BSME 2201 Engineering Mathematics III

Teaching Scheme: **Examination Scheme:**

Lectures: 3 Hrs/Week **In-Semester: 50Marks**

Tutorial: 1 Hr/Week **End-Semester: 50 Marks**

Credits: 4

Course Objectives:

1. To recall and remember basics of LDE, Vector analysis, Fourier and Laplace Transform.
2. To understand the concepts of basic mathematical methods for solving Higher order LDE and PDE , Fourier and Laplace Transform .
3. To apply these methods to solve Engineering problems.
4. To analyze Engineering problems and evaluate.

Course Outcomes:

1. Students will be able to remember terminologies and formulae in LDE, Vector analysis, Fourier and Laplace transforms, Statistics & Probability distribution.
2. Students will be able to understand and interpret the concepts of LDE, Vector analysis, Fourier and Laplace transforms, Statistics & Probability distribution.
3. Students will be able to predict and apply the methods for solving LDE, Vector analysis, Fourier and Laplace transforms, Statistics & Probability distribution.
4. Students will be able to compare and analyze the methods for solving LDE, Vector analysis, Fourier and Laplace transforms, Statistics & Probability distribution.

Theory Course Contents:

Unit – I: Higher Order Linear Differential Equations and Applications **7**

Higher order Linear differential Equation with constant coefficients, Simultaneous Differential Equations, Modeling of Mass Spring System, Applications in solving problems of Free and forced damped and undamaged systems and Manufacturing System problems.

Unit – II Laplace Transform **7**

Definition of Laplace, Inverse Laplace transform, Properties and theorems, LT of standard functions, LT of some special functions viz. periodic, unit step, unit impulse, application of LT for solving Linear Differential Equations and problems on Transfer function.

Unit – III: Fourier Transform **8**

Complex exponential form of Fourier series, Fourier integral theorem, sine and cosine integrals, Fourier transform, Fourier Sine and Cosine transform, Inverse Fourier Transform. Fast Fourier Transforms and Discrete Fourier Transforms.

Unit – IV: Vector Differentiation **6**

Physical interpretation of vector differentiation, vector differential operator, Gradient, Divergence, Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, vector identities.

Unit–V:Partial Differential Equations **8**

Basic Concepts , Method of separation of variables for solving Wave equation, One and two dimensional heat flow equations. Use of Fourier series. Solution of heat equation by Fourier transforms. Two- dimensional wave equation.

Unit–VI: Statistics and Probability Distribution **6**

Variance, standard deviation, Coefficient of variation, Moments, Skewness, Kurtosis, Binomial, Poisson, Normal distribution,

Text Books:

1. B. V. Ramana, **'Higher Engineering Mathematics ',** *Tata McGraw Hill Publications* (2007)
2. B.S. Grewal, **'Higher engineering Mathematics'**, *Khanna publishers, Delhi(*40th edition),(2008)
3. N.P. Bali, M. Goyal,**'Text book of Engineering mathematics'** *Laxmi Publication (P) Ltd*.(8th edition),(2011)
4. S.C. Gupta, V.K. Kapoor, '**Fundamental of Mathematical Statistics',** S. Chand & Sons (10th revised edition) 2002.

Reference Books:

1. C.R.Wylie, L.C. Barrette, **'Advanced Engineering Mathematics',** *McGraw Hill Publications, New Delhi.(*6th edition)(2003)
2. Peter V. O'neil,**'Advanced Engineering Mathematics'** ,*Thomson Brooks / Cole, Singapore (*5th edition) (2007).
3. Erwin Kreyszig ,**'Advanced Engineering Mathematics'***Wiley Eastern Ltd.*(8th Student Edition), (2004).

ME 2201 Strength of materials

Teaching Scheme
Lectures: 3Hrs/week

Examination Scheme
In Sem. - I, II: 50marks
End Sem.: 50 Marks
Credits: 3

Objectives:

1. To gain knowledge of different types of stresses, strain and deformation induced in the mechanical components due to external loads.
2. To study the distribution of various stresses in the mechanical elements such as beams, shafts etc.
3. To study Effect of component dimensions and shape on stresses and deformations.

Outcomes:

Learner should be able to....

1. Demonstrate fundamental knowledge about various types of loading and stresses induced.
2. Draw SFD and BMD for different types of loads and support conditions
3. Compute and analyze stresses induced in basic mechanical components
4. Analyze buckling and bending phenomenon in columns and beams respectively.

Unit I Simple Stresses & Strains:

Concept & types of Stresses and strains, Poison's ratio, stresses and strain in simple and compound bars under axial loading, stress strain diagrams, Hooks law, elastic constants & their relationships, temperature stress & strain in simple & compound bars under axial loading,

Unit II Shear Force & Bending Moments:

Definitions, SF & BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM & SF and the point of contra-flexure under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads, (iv) uniformly varying loads and (v) application of moments, relation between the rate of loading, the shear force and the bending moments.

Unit III Bending & Shear Stresses in Beams:

Bending stresses in beams with derivation & application to beams of circular, rectangular, I,T and channel sections, composite beams, shear stresses in beams with combined bending, torsion & axial loading of beams.

Unit IV Slope & Deflection:

Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, method of integration, Macaulay's method, calculations for Compound
lope and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, Uniformly distributed loads or combination of concentrated and uniformly distributed loads.

Unit V Torsion Of Circular Members:

Torsion of thin circular tube, Solid and hollow circular shafts, tapered shaft, stepped shaft & composite circular shafts, combined bending and torsion, equivalent torque, effect of end thrust. Numericals.
Thin Cylindrical and Spherical Shells: Cylinders and Spheres due to internal pressure. Cylindrical Shell with hemi spherical End

Unit VI Compound Stresses & Strains:

Concept of surface and volumetric strains, two dimensional stress system, conjugate shear stress at a point on a plane, principle stresses & strains and principal- planes, Mohr's circle of stresses.

Reference Books

1. Strength of Materials, Subramanyam, Oxford University Press, Edition 2005
2. Mechanics of Materials, Thin Cylindrical and Spherical Shells: Cylinders and Spheres due to internal pressure. Cylindrical Shell with hemispherical End B.C Punmia Ashok Jain, Arun Jain, Lakshmi Publications, NewDelhi.
3. Strength of Materials, Basavarajaiah and Mahadevappa Khanna Publishers, New Delhi.
4. Strength of Materials, Singer Harper and Row Publications
5. Elements of Strength of Materials, Timoshenko and Young Affliated East West Press.
6. Mechanics of Materials, James M. Gere (5th Edition), Thomson Learning
7. Strength of Materials S. Ramamrutham, DhanpatRai Pvt. Ltd.
8. Mechanics of Materials S. S. Rattan, TMH Pvt. Ltd.
9. Mechanics of Structures S. B. Junnarkar, Charotar Publication.
10. Strength of Materials W. Nash, Schaum's Outline Series, McGraw Hill Publication

ME 2202 Fluid Mechanics

Teaching Scheme
Lecture: 3 Hrs/week
Tutorials: 1Hr/week

Examination Scheme
In semester: 25 marks
End semester: 50 marks
Credits: 3

Prerequisite:Engineering Physics, Engineering Mathematics

Course Objectives:

- Applying the mass conservation principle, to engineering problems.
- Applying the momentum and energy equations to engineering problems.
- Evaluating head loss in pipes and conduits.
- Introduction to formation of boundary layer and drag and lift concepts associated with it

Course Outcome:

- Student will able to apply mass conservation principle for the given system
- Student will able to understand the energy conservation principle for fluid flow
- Student will able to calculate the pressure drop for given system
- Student will able to explain the boundary layer formation on the flat plate

Unit 1: Fluid Properties **(6)**

Applications of fluid mechanics, Basic tensor and vector calculus, Definition and characteristics of Fluids, Density, Specific Weight, Specific Gravity, Dynamic Viscosity, Kinematics Viscosity, Surface Tension, Capillarity, Compressibility, Vapor pressure. Pascal's Law, Centre of pressure, Buoyancy and flotation

Unit 2: Fluid Kinematics **(6)**

Eulerian and Lagrangian fluid description, Types of flows (One , two, three dimensional , steady unsteady, uniform, non-uniform, laminar, turbulent, compressible, incompressible, rotational, Irrotational, Visualization of flow field (Stream, Path and Streak line), Fluid Acceleration and Material Derivative, vorticity in two dimensional flow, Control volume approach for solution.

Unit 3: Fluid Dynamics **(8)**

Flow Analysis using Control volume Approach, Continuity and Linear momentum Equation. Flow Analysis using differential Approach: Continuity and linear momentum equation. Euler equation of motion, Derivation Bernoulli's equation along and normal to Stream line, application of Bernoulli's equation to Pitot tube, Orifices and Venturi meter

Unit 4: Internal Flow **(6)**

Entrance region and fully developed flow. Pressure and Shear Stress distribution for laminar flow in a pipe and plane Poiseulle flow, Fully developed Turbulent flow, Transition from laminar to turbulent, Velocity profile of Turbulent flow, Introduction to Navier – Stokes Equation and Exact Solution to Plane Poiseulle flow

Unit 5: Flow through Pipes **(6)**

Energy losses through pipe, Major and Minor Darcy-Weisbach equation, Moody's diagram, Dimensional Analysis-Dimensions of physical quantities, dimensional homogeneity, Buckingham

pi Theorem, important dimensionless numbers, Model analysis (Reynolds, Froude and Mach).

Unit 6: External Flow **(6)**

Boundary layer Structure and Thickness on Flat plate, Effect of Pressure Gradient on Boundary layer, Separation of Boundary Layer and Methods of Control, Lift and Drag concepts , Drag – Pressure and Friction, Drag Coefficient, Lift - Surface pressure Distribution and Circulation

Text Books:

1. Munson, Okiishi, Young, 'Fluid Mechanics', 7th Ed,Wiley, 2016.
2. Cengel, Cimbala, 'Fluid mechanics', Tata Mcgraw hill publishing

References:

1. Gupta and Gupta, 'Fluid Mechanics', 3rd Ed, New Age publications, 2016.
2. Kundu, Cohen, Dowling, 'Fluid Mechanics', Elsevier India
3. K. Muralidhar, G. Biswas, 'Advance Fluid Mechanics', 3rd Edition, Narosa Publishing House
4. Fox, Mcdonald, 'Fluid Mechanics', 8thEdition,Wiley.

ME 2203 Manufacturing Processes II

Teaching Scheme
Theory: 3 Hr/week

Examination Scheme
In-Sem Exam: 25
End-Sem Exam: 75
Credit: 3

Prerequisites:

Basic Mechanical Engineering, Manufacturing Process I

Course Objectives:

1 To familiarize with the basic concepts of machining science.
2 To acquaint with various single and multipoint cutting tools designing processes
3 To make the students understand the economics of machining process.

Course Outcomes:

Students will be able to

1 Calculate the values of various forces involved in the machining operations.
2 Use various single and multipoint cutting tools.
3 Select an appropriate tool material for a particular machining application.
4 Estimate machining performance measures like power requirement, cutting time, tool life and surface finish.

Unit –I **Sheet metal working and forging** **(06)**

Stress-strain relations in elastic and plastic deformation; concept of flow stress, deformation mechanisms; hot and cold working. Forging, other deformation processes related to forging, Wire and Tube drawing; Sheet metal working processes such as blanking, piercing, bending, deep drawing, coining and embossing; defects.

Unit –II **Rolling, Extrusion, shaping process for plastic:** **(07)**

Rolling, extrusion, types and analysis. Plastic: types, plastic production processes, injection molding, compression and transfer molding, blow molding and rotational molding; defects.

Unit –III **Metal Cutting Theory:** **(07)**

Orthogonal and oblique cutting, various types of chips, Mechanics of orthogonal steady state metal cutting, shear plane and shear plane angle, Merchant's circle of forces, velocity relations. Merchant's theory & modified theory of metal cutting. Concept of specific power consumption in machining. Cutting forces measurement using dynamometers. Surface Integrity and Cutting fluids: Measurement and specification of surface finish Function of coolant, types of coolants and cooling system. Major tool material types. **Tool life and machining economics:** types of tool wear Taylor's tool life equation: Components of product cost, Optimum cutting velocity for minimum cost of production and maximum production rate.

Unit –IV **Design of cutting tools:** **(07)**

Design of shanks, cutting tip and chip breakers for HSS. Study of machining tool's Nomenclature: Various types such as flat form tool, tangential form tool, circular form tool, constructional details and fields of application. Profile design of flat and circular form tools. Nomenclatures of Broach, Drills, Reamers,: Taps and Milling cutters.

Unit –V **Unconventional machining processes:** **(06)**

Classification according to type of energy used for machining, basic principles,

machines, applications of Electrical discharge machining (EDM), Electron beam machining (EBM), Plasma arc machining (PAM), Laser beam machining (LBM), Electrochemical machining (ECM), Chemical machining (CHM), Ultrasonic machining (USM), Abrasive jet machining (AJM), Water jet machining (WJM) and Abrasive water jet machining (AWJM).

Unit –VI **Basic Construction of Jig & Fixture:** **(06)**

Location & Locating Devices Locating principles: Degrees of freedom, Redundant location, Fool proofing, nesting, Material used. Locators: types and there functions; Clamping & clamping Devices: Position, types of mechanisms and there functions. Component distortion under clamping and cutting forces. Design of simple Jig and Fixtures.

Reference Books:

1 Modern Manufacturing, Fifth Edition, Mikell P. Groover, Wiley Publication
2 Fundamentals of Metal Machining and Machine Tools, Third Edition by Winston A.
3 Knight, Geoffrey Boothroyd, CRC press Taylor and Francis group.
4 Metal Cutting Principles (2nd Edition), by Milton Clayton Shaw, Oxford University Press.
5 Cutting Tools, by P. H. Joshi, A. H. Wheeler Publishing Co. Ltd.
6 ASM Handbook, Vol. 16: Machining (9th Edition), by Joseph R. Davis, ASM International.
7 Fundamentals of Metal Cutting and Machine Tools (2nd Edition), by B. L. Juneja, G. S. Sekhon and Nitin Seth, New Age International Pvt. Ltd.
8 Metal Cutting Theory and Cutting Tool Design, by V. Arshinov and G. Alekseev, Mir publishers, Moscow.
9 Production Technology by HMT.
10 Typical Examples and Problems in Metal Cutting and Tool Design, by N. Nefedov and K. Osipov, Mir publishers, Moscow.
11 Jig and Fixture Design Manual, Erik K. Henrikson, Industrail Press.
12 An introduction to jig and tool Design, M.H.A. – Kempster, III Ed.Pub ELBS.
13 Jigs and Fixture, P.H. Joshi, THM.
14 Tool design, C. Donaldson, George H. Lecain, V.C. Goold, THM
15 Jigs and Fixture Handbook, A.K. Goroshkin, Mir Publication.
16 Jigs and Fixture, ASTME.

ME 2204 Rigid Body Dynamics

Teaching Scheme
Theory: 2 Hr/week

Examination Scheme
In-Sem Exam: 25
End-Sem Exam: 25
Credit: 2

Prerequisites:

Engineering Mathematics, Engineering Mechanics, Physics

Course Objectives:

1. To present the basic principles of rigid body dynamics
2. To help develop proficiency in applying these principles to formulate and solve dynamics

Course Outcomes:

Upon completion of this course, the student will be able to:

1. Apply impulse/momentum methods to kinetics problems of particles, rigid bodies, and systems
2. Analyze planar rigid body kinematics problems
3. Apply Newton/Euler methods to kinetics problems
4. Apply work/energy methods to kinetics problems of rigid bodies

Unit 1 **Kinetics of a Particle: Dependant Motion, Impulse and Momentum**

System of Particles - Dependant Motion, Principle of Linear Impulse and Momentum, Principle of Linear Impulse and Momentum for a System of Particles, Conservation of Linear Momentum, Central Impact

Unit 2 **Planar Kinematics of a Rigid Body**

Planar Rigid-Body Motion, Translation, Rotation about a Fixed Axis, Absolute Motion Analysis, Relative-Motion Analysis: Velocity, Instantaneous Centre of Zero Velocity, Relative-Motion Analysis: Acceleration, Relative-Motion Analysis using Rotating Axes (Coriolis Component of Acceleration)

Unit 3 **Planar Kinetics of a Rigid Body: Force and Acceleration**

Moment of Inertia, Planar Kinetic Equations of Motion, Equations of Motion: Translation, Equations of Motion: Rotation about a Fixed Axis, Equations of Motion: General Plane Motion

Unit 4 **Planar Kinetics of a Rigid Body: Work and Energy**

Kinetic Energy, Work of a Force, Work of a Couple, Principle of Work and Energy, Conservation of Energy

Unit 5 **Planar Kinetics of a Rigid Body: Impulse and Momentum**

Angular Momentum, Relation Between Moment of a Force and Angular Momentum, Principle of Angular Impulse and Momentum, Linear and Angular Momentum, Principle of Impulse and Momentum, Conservation of Momentum, Eccentric Impact.

Text Book:

1. Engineering Mechanics – Dynamics, R. C. Hibbeler, 12th Edition, Pearson publication https://docs.google.com/file/d/0B4FucDjPtPAedTZpWllOcWhwOGM/edit

References:

1. Engineering Mechanics – Statics and Dynamics, A Nelson, Mc Graw Hill Education
2. Vector Mechanics for Engineers-Dynamics, Beer and Johnson, Mc Graw Hill Education
3. Engineering Mechanics- S. Timosenko. DPT.young & J.V.Rao- Tata Mc Graw hill education pvt. Ltd. New Delhi.

ME 2206 Fluid Mechanic Lab

Teaching Scheme
Theory: 2 Hr/week

Examination Scheme
Oral: 25 Marks
Credit: 1

Prerequisites:

Engineering Physics

Co-Prerequisites:

Fluid Mechanics

Course Objectives:

1 Introduction to the basics of experimental techniques in fluid mechanics.

Course Outcomes:

1 Student will understand the basic experimental techniques in fluid mechanics.

List of experiments

1 Measurement of Viscosity and Sp. Gravity

2 Measurement of Pressure and velocity

3 Measurement of coefficient of orifice

4 Verification of Bernoulli's theorem

5 Calibration of Venturi/Orifice meter

6 Flow visualization using Reynolds Apparatus

7 Measurement of coefficient of friction in pipe

8 Verification of momentum equation

Text Books:

Instrumentation, Measurements, and Experiments in Fluids, E. Rathakrishnan , CRC Press.

References:

1 Fluid Mechanics Measurements Taylor & Francis Inc, Richard J. Goldstein, Taylor & Francis Inc

2 Springer Handbook of Experimental Fluid Mechanics, by Cameron Tropea (Editor), Alexander Yarin (Editor), John F. Foss (Editor).

ME 2207 Manufacturing Processes Lab II

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Practical Examination. 25 Marks
Credits: 1

Objectives:

1. To practice machining of flat surfaces on shaping and grinding machines.
2. To practice milling, boring and thread cutting operations.

Outcomes: Learner should be able to:-

1. Understand the difference between metal machining and composite machining.
2. Understand different practical aspects involved in operation and applications of milling, shaping, grinding, boring etc.
3. Prepare welding joints for different kinds industrial applications.

Term Work:

1. One composite job consisting of minimum four parts, employing operations on lathe, precision turning, screw cutting, boring etc. and involving the use of milling and grinding operations.
2. Demo of injection molding of plastic parts.
3. Demo on machining of Glass Fiber Reinforcement Plastic (GFRP) composite material, Drilling and edge milling operation are to be studied (Any of the commercial available GFRP/Epoxy plates are to be used).

ME 2208 Rigid Body Dynamics

Teaching Scheme
Theory: 2 Hr/week

Examination Scheme
Oral : 25 Marks
Credit: 1

Prerequisites:

Engineering Mathematics, Engineering Mechanics, Physics

Course Objectives:

1. To present the basic principles of rigid body dynamics
2. To help develop proficiency in applying these principles to formulate and solve dynamics

Course Outcomes:

Upon completion of this course, the student will be able to:

1. Apply impulse/momentum methods to kinetics problems of particles, rigid bodies, and systems
2. Apply work/energy methods to kinetics problems of rigid bodies
3. Analyze working principal of gyroscope

List of Assignments:

1. Impact on rigid body
2. Moment of Inertia
3. Conservation of Momentum
4. Conservation of Energy

List of Assignments:

Three assignments based on the theory topics will be given during the semester.

Text Book:

1. Engineering Mechanics – Dynamics, R. C. Hibbeler, 12th Edition, Pearson publication
   https://docs.google.com/file/d/0B4FucDjPtPAedTZpWllOcWhwOGM/edit

References:

1. Engineering Mechanics – Statics and Dynamics, A Nelson, Mc Graw Hill Education
2. Vector Mechanics for Engineers-Dynamics, Beer and Johnson, Mc Graw Hill Education
3. Engineering Mechanics- S. Timosenko. DPT.young & J.V.Rao- Tata Mc Graw hill education pvt. Ltd. New Delhi.

ME 2209 Materials Technology Lab II

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Oral Exam: 25
Credit: 1

Experiments on Material testing (at least 8 of the following)

1. Strength test of a given mild steel specimen on UTM with full details and stress versus strain plot on the machine.
2. Other tests such as shear, bend tests on UTM.
3. Impact test on impact testing machine like Charpy, Izod or both.
4. Hardness test of given specimen using Rockwell and Vickers/Brinell testing machines.
5. Spring index test on spring testing machine.
6. Fatigue test on fatigue testing machine.
7. Creep test on creep testing machine.
8. Experiment on deflection of beam, comparison of actual measurement of deflection with dial gauge to the calculated one, and or evaluation of young's modulus of beam.
9. Torsion test of a rod using torsion testing machine.
10. Study of NDT (non-destructive testing) methods like magnetic flaw detector, ultrasonic flaw detector, eddy current testing machine, dye penetrant tests.

ME 2210 Solid Modeling Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
Practical Exam: 25
Credit: 1

Assignments

1	Assignment on Solid modeling of simple and intricate machine and automobile components.	**(10)**
2	Assignment on parametric solid modeling of a machine component using various commands and features of the software.	**(04)**
3	Assignment on assembly modeling.	**(04)**
4	Generation of production drawings of the parts and assembly with appropriate tolerances.	**(04)**
5	Assignment on rapid prototyping	**(04)**