Jabalpur Engineering College, Jabalpur (M.P)

Choice Based Credit System (CBCS)

Scheme of Examination

w.e.f. 20 Jan 2017

Bachelor of Engineering (Mechanical Engineering)

SEMESTER IV

S. No.	Subject Category	Subject Code	Subject Name	Maximum Marks Allotted									Hours/Week			Total Credits
				Theory						Practical						
				End Sem	Minor-I	Minor-II	Quiz	Assignment	Tutorials/ Problem Solving	End Sem	Lab Work	Viva Voce/ Assignment	L	T	P	
1.	DC	ME 242	Fluid Mechanics	60	10	10	5	5	10	10	20	20	3	-	2	4
2.	DC	ME-243	Machine Drawing & CAD	60	10	10	5	5	10	10	20	20	3	-	2	4
3.	DC	ME-244	Energy Conversion	60	10	10	5	5	10	10	20	20	2	1	2	4
4.	DC	ME-245	Machine Design-I	60	10	10	5	5	10	-	-	-	3	1	-	4
5.	EAS	ME-246	Computer Programming	-	-	-	-	-	-	10	20	20	-	-	4	2*
6.	DE	MA-241	Mathematics-III	60	10	10	5	5	10	-	-	-	3	1	-	4
7.	EAS	ME-247	System Engineering	60	10	10	5	5	10	-	-	-	3	1	-	4
8.	HU	HU 248	NSS/NCC	-	-	-	-	-	-	-	-	-	-	-	-	Qualifier*
			Total	360	60	60	30	30	60	40	80	80	17	4	10	26

L: Lecture T: Tutorial P: Practical

Note:

- For 'Computer Programming' there will be no examination and credits will be awarded only on the basis of internal assessment.
- NSS/NCC is just a qualifier subject which means student has to compulsorily qualify this is a mandatory requirement for the award of degree before completing the course.
- Mathematics- III will be a departmental elective subject with content customized to the requirements of parent discipline.

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Jabalpur Engineering College, Jabalpur (M.P)
PROGRAMME: B.E. Mechanical Engineering (IV-Semester) CBCS

Credits: 4 | **ME-242 Fluid Mechanics** | **L: 3, T: 0, P: 2**

Course Objective:
To be familiar with all the basic concepts of fluids and fluid flow phenomenon, conservation equations and their applications to fluid flow problems.

Course Contents:

Fluid Statics: 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 & ir-rotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flow net & its applications.

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. 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, similarity laws and model investigations.
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. Aero-foil theory, lift and drag coefficients, streamlined and bluff bodies.

Flow through Pipes : Reynolds experiment & Reynolds number, laminar & turbulent flow, Introduction to Navier Stoke's Equation, relation between shear & pressure gradient, laminar flow through circular pipes, friction factor, laminar flow between parallel plates, flow through pipes in series and parallel, different types of head losses, friction factor and pressure drop.

Outcomes: At the completion of this course, students should be able to

1. Understand the properties of the fluid.
2. Understand and solve the fluid flow problems.
3. Understand the mathematical techniques of practical flow problems.
4. Understand the energy exchange process in fluid machines.

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
2. FOX , 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.

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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 Venturimeter.
4. Determination of C_c, C_v, C_d 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.

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Jabalpur Engineering College, Jabalpur (M.P)
PROGRAMME: B.E. Mechanical Engineering (III-Semester) CBCS

Credits: 4	**ME-243 Machine Drawing & CAD**	**L: 3, T: 0, P: 2**

Course Objective:
To enable the students to prepare a detailed assembly drawing for machine components.

Course Contents:

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 e.g. 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.

Course 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.*

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.

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Jabalpur Engineering College, Jabalpur (M.P)
PROGRAMME: B.E. Mechanical Engineering (III-Semester) CBCS

Credits: 4	**ME-244**	**Energy Conversion**	**L: 2, T: 1, P: 2**

Course Objective:

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.

Course Contents:

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: Time 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. Microprocessor controlled supercharging.

Outcomes:

1. *Acquire the knowledge of engine components and fuel air cycles.*
2. *Understand the working of engine auxiliary systems.*
3. *Understand the combustion aspects of SI Engines.*
4. *Understand the combustion aspects of CI Engines.*

EVALUATION

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

Reference:

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).

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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.

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Jabalpur Engineering College, Jabalpur (M.P)
PROGRAMME: B.E. Mechanical Engineering (III-Semester) CBCS

Credits: 4	**ME-245 Machine Design-I**	**L: 3, T: 1, P: 0**

Course Objective:

To study the basic design principles and apply the principles to the design of various elements encountered in Mechanical machines and structures.

Course Contents:

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.

Outcomes:

1. *To determine the strength of the components*
2. *To determine the failure conditions and apply them to real life Problems*
3. *To design simple joints, fasteners, levers and springs.*

EVALUATION

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

References:

1. Robert 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.
5. J E Shingley Machine design Mc Graw Hills.
6. Gope P C, Machine Design, PHI Learning. 2015.
7. P Kannaiah, Machine Design, SCITECH.
8. Nortan RL, Machine Design, Pearson, Fifth Edition.

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Jabalpur Engineering College, Jabalpur (M.P)
PROGRAMME: B.E. Mechanical Engineering (III-Semester) CBCS

Credits: 4	~~EAS~~ ME-247 **System Engineering**	**L: 3, T: 1, P: 0**

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 Contents:

Introduction: 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, System Engineering Approaches.

Complex Systems: 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.

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

Engineering Developments and Risk Reduction: Engineering Development, Reducing Program Risks, Requirements Analysis, Functional Analysis and Design, Prototype Development as a Risk Mitigation Technique, Development Testing, Risk Reduction.

System Integration and Evaluation: 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.

Outcomes:

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.

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