Jabalpur Engineering College, Jabalpur

Semester IV Credit Based Grading System (CBGS) w.e.f. July 2017

Scheme of Examination

Bachelor of Engineering B.E. (Mechanical Engineering)

Subject wise distribution of marks and corresponding credits

Scheme of Examination w.e.f. July-2017 (Academic Session-2017-18)

S. No.	Subject Code	Subject Name & Title	Maximum Marks Allotted						Hours / week.			Total Credits	Total Marks
			Theory			Practical		Total Marks					
			End Sem	Mid Sem. MST	Quiz, Assignment	End Sem.	Lab Work		L	T	P		
1	**MA4101**	Mathematics-III	70	20	10	-	-	100	3	1	-	4	
2	**ME4002**	Fluid Mechanics	70	20	10	30	20	150	3	1	2	6	
3	**ME4003**	Machine Drawing & CAD	70	20	10	30	20	150	3	1	2	6	
4	**ME4004**	Energy Conversion	70	20	10	30	20	150	3	1	2	6	
5	**ME4005**	Machine Design-I	70	20	10	-	-	100	3	1	-	4	
6	**CS4106**	Departmental Lab-I (Java)	-	-	-	30	20	50	-	-	2	2	
7	**ME4007**	Programming Tools (CAD Tools) (Internal Assessment)	-	-	-	-	50	50	-	-	2	2	
8	**ME4008**	Professional Ethics/ Security and regulation act (Internal Assessment)	-	-	-	-	50	50	-	-	2	2	
Total			**350**	**100**	**50**	**120**	**180**	**800**	**15**	**5**	**12**	**32**	**800**

MST: Minimum of two mid semester tests to be conducted. **L: Lecture** **T: Tutorial** **P: Practical**

- **Students have to go for Industrial Training /Internship of 4 weeks at the end of IV Semester.**

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B.E. (CBGS) IV SEMESTER
MECHANICAL ENGINEERING
MATHEMATICS- III

Course	Subject Title	Subject Code	Grade for End Sem.		CGPA at the end of every even semester
			T	P	
B.E. (CBGS)	Mathematics- III	MA4101	Min. "D"	Min. "D"	5.0

Unit-I:

Analytic functions, Cauchy- Riemann equaticns in Cartesian and polar coordinates, harmonic and conjugate harmonic functions, Complex integration, line integral, Cauchy's integral theorem, Cauchy integral formula.

Unit –II:

Residue theorem, evaluation of simple real integrals, Taylors and Laurent series, Conformal mappings, mappings of elementary functions, Bilinear transformations, Jock vow ski's transformation, Schwarz – Christ of fel transformation.

Unit –III:

Roots of algebraic and transcendental equations: Bisection method, Regula-Falsi method, Newton-Raphson method, iteration method, Graffes root squaring method. Solution of system of linear equations: Gauss elimination method, Gauss Jordan method, LU decomposition method, relaxation method, Jacobi and Gauss-Seidel methods.

Unit –IV:

Interpolation: Finite difference operator and their relationships, difference tables, Newton, Gauss, Bessel and Stirling's interpolation formulae, Divided differences, Lagrange Interpolation and Newton's divided difference interpolation.Numerical differentiation and Integration: First and second order derivatives by various interpolation formulae, Trapezoidal, Simpsons 1/3rd and 3/8th rules with errors and their combinations, Gauss Legendre 2-points and 3-points formulae.

Unit –V:

Numerical Solution of ordinary differential equations: Solution of ODE by Taylor series, Picard's method, Modified Euller method, Runge-kutta Method, predictor corrector method.Sampling: Brief idea of sampling, t, F and χ^2 distribution and their applications, ANOVA, Statistical quality control, control charts, sampling inspection, acceptance sampling, Producers and consumers risk, O.C. curve, Taguchi method.

Reference Books:

1. Advanced Engineering Mathematics by E. Kreyszig John Willey & Sons
2. Higher Engineering Mathematics by B.S. Grewal, Khanna Publishers.
3. Numerical Methods in Engineering and science by B.S. Grewal, Khanna Publishers .
4. Higher Engineering Mathematics by B.V. Ramana TMH.
5. Numerical Methods by E. Balagurusamy, Tata Mc Graw- Hill Publishing CompanyLtd., New Delhi.

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B.E. (CBGS) IV SEMESTER
MECHANICAL ENGINEERING
FLUID MECHANICS

Course	Subject Title	Subject Code	Grade for End Sem.		CGPA at the end of every even semester
			T	P	
B.E. (CBGS)	Fluid Mechanics	ME4002	Min. "D"	Min. "D"	5.0

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.

1. Determination of properties of fluid and their utility
2. To understand the kinematic and dynamic behavior of fluid
3. Determination of discharge through flow measuring instruments
4. Determination of dimensionless numbers by applying mathematical techniques
5. To understand the fluid flow behavior through pipes

Course Contents

Unit-I:

Fluid Statics: Basic concepts &properties of the fluid. Pressure measurement by manometers and gauges. pressure variation in static fluid, Absolute and gauge pressure, total force and centre of pressure, hydraulic forces on submersed surfaces – plan, inclined and curved surfaces; buoyancy, meta-center , Stability of floating and submerged bodies, Relative equilibrium.

Unit –II:

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, source, sink and combination of source-sink flow, velocity potential, stream function, flow net & its applications.

Unit –III:

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, mouthpieces, orifice meter, nozzle meter, venturi-meter, weirs and notches).

Unit –IV:

Dimensional Analysis: Dimensional analysis, dimensional homogeneity, use of Buckingham-pitheorem, 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.

Unit –V:

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.

Evaluation:

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

Books 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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FLUID MECHANICS LAB

List of Experiments:

1. Determination of discharge of liquid flow in pipe by using orifice meter.
2. Determination of discharge of liquid through pipe by using venturimeter.
3. Determination of C_c, C_v, C_d of Orifices.
4. Determination of discharge of liquid flow in pipe through Mouth Piece.
5. Determination of discharge of liquid flow in pipe through v notches
6. Determination of discharge of liquid flow in pipe through weirs
7. Determination of discharge of liquid flow in pipe through sluice gate.
8. Reynolds experiment for demonstration of stream lines & turbulent flow.
9. Determination of Friction Factor of a pipe.
10. To determine the discharge of liquid through rotameter.

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B.E. (CBGS) IV SEMESTER
MECHANICAL ENGINEERING
MACHINE DRAWING & CAD

Course	Subject Title	Subject Code	Grade for End Sem.		CGPA at the end of every even semester
			T	P	
B.E. (CBGS)	Machine Drawing & CAD	ME4003	Min. "D"	Min. "D"	5.0

Note - Time Duration of Paper: Four Hours.

Course Objective:

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

Course Contents:

Unit-I:

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, Limit, Tolerances and fits.

Unit –II:

Assembly Drawing: Assembly Machine Drawing, Basic concept of assembly drawing, bill of materials, drawing of different types of keys, Assembly drawing of Cotter and Knuckle joints, Pedestal and footstep bearings.

Unit-III:

Drawing of Engine Parts:

Steam Engine Parts: Crosshead for vertical and horizontal engine, Stuffing box for small and large steam engines.

IC Engines Parts: Piston, piston rings, connecting rods for petrol and diesel engine, Eccentric.

Lathe Machine Parts: Tool post and Tail Stock.

Conventional representation of materials/machine components.

Unit-IV:

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 3D views, 3D coordinate entry (x, y, z), wire frame drawing, 2D to 3D (thickness, extrusion); surface models.

Evaluation:

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

Books References:

1. Bhatt, ND; Machine Drawing; Charotar Publication.
2. K C Jain,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.

Note: Weightage of Individual Unit as follows.

Unit -I	Unit -II	Unit -III	Unit -IV
20%	30%	30%	20%

MACHINE DRAWING & CAD LAB

List of Experiments:

Assembly Drawing and design problem as per given syllabus.

B.E. (CBGS) IV SEMESTER
MECHANICAL ENGINEERING
ENERGY CONVERSION

Course	Subject Title	Subject Code	Grade for End Sem.		CGPA at the end of every even semester
			T	P	
B.E. (CBGS)	Energy Conversion	ME4004	Min. "D"	Min. "D"	5.0

Course Objectives:

The purpose of this course is to introduce the undergraduate students with

1. To learn applications of energy conversion device to thermal power plant.
2. To provide an overview of steam boilers, condensers, steam nozzles their applications.
3. To perform calculations on related to designing of energy conversion devices.
4. Importance and components of cooling towers and heat exchangers.

Course Contents:

Unit -I:

Steam Generators (Boilers): Classification of boilers, Requirements of a good boiler, Conventional boilers, High-pressure boilers- Lamont, Benson, Loeffler and Velox steam generators, Fluidized bed boilers (FBB), Selection of boilers, Performance and rating of boilers, Equivalent evaporation, Boiler efficiency, Heat balance sheet, Heat losses in boiler plant, Combustion in boilers, Stoker firing system, Pulverized fuel firing system, Super critical boilers, Fuel and ash handling in power plants, Ash handling plant and challenges in India. Boiler draught, overview of boiler codes, ASME-BPVL 2007, Numerical problems on boiler performance and boiler draught.

Unit- II:

Phase Change Cycles: Introduction, Classifications of vapour power cycles, Basic elements of steam power plant, Vapor Carnot cycle, its efficiency and limitations, Rankin cycle, its efficiency and assumptions, effect of boiler and Condenser pressure and superheat on efficiency, Modified Rankin cycle, Comparison of Rankine and Carnot cycle, Reheat cycle, Perfect regenerative cycle, its expression of efficiency, Ideal and actual regenerative cycle with single and multiple heaters, Regenerative-reheat cycle, Binary-vapor cycle, properties of binary working fluid, work done and efficiency calculations. Simple numerical problems on Phase change cycles.

Unit –III:

Gas Dynamics: Introduction and Applications of Gas Dynamics, Concept from fluid mechanics, Continuity equation, Momentum equation, One dimensional gas dynamics, Isentropic condition, Speed of sound in fluid, One dimensional wave motion, Elastic waves, Mach number and its significance, Mach cone, Zone of action, Zone of silence, Stagnation state and properties, One-dimensional isentropic flow through variable area duct, Condition for maximum fluid flow, Effect of area ratio as a function of Mach number, Simple numerical problems on Gas Dynamics.

Unit- IV:

Air Compressors: Introduction, applications, and Classification of Air Compressors, Reciprocating Air Compressor; working, work done, power required, efficiency, for single and multistage stage compression, Comparison of single stage and multi stage compression, Two stage with intercooler, Condition for minimum work done in two stage. Rotary Compressors; working, classifications. Comparison of reciprocating and rotary compressors. Simple numerical problems on Air Compressors.

Unit –V:

(A) Steam Nozzles: Introduction and types, Flow of steam through nozzles, Effect of friction in nozzle efficiency, Condition for maximum discharge, Physical significance of critical pressure ratio, Super-saturated flow.

(B) Steam Condensers: Introduction, Objective, Classification of condensers, Comparison of jet and surface condensers, Air leakage and its effect on performance, back pressure and its effect on plant performance, Condenser efficiency and factors affecting, Thermal analysis of condenser, Simple numerical problems on Steam Condensers.

(C) Cooling Towers: Introduction, Function, Components and applications, Cooling tower materials, Classifications of cooling towers, Performance assessment of cooling towers, Energy efficiency opportunities, Best design practices for cooling tower.

(D) Heat Exchangers: Introduction and applications, Classification of heat exchangers.

Evaluation:

Evaluation will be continuous an integral part of the class followed by the final examination as well as through external assessment

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Books References:

1. Nag PK; Power plant Engineering; TMH
2. Thermodynamics by Gordon J. Van Wylen
3. P.K.Nag; Basic and applied Thermodynamics; TMH
4. Ganesan; Gas turbines; TMH
5. Heat Engines by V.P. Vasandani& D. S. Kumar
6. R. Yadav Steam and Gas Turbines
7. R.Yadav Thermal Engg.
8. Kadambi& Manohar; An Introduction to Energy Conversion – Vol II. Energy conversion cycles.

ENERGY CONVERSION LAB

List of Experiments:

1. Study of Separating & Throttling Calorimeter for measurement of dryness fraction.
2. Study of Benson Boiler.
3. Study of Lamont Boiler.
4. Study of Loeffler Boiler.
5. Study of Velox Boiler.
6. Study of Boiler Draught.
7. Study of Boiler Trial.
8. Study of Cooling Towers.
9. Study of Heat Exchangers.
10. Study of Air Compressor.

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B.E. (CBGS) IV SEMESTER
MECHANICAL ENGINEERING
MACHINE DESIGN-I

Course	Subject Title	Subject Code	Grade for End Sem.		CGPA at the end of every even semester
			T	P	
B.E. (CBGS)	Machine Design-I	ME4005	Min. "D"	Min. "D"	5.0

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:

Unit –I:

Mechanical Engineering Design - Design considerations, Design Procedure, Material selection Modes of failure, causes of stress concentration; stress concentration in tension, bending and torsion; reduction of stress concentration, theoretical stress concentration factor, notch sensitivity.

Fatigue - Cyclic loading, endurance limit, S-N Curve, loading factor, size factor, surface factor.Fatigue stress concentration factor, Design consideration for fatigue, Goodman and modified Goodman's diagram, Soderberg equation, Gerber parabola, design for finite life, cumulative fatigue damage.

Unit-II:

Design of Fasteners: Design of cotter joints, Design of knuckle joints, Design of welded joints; Fillet and butt welds, Welded joint subjected to Bending moment, Welded joint subjected to Torsional moment, Design of riveted joints; Design of Longitudinal Butt joint for Boiler shell, Design of Circumferential Lap joint for Boiler shell, Eccentrically Loaded Riveted Joint, Design of bolted joints, Forms of threads, Trapezoidal threads, Power screws.

Unit –III:

Shafts and Keys: Design of shaft under combined bending, twisting and axial loading; shock and fatigue factors, design for rigidity; design of shaft subjected to dynamic load; Design of keys; Design of Square and Flat keys, Design of Kennedy key.

Unit-IV:

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 bearing; 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.

Unit –V:

Design of Springs: Types of spring, Terminology of Helical Spring, Design of helical compression and tension spring, Design of leaf spring and Torsion springs, Fatigue loading of springs, Surge in springs, Spiral springs, Nipping of leaf spring.

Evaluation:

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

Books References:

1. Robert C Juvinal, Kurt M Marshek Machine Component design Wiley Student edition.
2. C S Sharma &KamleshPurohit, 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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B.E. (CBGS) IV SEMESTER
MECHANICAL ENGINEERING
COMPUTER PROGRAMMING LAB-II (JAVA)

Course	Subject Title	Subject Code	Grade for End Sem.		CGPA at the end of every even semester
			T	P	
B.E. (CBGS)	Computer Programming Lab- II (JAVA)	CS4106	Min. "D"	Min. "D"	5.0

Unit-I:

Basic Java Features : - C++ Vs JAVA, Flavors of Java, Java Designing Goal. Role of Java Programmer in Industry, Features of Java Language, JVM –The heart of Java, Java's Magic Byte code. Installing Java, Java Program Development, Java Source File Structure, Compilation, Execution. Lexical Tokens, Identifiers, Keywords, Literals, Comments, Primitive Data types, Operators, Assignments.

Unit- II:

Object Oriented Programming: Class Fundamentals, Object & Object reference, Object Life time & Garbage Collection, Creating and Operating Objects, Constructor & initialization code block, Access Control, Modifiers, methods , Inner Class & Anonymous Classes, Abstract Class & Interfaces. Defining Methods, Argument Passing Mechanism, Method Overloading, Recursion. Dealing with Static Members, Finalize() Method, Native Method, Use of "this" reference, Use of Modifiers with Classes & Methods. Design of Accessors and Mutator Methods, Cloning Objects, shallow and deep cloning, Generic Class Types.

Unit- III:

Extending Classes and Inheritance: Use and Benefits of Inheritance in OOP,Types of Inheritance in Java, Inheriting Data Members and Methods, Role of Constructors in inheritance, Overriding Super Class Methods, Use of "super", Polymorphism in inheritance. Implementing interfaces.

Unit- IV:

Exception Handling: The Idea behind Exception, Exceptions & Errors, Types of Exception,
Control Flow In Exceptions, JVM reaction to Exceptions, Use of try, catch, finally, throw, throws in Exception Handling, In-built and User Defined Exceptions, Checked and Un-Checked Exceptions.

Unit- V:

Array & String :Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Operation on String, Mutable & Immutable String, Using Collection Bases Loop for String, Tokenizing a String, Creating Strings using StringBuffer.

BooksReferences:

1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI.
2. Core Java 2, Vol 1, Fundamentals, Cay.S.Horstmann and Gary Cornell, Seventh Edition, Pearson Education.
3. Beginning in Java 2, Iver Horton, Wrox Publications.
4. The Complete Reference Java J2SE 5th Edition, Herbert Schildt, TMH Publishing Company Ltd, NewDelhi.
5. Big Java 2nd Edition, Cay Horstmann, John Wiley and Sons.

COMPUTER PROGRAMMING LAB-II (JAVA)

List of Experiment :

1. Write a program to print "HELLOWORLD" in java.
2. Write a program to show Concept of CLASS in JAVA
3. Write a program to show the Sum of two numbers using wrapper class in java.
4. Write a program to print area of rectangle using scanner class in java.
5. Write a program to show use and Advantages of constructor in java.
6. Write a program to implement single inheritance in java.
7. Write a program to implement polymorphism in java.
8. Write a program to implement abstract class in java.
9. Write a program to implement method overloading and method overriding in java.
10. Write a program to show Interfacing between two classes in java.
11. Write a program to explain the concept of exception handling in java.
12. Write a Program to show "HELLO JAVA " in Explorer using Applet.
13. . Write a program to demonstrate applet life cycle.

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B.E. (CBGS) IV SEMESTER
MECHANICAL ENGINEERING
PROGRAMMING TOOLS (CAD TOOLS) LAB

Course	Subject Title	Subject Code	Grade for End Sem.		CGPA at the end of every even semester
			T	P	
B.E. (CBGS)	Programming Tools (CAD Tools) Lab	ME4007	Min. "D"	Min. "D"	5.0

Course Objective:

The objective of the module is to make students familiar with AutoCAD software by making them learn the drafting and modeling on the software.

Course Contents:

Introduction to Drafting and Modeling on Software Packages like Auto-CAD, Solid Works, CATIA. Etc., 2D, 3D drawings. Drawing and assembly of various machine components. Examples: Sleeve and Cotter joint, Gib and Cotter joint/ Knuckle Joint/ Flanged Coupling, Assembly of Connecting Rod.

List of Experiments (Expandable)

1. Setting up of the drawing environment by learning the basic features like setting, drawing limits, drawing units, naming the drawing, saving the file with drawing extension, etc.
2. To create a 2D view of the diagrams given using AutoCAD.
3. To make an orthographic dimensioned drawing of a connecting rod.
4. Drawing a Flange.
5. Drawing a Bushing assembly.
6. To draw the orthographic views of a Cotter joint.
7. To create a spiral by extruding the circle.
8. To draw orthographic projection drawing of a lathe machine.
9. Draw 3D models by extruding simple 2D designs.
10. Layout drawing of a building using different layers and line colors indicating all building details.

Books References:

1. User manual of Auto-CAD software.
2. User manual of ANSYS and Fluent software.
3. Mastering AutoCAD 2017 by George Omura.
4. User's Guide, AutoCAD 2013.
5. https://knowledge.autodesk.com.
6. https://www.mycadsite.com.
7. https://thesourcecad.com.

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