directives writing simple 'C' programs, compiling and executing 'C' Programs.

Conditional statements and loops: IF statement IF–ELSE statement, SWITCH statement, FOR statement, WHILE and Do WHILE statement.

Function: Function declaration or prototype. Function definition, function calling: call by value, call by reference, Recursion.

Introduction to pointers, File processing: concept of files, file opening, editing, reading and writing.

Reference Books :

1. Programming in ANSI C, by Balagurusamy, Tata McGraw Hill
2. The C programming Language. By Brian W. Kernighan and Dennis M. Ritchie. Published by Prentice-Hall
3. Let us C by Y.Kanetkar, BPB Publication

Lab assignments :

1. Design and execute a 'C' program for multiplying two nXn matrics.
2. Design a 'C' program to calculate Average of 'n' numbers.
3. Design a 'C' program to add two numbers using call by value parameter passing mechanism.
4. Design a 'C' program to swap the contents of two variables using call by reference parameter passing mechanism.
5. Design a 'C' program to open a file and add contents to modify the file.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Mechanical Engineering, IV-Semester (Mathematics-III)

(Applicable to ME/AU/CM/FT/IP/Mining Branches)

COURSE OBJECTIVE- The objective of this course is to fulfill the needs of Engineers to understand the Applications of Fourier Series, Different Transforms, Complex Analysis & numerical methods in order to enable young technocrats to acquire Mathematical thinking of Formulating, Analyzing and Solving a wide range of Practical Problems Appearing in Science & Engineering.

Course Contents

Fourier Series: Fourier Series for Continuous & Discontinuous Functions, Expansion of odd and even periodic functions, Half-range Fourier series, Complex form of Fourier Series,

Integral Transforms:
Fourier Transform-Complex Fourier Transform, Fourier Sine and Cosine Transforms, Applications of Fourier Transform in Solving the Ordinary Differential Equation. **Laplace Transform-** Introduction of Laplace Transform, Laplace Transform of elementary Functions, Properties of Laplace Transform, Change of Scale Property, First and Second Shifting Properties, Laplace Transform of Derivatives and Integrals. Inverse Laplace Transform & its Properties, Convolution theorem, Applications of Laplace Transform in solving the Ordinary Differential Equations.

Functions of Complex Variables: Analytic functions, Harmonic Conjugate, Cauchy-Riemann Equations, Line Integral, Cauchy's Theorem, Cauchy's Integral Formula, Singular Points, Poles & Residues, Residue Theorem, Application of Residues theorem for Evaluation of Real Integrals.

Numerical Solution of Ordinary Differential equations: Picard's Method, Taylor's Series, Euler's Method, Modified Euler's Method, Runge-Kutta methods, Milne's and Adam's Bashforth Methods.

COURSE OUTCOMES- The curriculum of the Department is designed to satisfy the diverse needs of students. Coursework is designed to provide students the opportunity to learn key concepts of Fourier Series, Different Transforms, Complex Analysis & Numerical Methods for Solving Ordinary Differential Equations of First Order.

EVALUATION- Evaluation will be continuous, an integral part of the class as well as through external assessment.

References:

1. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley India.
2. H C Taneja: Advanced Engineering Mathematics, I.K. International Publishing House Pvt. Ltd.
3. B.S. Grewal: Higher Engineering Mathematics , Khanna Publication.
4. S S Sastri: Engineering Mathematics, PHI
5. Ramana: Advance Engg. Mathematics, TMH New Delhi
6. Engineering Mathematics By Samnta Pal and Bhutia, Oxford Publication

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Mechanical Engineering, IV-Semester

System Engineering

COURSE OBJECTIVE

This course in systems engineering examines the principles and process of creating effective systems to meet application demands. The course is organized as a progression through the systems engineering processes of analysis, design, implementation, and deployment with consideration of verification and validation throughout.

COURSE CONTENT

What is System Engineering, Origin, Examples of Systems requiring systems engineering,Systems Engineer Career Development Model, Perspectives of Systems Engineering, Systems Domains, Systems Engineering Fields, SystemEngineering Approaches.
Structure of Complex Systems, System Building Blocks and Interfaces, Hierarchy of Complex Systems, System Building Blocks, The System Environment, Interfaces and Interactions, Complexity in Modern Systems.

Concept Development and Exploration, Originating a New System, Operations Analysis, Functional Analysis, Feasibility, System Operational Requirements, Implementation of Concept Exploration.

Engineering Development, Reducing Program Risks, Requirements Analysis, Functional Analysis and Design, Prototype Development as a Risk Mitigation Technique, Development Testing, Risk Reduction.
Integration and Evaluation, Integrating, Testing, And Evaluating The Total System, Test Planning And Preparation, System Integration, Developmental System Testing, Operational Test And Evaluation, Engineering For Production, Transition From Development To Production, Production Operations.

COURSE OUTCOME

After successful completion of the course, students would be able to Plan and manage the systems engineering process and examine systems from many perspectives (such as software, hardware, product, etc.) Students can distinguish critical functions, diagnose problems, and apply descoping strategies and judge the complexity of production and deployment issues.

EVALUATION

Evaluation will be a continuous and integral process comprising classroom and external assessment.

REFERENCES:

1. Alexander Kossiakoff, William N Sweet, “System Engineering Principles and Practice, Wiley India
2. Blanchard Fabrycky, Systems engineering and analysis, Pearson
3. Dennis M. Buede, William D.Miller, “The Engineering Design of Systems: Models & Methods” Wiley India
4. JeffreyL Whitten, Lonnie D Bentley, “System Analysis and Design Methods”
5. Richard Stevens, Peter Brook,” System Engineering – Coping with complexity, Prentice Hall