Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Engineering Mechanics	ME 101	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
I/II	4	3-1-0	3 Hours

Unit - I

Introduction: Introduction to Engineering Mechanics and its Classification; Review of Vector Algebra.

System of Forces and Resultant – I (Concurrent Forces): Force; Force as a Vector; Effect of a Force; Law of Transmissibility of Force; System of Forces; Resultant of Force System; Resultant of Coplanar Concurrent Forces; Concurrent Forces in Space; Lami's Theorem; Composition of Forces; Resolution of Forces.

System of Forces and Resultant – I (Non-Concurrent Forces): Moment of a Force; Varignon's Theorem; Coplanar Non-Concurrent Forces; Couple; Force Couple System; Resultant of Non-Concurrent Forces; Reduction of a Force-Couple System in to Single Force; Relevant Numerical Problems **[1].(06 Hours)**

Unit - II

Equilibrium of System of Force: Free Body Diagram; Condition of Equilibrium Statically Indeterminate Structure; Relevant Numerical Problems.

Friction: Limiting Friction and Impending Motion; Coulomb's Law of Dry Friction; Coefficient of Friction; Angle of Friction; Cone of Friction; Impending Motion of Body; Ladder Friction; Wedge Friction; Belt Friction; Relevant Numerical Problems **[1].** **(08 Hours)**

Unit- III

Beams: Types of Beam; Statically Determinate Beams; Shear Force and Bending Moment in Beams; Shear Force and Bending Moment Diagram; Relevant Numerical Problems.

Plane Truss: Truss; Difference Between Truss and Frame; Perfect and Imperfect Truss; Assumption and Analysis of Plane Truss; Method of Joints; Method of Section; Relevant Numerical Problems **[1].** **(08 Hours)**

Unit- IV

Center of Gravity: Center of Gravity; Center of Mass; Centroid; Centroid of Composite Figures; Theorem of Pappus and Guldinus; Relevant Numerical Problems.

Moment of Inertia: Second Moment of Area (Moment of Inertia); Radius of Gyration; Parallel Axis Theorem Or Transfer Formula; Perpendicular Axis Theorem; Polar Moment of Inertia; Moment of Inertia of Composite Areas; Relevant Numerical Problems.

Mass Moment of Inertia: Mass Moment of Inertia; Radius of Gyration; Mass Moment of Inertia of Thin Plates and Basic Solid Shapes; Relevant Numerical Problems **[1].** **(08 Hours)**

Unit- V

Kinematics: Motion of a Particle, Displacement, Velocity and Acceleration, Plane Rectilinear Motion; Uniformly Accelerated Motion; Relevant Numerical Problems.

Kinetics: Newton's Laws of Motion; D'Alemberts Principle; Dynamic Equilibrium; Motion of Connected Bodies; Relevant Numerical Problems **[1].** **(08 Hours)**

Unit- VI

Virtual Work: Work done on a Rigid Body; Virtual Displacement; Virtual Work; Completely Constrained Body; Relevant Numerical Problems.

Work and Energy: Work done by a Force; Kinetic Energy; Potential Energy; Principle of Work and Energy; Conservative Forces; Relevant Numerical Problems.

Impulse and Momentum: Impulsive Forces; Non-Impulsive Forces; Linear Impulse and Momentum; Conservation of Linear Momentum; Collision; Relevant Numerical Problems **[1].** **(07 Hours)**

Text Books:

[1] Engineering Mechanics, Statics and Dynamics by A. Nelson, Mcgraw Hill Education (India) Private Limited.

[2] Engineering Mechanics, Statics and Dynamics by Andrew Pytel, Jaan Kiusalaas, Ishan Sharma, Cengage Learning.

[3] Engineering Mechanics, Statics and Dynamics by R. C. Hibbeler and Kai Beng Yap, Pearson India Education Services Pvt. Ltd.

Reference Books:

[1] F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol. I - Statics, Tata Mcgraw Hill.

[2] F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, – Dynamics, Tata Mcgraw Hill.

[3] Engineering Mechanics – Statics, Vol. 1 by Dietmar Gross, Werner Hauger, Jörg Schröder, Wolfgang A. Wall, Nimal Rajapakse, Springer.

[4] Particle Dynamics and Rigid Body Dynamics – Vol. 3, Dietmar Gross, Werner Hauger, Jörg Schröder, Wolfgang A. Wall, Nimal Rajapakse, Springer.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. Mechanical Engineering	Workshop Practice	ME 102	SM+EM 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
I / II	2	1-0-2	3 Hours

List of Experiments

Note: Minimum of Any 10 Experiments Should be Performed.

A) Measurement Shop

1. To Study the Need for Inspection and Important Elements of Measurement. To Study the Following Terms:-
   - **a)** Range of Measurement
   - **b)** Sensitivity
   - **c)** Consistency
   - **d)** Repeatability
   - **e)** Calibration
   - **f)** Traceability
   - **g)** Precision And Accuracy
2. To Study Briefly the Different types of Measuring Equipments such as Linear Measurement, Angular Measurement, Force, Torque, Strain, Temperature and Pressure Measuring Equipments.
3. To Study Different types of Micrometer and Vernier Calipers and to Calculate the Least Count of Micrometer and Vernier Caliper.

B) Carpentry Shop

4. To Study Types of Carpentry Tools with their Specifications.

5. To Prepare Two Wooden Joints (T-Joint and Cross (+) Joint).

C) Sheet Metal Shop

6. To Prepare Layout on a Metal Sheet By Marking and Preparing Rectangular Tray, Pipe Shaped Components E.G. Funnel etc.

D) Machine Shop

7. To Study Different Parts of Lathe Machine, its Specifications and Various Operations Performed.

8. To Prepare Job on Lathe Involving Facing and Step Turning and Drilling Operations.

9. To Prepare Job on Lathe Involving Taper Turning and Knurling Operations.

10. To Study Shaper, Planner and Slotter and Their Specifications.

11. To Study Different Operations Performed on Shaper, Planner and Slotter.

12. To Prepare Horizontal Surface, Taper Surface and V-Grove on a Shaper Machine.

13. To Study Different Parts of Drilling Machine, its Specifications and Various Operations Performed.

14. To Study Different Parts of Milling Machine, its Specifications and Various Operations Performed.

E) Welding Shop

15. To Prepare Butt Welding and Lap Welding Joints by Using Simple Arc Welding Process.

16. To Study Resistance Welding and to Prepare a Job By Using Spot Welding Process.

F) Fitting Shop

17. To Study types of Fitting Shop Tools with their Specifications.

18. To Prepare a Square Job of 45*45mm^2.

G) Foundry Shop

19. To Study Metal Casting Process and Different types of Patterns used in Metal Casting Process.

20. To Prepare Mould and Core Assembly and to put Molten Metal in Mould and Fettle the Casting.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Theory of Production Processes - I	ME 201	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
III	4	4-0-0	3 Hours

Unit - I

Introduction to Manufacturing Technology and Powder Metallurgy: Manufacturing; Materials in Manufacturing, Manufacturing Process, Production System; Mechanical and Physical Properties in Manufacturing- Stress Strain Relationships, Hardness, Effect of Temperature on Properties, Volumetric and Melting Properties, Thermal Properties.

Characterization of Engineering Powders, Production of Metallic Powders, Conventional Pressing and Sintering Technique, Alternative Pressing and Sintering Techniques, Materials and Product for Powder Metallurgy, Design consideration in Powder Metallurgy **[1].** **(10 Hours)**

Unit – II

Metal Casting Process: Brief History, Advantages and Limitations, Applications, Patterns, Pattern Allowances, Pattern Materials, Types of Pattern, Design of Patterns, Color Code Scheme, Moulding Materials, Cores, Use of Cores, Core Materials, Types of Cores, Core Prints, Chaplets **[1].** **(10 Hours)**

Unit – III

Gating and Risering System: Element of Gating Systems, Types of Gates, Casting Yield. Gating System Design; Pouring Time, Choke Area, Gating Ratios, Slag Trap System. Risering Design; Caine's Method, Modulus Method, Navel Research Laboratory Method, Chills, Feeding Aids **[1].** **(10 Hours)**

Unit – IV

Melting and Casting Quality; Melting Practices; Cupola, Other Furnace, Degassing, Different Types of Castings; Sand Casting Processes: Green and Dry Sand Casting Process; Defects in Castings, Non Destructive Testing, Product Design for Sand Casting.

Melting, Pouring, Cooling and Solidification, Mechanism of Solidification, Types of Sand; Molding Sand and its Properties; Molding Sand Composition. Special Casting Processes; Shell Moulding, Precision Investment Casting, Permanent Mould Casting, Die Casting, Centrifugal Casting, Continuous Casting, Squeeze Casting, Slush Casting, Vacuum Casting **[1].** **(10 Hours)**

Unit – V

Metal Forming and Sheet Metal Working: Overview of Metal Forming, Material Behavior in Metal Forming, Temperature in Metal Forming, Strain Rate Sensitivity, Friction and Lubrication in Metal Forming.

Nature of Plastic deformation - Hot working and cold working. Metal Working and Bulk Deformation Process; Rolling, other Deformation Process related to Rolling, Forging, other Deformation Process related to Forging, Extrusion, Wire and Bar Drawing. Sheet Metal Processes; Cutting, Bending, Drawing, Spinning, Bending, Stretch Forming, Embossing and Coining, Sheet Metal Die Design **[1].** **(10 Hours)**

Unit- VI

Joining and Assembly Process: Welding Fundamentals; Overview of Welding Technology, Weld Joint, Physics of Welding, Features of a Fusion Welded Joint, Welding Methods and Procedures; Arc Welding, Resistance Welding, Oxyfuel Gas Welding, Solid State Welding, Weld Quality, Weldability, Design Considerations in Welding, Defects in Welding, Weld Testing, Brazing, Soldering **[1].**

(10 Hours)

Text Books:

[1] Manufacturing Technology: Foundry, Forming and Welding (Vol. 1); P. N. Rao; Tata McGraw Hill; New Delhi.

[2] Production Technology; P. C. Sharma; S. Chand Publisher.

[3] Fundamentals of Modern Manufacturing: Materials; Processes and Systems; Mikell P. Groover; Publisher Willey.

Reference Books:

[1] Manufacturing Science; Ghosh and Malik; East West Press.

[2] Manufacturing Engineering & Technology; Kalpakjian; Pearson Pub.

[3] Manufacturing Technology: Er. R. K. Rajput; Laxmi Publications.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Strength of Materials-I	ME 203	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
III	4	3-1-0	3 Hours

Unit - I

Axial Stress and Strain:- Introduction; Stresses in the Members of a Structure, Axial Loading, Normal Stress, Shearing Stress; Bearing Stress in Connections; Stress on an Oblique Plane under Axial Loading; Stress under General Loading Conditions; Components of Stress; Stress-Strain Diagram of Ductile and Brittle Material; True Stress and True Strain; Elastic versus Plastic Behavior of a Material; Modulus of Elasticity; Hooke's Law, Multi-axial Loading, Generalized Hooke's Law; Poisson's Ratio; Bulk Modulus; Fatigue; Creep **[1]**.
Stresses due to Self-Weight, Stress in Rod due to Rotation **[2]**; Statically Indeterminate Problems; Problems Involving Temperature Changes; Shearing Strain; Relation among Elastic Constants; Stress Concentrations; Plastic Deformations; Residual Stresses**[1]**. **(07 Hours)**

Unit– II

Transformation of Stress and Strain:- Introduction; Transformation of Plane Stress; Principal Stresses and Principle Planes, Maximum Shearing Stress; Mohr's Circle for Plane Stress; Yield Criteria for Ductile Materials under Plane Stress; Fracture Criteria for Brittle Materials Under Plane Stress **[1]**; Transformation of Plane Strain; Mohr's Circle for Plane Strain; Three-Dimensional Analysis of Strain; Measurements of Strain, Strain Rosette **[1]**.
Static Theories of Failure:-Theories of Failures; Graphical Representation of Theories of Failures and its Applications **[2].** **(08 Hours)**

Unit– III

Pure Bending: - Introduction; Symmetric Member in Pure Bending; Deformations in a Symmetric Member in Pure Bending; Stresses and Deformations in the Elastic Range **[1].**

Analysis and Design of Beams for Bending:- Classification of Beams; Types of Load on Beam **[2]**; Shear and Bending-Moment Diagrams - Simply Supported, Overhang and Cantilever Beams Subjected to any Combination of Point Loads, Uniformly Distributed and Varying Load and Moment **[2]**.
Relations among Load, Shear, and Bending Moment; Design of Prismatic Beams for Bending; Using Singularity Functions to Determine Shear and Bending Moment in a Beam **[1]**. **(07 Hours)**

Unit– IV

Shearing Stresses in Beams:- Introduction; Shear on the Horizontal Face of a Beam Element; Determination of the Shearing Stresses in a Beam; Shearing

Stresses in Common Types of Beams; Longitudinal Shear on a Beam Element of Arbitrary Shape; Plastic Deformations **[1].**

Principal Stresses: - Introduction; Principal Stresses in a Beam; Design of Transmission Shafts; Stresses under Combined Loadings **[1]. (08 Hours)**

Unit - V

Torsion:-Introduction; Preliminary Discussion of the Stresses in a Shaft; Deformations in a Circular Shaft; Stresses in the Elastic Range; Angle of Twist in the Elastic Range; Statically Indeterminate Shafts; Design of Transmission Shafts; Residual Stresses in Circular Shafts **[1].**

Columns:- Introduction; Stability of Structures; Euler's Formula for Pin-Ended Columns; Rankine's Formula; Extension of Euler's Formula to Columns with Other End Conditions; Eccentric Loading, the Secant Formula; Design of Columns under a Centric Load; Design of Columns under an Eccentric Load **[1].**

(08 Hours)

Unit - VI

Energy Methods:-Introduction; Strain Energy; Strain-Energy Density; Elastic Strain Energy for Normal Stresses; Elastic Strain Energy for Shearing Stresses; Strain Energy for a General State of Stress; Impact Loading; Design for Impact Loads; Work and Energy under a Single Load; Deflection under a Single Load by the Work-Energy Method; Work and Energy under Several Loads; Castigliano's Theorem; Deflections by Castiglione's Theorem; Statically Indeterminate Structures **[1].** **(07 Hours)**

Text Books:

[1] Mechanics of Materials; Ferdinand P. Beer; E. Russel Johnston; John F. Dewolf; David F. Mazurek; Tata McGraw Hill.

[2] Strength of Materials; S. S. Rattan; Tata McGraw Hill.

[3] Mechanics of Materials; Andrew Pytel and Jaan Kiusalaas; Cengage Learning.

Reference Books:

[1] Advanced Mechanics of Solids; L. S. Srinath; Tata McGraw Hill.

[2] Fundamentals of Solid Mechanics; M. L. Ghambhir; Prentice Hall India.

[3] Strength of Materials; R. Subramanian; Oxford Higher Education.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Engineering Thermodynamics	ME 205	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
III	4	3-1-0	3 Hours

Unit - I

Introduction: System; Universe; Surrounding; Control Volume; Boundaries; Types of Systems; Macroscopic and Microscopic Viewpoints; Concept of Continuum; Thermodynamic Equilibrium; State Postulate; Thermodynamic Property; Process; Cycle **[1].** Reversibility; Quasi–Static Process; Irreversible Process; Causes of Irreversibility; Energy in State and in Transition; Work and Heat **[2].** Point and Path Function **[1]**.

(08 Hours)

Unit - II

Zeroth and First Laws of Thermodynamics: Temperature; Principles of Thermometry; Reference Points; Constant Volume Gas Thermometer; Scales of Temperature; PMM1**[1].** Joule's Experiments; First Law of Thermodynamics; Corollaries **[2].** First Law Applied to a Process; Applied to a Flow System; Steady Flow Energy Equation **[1]**. **(08 Hours)**

Unit – III

Second Law of Thermodynamics: Limitations of The First Law of Thermodynamics; Thermal Reservoir; Heat Engine; Heat Pump; Coefficient of Performance; Second Law of Thermodynamics; Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries; PMM of Second Kind; Carnot's Principle; Carnot Cycle and its Specialties; Thermodynamic Scale of Temperature; Clausius Inequality **[1]**.

(07 Hours)

Unit - IV

Entropy, Availability and Property Relations: Entropy; Principle of Entropy Increase; Availability and Irreversibility; Derivation of Maxwell's Equations, Clapeyron and Kirchoff Equation, Phase Rule **[1]**. **(06 Hours)**

Unit – V

Properties of Pure Substances: P-V-T- Surfaces; T-S and H-S Diagrams; Mollier Charts; Phase Transformations; Triple Point at Critical State Properties During Change of Phase; Dryness Fraction; Clausius–Clapeyron Equation; Property Tables; Moiller Charts, Steam Tables **[1].** Various Thermodynamic Processes and Energy Transfer; Steam Calorimeter **[2]**.

(08 Hours)

Unit - VI

Properties of Gases: Perfect Gas Laws; Equation of State; Specific and Universal Gas Constants; Various Non-Flow Processes; Properties; End States; Heat and Work Transfer; Changes in Internal Energy; Throttling and Free Expansion Processes; Deviations From Perfect Gas Model; Vander Waals Equation of State; Compressibility Charts; Variable Specific Heats; Gas Tables **[1]**. **(08 Hours)**

Text Books:

[4] Thermodynamics – An Engineering Approach; Yunus A. Cengel & Michael A. Boles; Tata McGraw Hill.

[5] Engineering Thermodynamics; P. K. Nag; Tata McGraw Hill.

[6] Thermodynamics – Basics and Applied; V. Ganesan; Tata McGraw Hill.

Reference Books:

[1] Fundamentals of Thermodynamics; Sonntag; Borgnakke and Van Wylen; John Wiley & Sons (Asia) Pvt. Ltd.

[2] Thermodynamics; J. P. Holman; Tata McGraw Hill.

[3] An Introduction to Thermodynamics; Y. V. C. Rao; New Age International.

[4] Engineering Thermodynamics; Jones & Dugan; Chapman and Hall.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Materials Engineering	ME 207	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
III	4	4-0-0	3 Hours

Unit - I

Classification and Selection of Materials:– Introduction; Engineering Requirements; Classification of Engineering Materials; Organic, Inorganic and Biomaterials; Semiconductors; Current Trends and Advanced Materials (Smart Materials; Nanostructured Materials and Nanotechnology; Quantum Dots; Spintronics; Fermionic Condensate Matter); Material Structure (Macrosctructure, Microstructure, Substructure, Crystal Structure and Electronic Structure); Engineering Metallurgy; Selection of Materials; Modern Materials Need **[1]**.

(09 Hours)

Unit - II

Crystal Geometry, Structure and Defects:- Crystal, Single Crystal and Whiskers; Lattice points and Space Lattice and Basis; Unit Cell and Primitive Unit Cell; Crystal Class / Symmetry; Crystal Systems; Directions, Lattice Planes and Miller Indices; Interplanar Spacing; Angle Between Two Planes or Directions; Coordination Number; Linear and Planar Atomic Density; Defects/ Imperfection in Crystals- Point, Line, Surface and Volume Defects; Liquid Crystal, Isotropy and Anisotropy, Frank Reed Source; Theory of Dislocations and Salient Features **[1-3]**. **(10 Hours)**

Unit – III

Alloy Systems, Phase Diagrams and Phase Transformations:- Alloy Systems; Solid Solutions; Hume Rothery Rules; Intermediate Phases/compounds; Gibb's Phase Rule; Cooling Curves; Kinetics of Phase Transformation – Gibbs Free Energy, Homogeneous and Heterogeneous Nucleation, Rate of Nucleation, Grain Growth; Directional Solidification and Solidification Defects **[1, 2]**.

Construction of Phase Diagrams; Lever Rule; Equilibrium Phase Diagrams (Complete Solid Solutions, Partial Solid Solutions Eutectic Systems), Application of Phase Diagrams; Coring; Grain Growth; Effects of Alloying Elements on Properties of Steel; Cast Iron and their Types **[1, 2]**. **(10 Hours)**

Unit – IV

Deformation of Materials:– Elastic and Plastic Deformation; Mechanism of Plastic Deformation- Deformation by Slip, Dislocation, Twinning, Neumann Bands; Comparison Between Slip and Twin; Work Hardening/ Strain Hardening; Bauschinger Effect; Adiabatic and Isothermal Straining; Yield Point Phenomena

and Related Effects; Preferred Orientation; Recovery, Recrystalization and Grain Growth **[1-3]**. **(10 Hours)**

Unit - V

Mechanical Properties of Materials and Mechanical Tests:- Some Important Terms Related to Mechanical properties and Tests; Engineering and True Stress Strain Diagram; Elastic, Aneslastic, Relaxation and Viscoelastic Behavior; Fundamental Mechanical Properties – Tensile Strength, Hardness, Impact Strength, Fatigue and Creep Strength; Factors Affecting Mechanical Properties; Fracture **[1]**. **(11 Hours)**

Unit - VI

Heat Treatments and Processes:- Objectives of Heat Treatment; Iron Carbon/Iron Carbide Phase Diagram; Isothermal Transformation Diagram (TTT Diagram) and Continuous Cooling Diagram (CCD); Transformation of Austenite upon Continuous Cooling; Transformation of Austenite into Martensite; Heat Treatment Processes- (i) Annealing (ii) Normalising (iii) Hardening (iv) Tempering (v) Case hardening (vi) Surface hardening and (vii) Ageing and Types of Each Process **[1]**. **(10 Hours)**

Text Books:

[1] Material Science; S. L. Kakani, Amit Kakani; New Age International Publisher.

[2] Material Science and Engineering- An Introduction; William D. Callister; John Wiley & Sons.

[3] The Science and Engineering Materials; Donald R. Askeland, Pradeep P. Fulay, Wendelin J. Wright; Publisher Cenage Learning.

Reference Books:

[1] Material Science and Engineering; V. Raghvan; Prentice Hall of India.

[2] Modern Physical Metallurgy and Materials Engineering; R. E. Smallman, R. J. Bishop; Publisher Butterworth Heinemann.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Production Processes Lab I	ME 209	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
III	2	0-0-3	3 Hours

List of Experiments

Note: Minimum of Any 10 Experiments Should be Performed.

1. To Study the Various Angles of a Single Point Cutting Tool and To Make a Single Point Cutting Tool by Grinding Various Angles on Tool and Cutter Grinder. Also Define the Tool Signature.
2. To Study the Different Types of Cutting Inserts and Tool Holders. Study of ISO Designation of Cutting Inserts and Tool Holders.
3. To Study Thread Terminology and Various Types of Thread Profiles.
4. To Calculate the Gear Change (Metric and Inch Systems) for a Given Pitch of Thread and To Cut External Threads on a Lathe.
5. To Perform Drilling, Boring and Reaming Operations for Manufacturing of a Bush.
6. (A) To Study Various Parts of Driiling Machine, Various Operations Performed on Drilling Machine.

   (B) To Perform Tapping Operation on Drilling Machine Or Manual Tapping.
7. (a) To Study Various Parts of a Shaper and Various Operations Performed on a Shaper Machine.

   (b) To Study Quick Retune Mechanism of a Shaper (Mechanical and Hydraulic).
8. To Study the Indexing Mechanism (Dividing Head) and Various Indexing Methods.
9. To Study Gear Terminology and Calculation of Various Parameters for Gear Manufacturing.

10. To Cut Gear on Shaper/ Milling Machine Using Indexing Head / Dividing Head.

11. To Study Various Parts of a Milling Machine and Various Operations Performed on a Milling Machine.

12. To Study Different Types of Grinding Operations and To Prepare a Job on Surface Grinder/Cylindrical Grinder.

13. To Study Honing; Lapping; Superfinishing; Polishing; Buffing Operations.

14. Manufacture and Assembly of a Unit Consisting of 2 To 3 Components, To Have the Concept of Tolerances and Fits (Shaft and Bush Assembly Or Shaft, Key And Bush Assembly Or Any Suitable Assembly).

15. (a) To Make Mosquito Coil Stand/Washer/Lid Using Hydraulic Press.

(b) To Prepare a Required Shape and Size of Material Using Power Press.

16. (a) To Study Various Types of Pipe Joints and Applications.

(b) Disassembly and Assembly of Small Assemblies Such as Tail Stock, Bench Vice, Screw Jack etc.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Strength of Materials Lab	ME 211	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
III	1	0-0-2	3 Hours

List of Experiments

Note: Minimum of Any 10 Experiments Should be Performed.

1. Standardization and Classification of Various Standards. Study of Various ASTM Standards.
2. Classification of Various Properties of Metals, Important Technological Properties of Metals and To Study the Various Factors Affecting the Mechanical Properties of a Material.
3. Preparation of Specimen for Metallographic Examination of Different Engineering Materials.
4. (a) To Study the Tensile Testing Method & Determine the Tensile Strength of a Given Specimen.

   (b) To Study the Compression Testing Method & Determine the Compression Strength of aA Given Specimen.
5. To Study The Shear Testing Method & Determine the Shear Strength of a Given Specimen.
6. To Study the Torsion Testing Method & Determine the Torsional Strength of a Given Specimen.
7. (a) To Study the Brinell Hardness Testing Method & Determine the Brinell Hardness of a Given Specimen.

   (b) To Study the Rockwell Hardness Testing Method & Determine the Rockwell Hardness of a Given Specimen.
8. To Study the Vicker's Hardness Testing Method & Determine the Vicker's Hardness of a Given Specimen.
9. To Study the Impact Testing Method & Determine the Impact Strength of a Given Specimen (Izod & Charpy).

10. To Conduct Bending Test for the Given Specimen and To Determine the Following: a) Modulus of Elasticity and b) Modulus of Rupture Or Flexure Modulus (Maximum Bending Stress at Failure Using Bending Equation).

11. To Study the Creep, Types of Creep, Creep Testing Method & Determine the Creep Strength of a Given Specimen.

12. To Study the Fatigue Testing Method & Determine the Fatigue Strength of a Given Specimen.

13. Study of Ductile and Brittle Facture. Study of Griffth's Theory of Brittle Fracture.

14. To Determine the Stiffness of the Spring and Modulus of Rigidity of the Spring Wire

15. Heat Treatment: Annealing, Normalizing, Hardening and Tempering of Steel.

16. Non-Destructive Testing - a) Magnetic Crack Detection b) Dye Penetration Testing.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Machine Drawing	ME 213	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
III	2	1-0-2	3 Hours

Note:-

1) **Drawing Should be Made using Mini Drafter or T-square. Some of the Drawing Sheets Should be Prepared Free Hand.**

2) **End Term Examination Marks – 30 Marks Theory + 40 Marks Drawing.**

Unit - I

Graphic Language-Introduction, Importance of Graphic Language, Need for Correct Drawings; Classification of Drawings **-**Machine Drawing, Production Drawing, Part Drawing and Assembly Drawing. Drawing Sheet Sizes and their Designations; Scales – Scale Designation, Recommended Scales and Scale Specification; Lines and their Thickness **[1]**. Drawing Standards (International and Bureau of Indian Standards); Various Standards for the Practice of Engineering Drawing Under BIS and their Respective Codes **[2].**

Orthographic Projections:- Introduction; Principle of First and Third Angle Projections **[1]**.

Sections and Sectional Views - Cutting Planes, Half Section, Local Section, Arrangement of Successive Sections; Conventional Representation-Materials and Machine Components; Standard Abbreviations **[1]**. **(03 L + 09 P - Hours)**

Unit – II

Development of Surfaces of Solids - Principle of Development; Various Methods of Development.

Keys - Saddle Keys and Sunk Keys; **Cotter Joints -** Cotter Joint with Sleeve, Cotter Joint with Socket and Spigot Ends and Cotter Joint with a Gib; **Pin Joints -** Knuckle Joint **[1]**. **(03 L + 06 P - Hours)**

Unit – III

Screw and Fasteners:- Introduction; Screw Thread Nomenclature; Forms of Threads, Other Thread Profiles; Thread Series; Thread Designation; Multi-start Threads; Right Hand and Left Hand Threads , Representation of Threaded Parts in Assembly, Bolted Joint - Methods of Drawing Hexagonal (Bolt Head) Nut, Method of Drawing Square (Bolt Head) Nut. Hexagonal and Square Headed Bolts, Washers, Other Forms of Bolts, Other Forms of Nuts, Cap Screws and

Machine Screws, Set Screws; Locking Arrangements for Nuts - Lock Nut, Locking by Split Pin, Locking by Castle Nut, Wile's Lock Nut, Locking by Set Screw, Grooved Nut, Locking by Screw, Locking by Plate, Locking by Spring Washer; Foundation Bolts - Eye Foundation Bolt, Bent Foundation Bolt, Rag Foundation Bolt, Lewis Foundation Bolt and Cotter Foundation Bolt **[1]**. *Drawing of Hexagonal Nut and Bolt, Square Nut and Bolt should be Prepared and rest should be Drawn Freehand*. **(03 L + 06 P - Hours)**

Unit – IV

Gears – Introduction; Classification of Gears; Spur Gear Terminology and Various Formulae; Cycloidal and Involutes Curves; Characteristics of Involutes Teeth; Working Drawings of Gears **[2].** **(02 L + 06 P - Hours)**

Unit – V

Introduction to Limits, Fits and Tolerances:- Principle of Interchangeability; Tolerances and its Classifications; Maximum and Minimum Metal Conditions; Fits and their Types; System of Limits and Fits; General Terminology; Limit Gauging and their Classifications (Plain Gauge, Snap Gauge etc.) **[3]**. ***Theory Only for this Unit.*** **(04 Hours)**

Unit - VI

Assembly Drawings:- Piston and Screw Jack; Lever safety Valve and Self Centering Chuck (Three Jaw Chuck) *(Three Drawing Sheets Should Be Prepared (Piston and Screw Jack is in One Sheet))*

Production Drawings:- Introduction; Types of Production Drawings; Detail or Part Drawings; Working Assembly Drawings; Detailed Drawings and Manufacturing Methods; Example Drawings Should be Taken in Order to Give an Idea, How to Read these Drawings? **[1].** **(02 L + 09 P - Hours)**

Text Books:

[7] Machine Drawing; K. L. Narayana, P. Kannaiah and K. Venkata Reddy; New Age International Publishers.

[8] Engineering Drawing; N. S. Parthasarathy and Vela Murali; Oxford University Press.

[9] Engineering Metrology and Measurements; R. V. Raghavendra, L. Krishnamurthy; Oxford University Press.

Reference Books:

[1] Machine Drawing; R. B. Gupta; Satya Prakashan, New Delhi.

[2] Engineering Drawing; P. S. Gill; S. K. Kataria and Sons.

[3] Machine Drawing; P. S. Gill; S. K. Kataria and Sons.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Theory of Production Processes – II	ME 202	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
IV	4	4-0-0	3 Hours

Unit – I

Metal Cutting: Introduction; **Chip Formation -** Discontinuous Chip, Continuous Chip, Continuous Chip with a Built-Up Edge; **Orthogonal Cutting** - Mechanics of Orthogonal Metal Cutting; **Cutting Tool Geometry**-American (ASA) System, Orthogonal Rake System, Normal Rake system, Significance of Various Tool Angles**.**

Cutting Tool Materials- Requirements of Tool Materials; Classification of Tool Materials-Ferrous Tool Materials, Nonferrous Tool Materials, Nanocoated Tools **[1, 2].** **(10 Hours)**

Unit-II

Tool Wear & Tool Life: Introduction, Forms Of Tool Wear, Crater Wear, Flank Wear; **Tool Life**- Factors Affecting Tool Life; Economics Of Metal Cutting; **Machinability**.- Introduction; Factors Affecting Machinability-Condition Of Work Material, Physical Properties Of Work Materials; Cutting Fluids **[1, 2].**

(10 Hours)

Unit -III

Cutting Cylindrical Surfaces: Introduction; Construction Features of a Centre Lathe-Lathe Specifications; Operation Performed in a Centre Lathe – Turning, Facing, Knurling, Parting, Drilling, Boring; Taper Turning Methods; Thread Cutting Methods**.**

Cutting Flat Surfaces: Introduction; **Shaping and Planing** - Shaper and Planer Tools; **Milling**-Horizontal (Plain) Milling, Plain-Milling Cutters; Face Milling - Face-Milling Cutters; Selection of Milling Conditions; **Broaching** - Broach Tool, Chip Formation in Broaching, Broach Design **[1, 2].** **(10 Hours)**

Unit - IV

Drilling & Reaming: – Introduction; Drill Tool, Elements of Undeformed Chip, Cutting Forces, Torque, and Power, Factors Affecting the Drilling Forces (Factors

Related to the Workpiece, Factors Related to the Drill Geometry, Factors Related to Drilling Conditions). Drilling Time, Surface Quality, Selection of Drilling Conditions; **Reaming**-Finish Reamers, Elements of Undeformed Chip, Forces, Torque, and Power in Reaming Reaming Time, Selection of the Reamer Diameter, Selection of Reaming Conditions **[1, 2].** **(10 Hours)**

Unit - V

Abrasive Cutting and Finishing Processes: Introduction; **Grinding** - Grinding Wheels, Wheel Wear, Surface Roughness; Surface Grinding; Surface Grinding Operations-Plain and Face Grinding with Reciprocating Feed, Surface Grinding with a Rotating Table, Creep-Feed Grinding, Cylindrical Grinding; **Abrasive Finishing Processes-**Honing; Lapping; Superfinishing; Polishing; Buffing **[1, 3].** **(10 Hours)**

Unit – VI

Jigs and Fixtures – Introduction, Types of Jigs and Fixture, Advantages of using Jigs and Fixture ,Design of Jigs and Fixtures, Main Component of Jigs and Fixture, Degree of Freedom, Principals of Location, Locating Devices, Clamping Devices **[2].** **(10 Hours)**

Text Books:

[1] Manufacturing Technology; Metal Cutting and Machine Tools; Vol. 2; P. N. Rao; Tata McGraw Hill.

[2] Metal Cutting and Design of Cutting Tools, Jigs and Fixtures; N. K. Mehta; McGraw Hill Education (India) Private Limited.

[3] Fundamentals of Modern Manufacturing, Materials; Processes and Systems; Mikell P. Groover; Publisher Willey.

Reference Books:

[4] Manufacturing Engineering & Technology; Kalpakjian; Pearson Pub.

[5] Manufacturing Science; Ghosh and Malik; East West Press.

[6] Manufacturing Technology: Er. R. K. Rajput; Laxmi Publications.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Strength of Materials-II	ME 204	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
IV	4	3-1-0	3 Hours

Unit - I

Thin Cylinders: Thin Seamless Cylindrical Shells - Derivation of Formula for Longitudinal and Circumferential Stresses - Hoop, Longitudinal and Volumetric Strains - Changes in Dia and Volume of Thin Cylinders -Thin Spherical Shells. **[1].**

Thick Cylinders: Introduction Lame's Theory for Thick Cylinders -Derivation of Lame's Formulae - Distribution of Hoop and Radial Stresses across Thickness; Design of Thick Cylinders - Compound Cylinders, spherical shells. Problems **[2].**

(08 Hours)

Unit - II

Rotating Rims and Discs: Stresses in Uniform Rotating Rings & Discs; Rotating Discs of Uniform Strength; Stresses in (ii) Rotating Rims; Neglecting the Effect of Spokes; (ii) Rotating Cylinders; Solid cylinders; Hollow cylinders Problems **[2].** **(07 Hours)**

Unit – III

Bending of Curved Beams: Introduction of Circular Beams Loaded Uniformly and Supported on Symmetrically Place Columns; Semi-Circular Beam Simply-Supported on Three Equally Spaced Supports **[1]**; Stresses in Curved Beams of Initial Large Radius of Curvature, Beams of Initial Small Radius of Curvature, Deflection of Curved Beams and Rings; Problems **[2].** **(08 Hours)**

Unit - IV

Unsymmetrical Bending: Introduction and properties of Beam Cross Sections; Moments of Inertia; Product of Inertia; Ellipse of Inertia; Slop of Neutral Axes; Stresses and Deflections; Shear **[1].**

Shear Centre: Introduction of Shear Centre and Flexural Axes; Shear Centre for Symmetrical and Unsymmetrical (Channel, I, T and L) Sections. Problems **[2].**

(07 Hours)

Unit – V

Slope and Deflection of Beams:-Introduction; Deformation of a Beam under Transverse Loading; Equation of the Elastic Curve; Direct Determination of the Elastic Curve from the Load Distribution, Double Integration Method; Statically Indeterminate Beams; Using Singularity Functions to Determine the Slope and Deflection of a Beam, Macaulay's Method; Method of Superposition, Moment Area Method, Application of Superposition to Statically Indeterminate Beams **[1].** **(08 Hours)**

Unit - VI

Fixed Beams: Deflections, Reactions and Fixing Moments with SF & BM Calculations & Diagrams for Fixed Beam under (i) Concentrated Loads, (ii) Uniformly Distributed Load and (iii) A Combination of Concentrated Loads & Uniformly Distributed Loads; Problems **[2].** **(07 Hours)**

Text Books:

[10] Mechanics of Materials; Ferdinand P. Beer; E. Russel Johnston; John F. Dewolf; David F. Mazurek; Tata McGraw Hill.

[11] Strength of Materials; R. K. Bansal, Lakshmi Publications House Pvt. Ltd.

[12] Strength of Materials; S. S. Rattan, Tata McGraw Hill Education Pvt. Ltd.

[13] Mechanics of Materials; Andrew Pytel and Jaan Kiusalaas; Cengage Learning.

Reference Books:

[1] Fundamentals to Solid Mechanics; M. L. Gambhir, PHI Learning Pvt. Ltd.

[2] Strength of Materials; Bhattacharya, Cengage Learning

[3] Strength of Materials; R. Subramanian, Oxford University Press.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Fluid Mechanics	ME 206	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
IV	4	3-1-0	3 Hours

Unit - I

Introduction: Classification of Fluids; Continuum Concept; Properties of Fluids-Density Specific Gravity, Viscosity, Surface Tension and Capillary Effect; Vapor Pressure and Cavitation; Newtonian and Non Newtonian Fluids; Pascal's Law; Hydraulic Pressure; Pressure Measurement; Manometer and Micro-Manometer; Pressure Gauges; Slip / No Slip condition **[1-3].** **(08 Hours)**

Unit – II

Fluid Statics: Hydrostatic Forces on Submerged Plane and Curved Surfaces; Centre of Pressure; Equilibrium of Submerged and Floating Bodies; Buoyancy; Meta-Centric Height; Fluid Subjected to Constant Linear Acceleration and to Constant Rotation **[1-3].** **(07 Hours)**

Unit - III

Kinematics of Fluid: Classification of Fluid Flows; Lagrangian and Eulerian Approach; Velocity and Acceleration of Fluids; Path Line; Streak Line and Stream Line; Stream Tube; Stream Function and Potential Function; Flownet; Deformation of Fluid Elements; Vorticity and Circulation; Reynolds Transport Theorem **[1-3].** **(07 Hours)**

Unit - IV

Fluid Dynamics and its Applications: Conservation Equations of Mass, Momentum and Energy; Navier-Stokes Equations; Euler and Bernaulli Equation; Forces due to Fluid Flow in the Bends; Pitot Tube; Venturimeter and Orifice Meters; Orifice and Mouthpieces; Notches and Weirs; Rotameter and Other Devices **[1-3].** **(08 Hours)**

Unit – V

Dimensional Analysis and Similitude: Basic and Derived Quantities; Similitude and Dimensional Analysis; Rayleigh's Method; Buckingham π Method; Non-Dimensional Parameters and Model Testing**[1-3]. (07 Hours)**

Unit - VI

Incompressible Flow: Reynold's Experiment; Laminar and Turbulent Flow in Pipes; Darcy Equation; Poiseuille Flow; Couette Flow; Hagen-Poiseuille Flow; Friction Factor and Moody's Diagram; Flow Through Pipes; Losses in Pipes and Fittings; HGL and TEL; Aerofoil; Lift and Drag; Flow Separation **[1-3].**

(08 Hours)

Text Books:

[1] Fluid Mechanics- Fundamentals and Applications; Yunus A. Cengel, John M. Cimbala; McGraw-Hill Publications.

[2] Fluid Mechanics and Hydraulic Machines; R. K. Bansal; Laxmi Publication.

[3] Fluid Mechanics and Machines; S. K. Som; Tata McGraw Hill.

Reference Books:

[1] Hydraulics and Fluid Mechanics; P. N. Modi and S. M. Seth; Rajsons Publications.

[2] Fluid Mechanics; F. M. White; McGraw-Hill Publications.

[3] Fundamental of Fluid Mechanics; B. R. Munson; D. F. Young and T. H. Okishi; Wiley India.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Kinematics of Machines	ME 208	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
IV	4	3-1-0	3 Hours

Unit - I

Introduction: Kinematic Quantities (Displacement, Velocity, Acceleration), Structure; Machine; Kinematic Link; Kinematics Pairs; Mechanisms and Inversions; Kinematics Chain; Degree of Freedom; Grublers Equation; Kutzbach Criterion; Joints-Types of Joints; Inversion of Mechanism- Four Bar Chain, Inversion of Four Bar Chain (Grashof's Criteria for Movability), Slider Crank Chain, Inversion of Slider-Crank Chain, Double Slider Crank Chain; Four Link Planar Mechanisms; Straight Line Mechanisms; Steering Mechanisms; Pantograph **[1, 2].** **(09 Hours)**

Unit - II

Velocity in Mechanism: Analysis of Reciprocating Engine Mechanism; Analysis of Four Bar Mechanism; Definition and Classifications of Instantaneous Center, Methods for Locating the Instantaneous Center; Kennedy Theorem; Relative and Graphical Velocity Methods- Velocities in Four Bar Chain; Velocities in Slider-Crank Mechanism; Rubbing Velocity; Mechanical Advantage **[1, 2]. (07 Hours)**

Unit - III

Acceleration in Mechanism: Acceleration of a Body Moving Along a Circular Path; Acceleration Diagram for a Link; Acceleration Diagram for Slider-Crank Mechanism; Acceleration of Intermediate and Affect Points; Coriolis Acceleration Component **[1, 2].** **(06 Hours)**

Unit - IV

Cams and Followers: Classification; Types of Motion Curves and their Analytical Expressions; Graphical Construction of Cam Profiles for different Types of Followers; Basic Terminology; Motions of Followers; Cycloidal Motion; Cams With Specified Contours **[1, 2].** **(08 Hours)**

Unit - V

Gears: Introduction; Classification of Gears; Basic Terminology; Law of Gearing; Velocity of Sliding; Cycloidal Profile Teeth; Involute Profile Teeth; Length of Path of Contact; Length of Arc of Contact; Interference; Minimum Number of Teeth require to Avoid Interference Wheel and Pinion; Helical Gears; Spiral Gears **[1, 2].** **(08 Hours)**

Unit-VI

Gear Trains: Introduction; Types of Gear Trains-Simple, Compound, Reverted, Epicyclic; Velocity Ratio of Simple Gear Train, Compound Gear Train, Epicyclic Gear Train, Sun and Planet Gear Train, Compound Epicyclic Gear Train **[1. 2].** **(07 Hours)**

Text Books:

[1] Theory of Mechanisms and Machines; Jagdish Lal; Metropolitan Book Co. (Pvt) Ltd.

[2] Theory of Machines: S. S. Rattan; Tata McGraw Hill.

[3] Theory of Mechanisms and Machines: Amitabh Ghosh and Ashok Kumar Malik; Third Edition Affiliated East-West Press.

Reference Books:

[1] Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker; Jr. Second Edition; McGraw Hill.

[2] Theory of Machines; Thomas Bevan; 3rd Ed.; CBS Publishers.

[3] Kinematics and Dynamics of Machines; Martin; G.H.; 3rd Ed.; McGraw-Hill.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Engineering Measurements & Metrology	ME 210	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
IV	3	3-0-0	3 Hours

Unit - I

Basic Principles of Engineering Metrology:- Definition of Metrology; Need for Inspection; Accuracy and Precision; Objectives of Metrology and Measurement; General Measurement Concept; Errors in Measurement; Methods of Measurement **[1]**.

Standards of Measurement:- Standards and their Roles; Evolution of Standards; Material and Wavelength Standards; Subdivision of Standards; Brookes Level Comparator; Displacement Method; Calibration of End Bars; Numerical Problems **[1]**.

Measurement Systems- Some Basic Definitions -Hysteresis and Linearity in Measurement Systems, Resolution, Threshold, Drift, Zero Stability, Loading Effects, System Response; Functional Elements of a Measurement System – Primary, Intermediate and Output Stage **[1]**. **(02+03+02 Hours)**

Unit - II

Limits, Fits, Tolerances and Gauging:- Principle of Interchangeability; Selective Assembly Approach; Tolerances and its Classifications; Maximum and Minimum Metal Conditions; Fits and their Types; Numerical Problems; System of Limits and Fits; General Terminology; Limit Gauging and their Classifications (Plain Gauge, Snap Gauge etc.); Tyalor's Principle and Important Points of Gauge Design **[1]**.

Metrology of Surface Finish:- Surface Metrology Concepts and Terminology; Analysis of Surface Traces; Specification of Surface Texture Characteristics; Methods of Measuring Surface Finish- Stylus System; Stylus Probe; Wavelength, Frequency and Cut-Off ; Other Methods for Measuring Surface Roughness- Pneumatic, Light Interference and Mercin Instrument **[1]**. **(05+03 Hours)**

Unit - III

Linear Measurement:- Depth Gauge; Combination Set; Vernier Callipers; Vernier Depth Gauge; Inside and Outside Micrometers; Vernier Micrometers; Depth Micrometer; Slip Gauges- Gauge Block Shapes, Grades and Sizes **[1]**.

Angular Measurement:- Universal and Optical Bevel Protractor; Sine Bar; Angle Gauges; Spirit Level; Optical Instrument for Angular Measurement- Autocollimator (Conventional, Digital and LASER Autocollimator) and its Applications **[1]**.

Comparators – Comparators and Functional Requirements; Classification of Comparators – Mechanical Comparators; Mechanical –Optical Comparators; Electrical and Electronic Comparators; Pneumatic Comparators **[1]**.

(03+03+03 Hours)

Unit - IV

Optical Measurement and Interferometer:– Optical Measurement Techniques – Tool Maker's Microscope, Profile Projector; Optical Interference; Interferometer and Optical Flats; Interferometers- NPL Flatness Interferometers, Pitter- NPL Gauge Interferometers; LASER Interferometers; Scales, Grating and Reticles **[1]**.

Metrology of Gears and Screw Threads:– Gear Terminology; Errors in Spur Gears; Measurement of Gear Elements; Composite Methods of Gear Inspection. Screw Thread Terminology; Measurement of Screw Thread Elements; Thread Gauges **[1]**. **(04+04 Hours)**

Unit - V

Measurement of Force, Torque and Strain:– Measurement of Force; Elastic Members (Load Cells, Cantilever Beams and Proving Rings); Measurement of Torque; Measurement of Strain – Mechanical Strain Gauges; Electrical Strain Gauges; Strain Gauge Materials, Backing or Carrier Materials; Gauge Factor; Theory of Strain Gauges; Methods of Strain Measurement; Strain Gauge Bridge Arrangement; Temperature Compensation in Strain Gauges **[1]**. **(07 Hours)**

Unit - VI

Measurement of Temperature:– Methods of Measuring Temperature; Thermocouples and Thermopiles; Resistance Temperature Detectors; Thermistors; Pressure Thermometers; Pyrometery- Total Radiation and Optical Pyrometer, Fibre-optic Pyrometers, Infrared Thermometers **[1]**.

Miscellaneous Metrology:– Precision Instruments Based on LASER Principle; Coordinate Measuring Machines and its Major Applications; Machine Tool Metrology – Straightness, Flatness, Parallelism, Sqaureness, Roundness, Cylindricity and Runout. Automated Inspection; Machine Vision and its Application in Inspection **[1]**. **(03+03 Hours)**

Text Books:

[1] Engineering Metrology and Measurements; R. V. Raghavendra, L. Krishnamurthy; Oxford University Press.

[2] Mechanical Measurement and Instrumentation; R. K. Rajput; S. K. Kataria & Sons.

[3] Engineering Metrology; R.K. Jain; Khanna Publishers.

[4] Engineering Metrology; I C Gupta; Danapath Rai & Co.

Reference Books:

[1] Instrumentation Measurement and Analysis; B. C. Nakra and K. K. Chaudhry, Publisher McGraw Hill Education.

[2] Measurement Systems- Design and Applications; Ernest O. Doeblin and D. N. Manik; Publisher Tata McGraw Hill Education Private Ltd.

[3] Introduction to Measurements and Instrumentation; Arun K Ghosh; Publisher PHI Learning Private Limited.

[4] Measurement and Instrumentation Principles; Alan S. Morris; Publisher Butterworth Heinemann.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Automobile Engineering	ME 212	(SM+MT) +ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
IV	3	3-0-0	3 Hours

Unit - I

Introduction to Automobiles: Classification of Automobiles; Requirements of automobile body, Vehicle frame, Separate body & frame, Unitised body, Front engine rear drive & front engine front drive vehicles; Four Wheel Drive Vehicles; Safety Considerations; Future Trends In Automobiles.

Clutches - Requirement of Clutches, Objectives of Clutch, Principle of Friction Clutch – Wet Type & Dry Types, Cone Clutch, Single Plate Clutch, Diaphragm Spring Clutch, Multi Plate Clutch, Centrifugal Clutch, Electromagnetic Clutch, Over Running Clutch, Clutch Linkages **[1]**. **(08 Hours)**

Unit - II

Power Transmission: Requirements of Transmission System; General Arrangement of Power Transmission System; Objectives of The Gear Box; Different Types of Gear Boxes; Sliding Mesh, Constant Mesh, Synchromesh Gear Box, Epi-Cyclic Gear Box; Freewheel Unit; Overdrive Unit- Principle of Overdrive, Advantage of Overdrive; Transaxle, Transfer Cases **[1, 3]**. **(07 Hours)**

Unit - III

Drive Lines, Universal Joint, Differential and Drive Axles: Effect of Driving Thrust and Torque Reactions; Hotchkiss Drive; Torque Tube Drive and Radius Rods; Propeller Shaft- Universal Joints, Slip Joint, Constant Velocity Universal Joints; Principle, Functions, Construction & Operation of Differential; Rear Axles; Types of Load on Rear Axles; Full Floating; Three Quarter Floating And Semi Floating Rear Axles **[1, 2]**. **(07 Hours)**

Unit – IV

Suspension Systems: Need of Suspension System; Types of Suspension; Suspension Spring; Constructional Details and Characteristics of Leaf Springs.

Steering System: Front Wheel Geometry & Wheel Alignment Viz. Caster, Camber, King Pin Inclination, Toe-In/Toe-Out; Conditions for True Rolling Motions of Wheels During Steering; Different Types of Steering Gear Boxes;

Steering Linkages and Layout; Power Steering; Rack & Pinion Power Steering Gear; Electronics Steering **[3]**. **(08 Hours)**

Unit V

Automotive Brakes; Tyres & Wheels: Classification of Brakes; Principle and Constructional Details of Drum Brakes; Disc Brakes; Mechanical; Hydraulic; Pneumatic Brakes; Factors Affecting Brake Performance; Power & Power Assisted Brakes; Tyres of Wheels; Types of Tyres & their Constructional Details; Wheel Balancing; Tyre Rotation; Types of Tyre Wear & their Causes **[1, 2]**.

(07 Hours)

Unit - VI

Emission Control System & Automotive Electrical: Sources of Atmospheric Pollution from the Automobile; Emission Control Systems – Construction and Operation of Positive Crank Case Ventilation (PVC) Systems; Evaporative Emission Control; Heated Air Intake System; Exhaust Gas Recirculation (ECR) Systems; Air Injection System and Catalytic Converters; Purpose Construction & Operation of Lead Acid Battery; Capacity Rating & Maintenance of Batteries; Purpose and Operation of Charging Systems; Vehicle Lighting System **[3]**.

(08 Hours)

Text Books:

[1] Automobile Engineering; Kirpal Singh; Standard Publishers Distributors.

[2] Automotive Technology; H.M. Sethi; Tata McGraw Hill; New Delhi.

[3] Automotive Mechanics Crouse; Donald Anglin; Tata McGraw Hill; New Delhi.

Reference Books:

[1] Automobile Engineering; Anil Chhikara; Satya Prakashan; New Delhi.

[2] Automotive Mechanics; S. Srinivasan; Tata McGraw Hill; New Delhi.

[3] Automotive Mechanics; Joseph Heitner; East West Press.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Production Processes Lab II	ME 214	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
IV	2	0-0-3	3 Hours

List of Experiments

Note: Minimum of Any 10 Experiments Should be Performed.

1. To Study the Various Properties of Molding Sand and their Testing Procedures.
2. To Find the Distribution of Sand Grains using a Set of Sieves and to Find the Average Grain Fineness Number.
3. To Study Different Types of Patterns, Pattern Materials and Pattern Allowances.
4. To Make a Pattern for a Given Casting with all the Necessary Allowances, Parting Line, Running System Details. Preparation of Mold and Casting.
5. Study the Solidifications Mechanism in a Castings Process.
6. **(A)** To Prepare A Casting using the Developed Pattern as Above.

   (B) To Study Various Types of Casting Defects, Reasons of their Origin and Remedial Measures to be used to Avoid these Defects.
7. To Study Resistance Welding; Different Types of Resistance Welding Operations and Prepare a Resistance Welded Joint.
8. To Study MIG (Metal Inert Gas) and TIG/WIG (Tungsten Inert Gas) Welding and Prepare a Welded Joint using TIG/WIG Welding Operation.
9. **(a)** To Make a Corner Joint, using the Given Two Mild Steel Pieces and by Arc Welding.

   (b) To Study Various Types of Welding Defects, Reasons of their Origin and Remedial Measures to be used to Avoid these Defects.

10. To Study Different Sheet Metal Joints and Prepare a Sheet Metal Product (Funnel).

11. To Study Various Characteristics of given Metal Powders and Evaluate Green Density as well as Strength Characteristics (hardness) of Cold-compacted and Sintered (Conventional) Powder

12. To study and observe the Closed Die Forging Techniques through Demonstration.

13. To Study and Observe the Plain and Grooved Rolling Techniques through Demonstration.

14. To Prepare a Hexagonal Allen Key / Hexagonal Bolt by Hand Forging Operation.

15. Development and Manufacture of Complex Sheet-Metal Components Such as Funnel etc.

16. (a) To Prepare a Plastic Product using Injection Molding Machine.

(b) To Prepare a Bottle of 200mL using Blow Molding Machine.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Fluid Mechanics Lab	ME 216	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
IV	2	0-0-3	3 Hours

List of Experiments

Note: Minimum of Any 10 Experiments Should be Performed.

1. To Determine Different Properties (Density, Specific Gravity, Surface Tension Etc) of A Fluid.
2. To Determine the Centre of Pressure on A Submerged Vertical Plate.
3. To Determine the Meta-Centric Height of A Floating Body.
4. To Determine Coefficient of Discharge of An Orifice Meter.
5. To Determine the Coefficient of Discharge of Notch (V and Rectangular Types).
6. To Determine the Friction Factor for the Pipes.
7. To Determine the Coefficient of Discharge of Venturimeter.
8. To Determine the Coefficient of Discharge, Contraction and Velocity of An Orifice.
9. To Verify the Bernoulli's Theorem.
10. To Find Critical Reynolds Number for A Pipe Flow.
11. To Determine the Minor Losses due to Sudden Enlargement, Sudden Contraction and Bends.
12. To Study the Formation of Boundary Layer around Different Shaped Objects.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Engineering Measurements & Metrology Lab	ME 218	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
IV	1	0-0-2	3 Hours

List of Experiments

Note: Minimum of Any 10 Experiments Should be Performed.

1. To Study the Importance of Design, Setting and Measuring Datum Surfaces.
2. **(a)** To Study Calibration Process and Calibrate a Given Micrometers.
   (b) To Study and Use of Dial Gauges as Mechanical Comparators.
3. **(a)** To Study the Use and Application of Sine Bars.
   (b) To Study the Use and Application of Bevel Protractors.
4. **(a)** To Study the Use and Application of Gear Tooth Micrometer.
   (b) To Study the Use and Application of Vernier Gear Tooth Calliper.
5. Determination of Effective Diameter of Screw Threads by Two- and Three-wire Methods.
6. **(a)** Measurement of Straightness Using Autocollimators.
   (a) Measurement of Flatness Using Clinometers.
7. To Study the Use and Application of Tool Maker's Microscope.
8. Measurement of Elements of Gears Using Profile Projectors (Optical Projector).
9. To Study the Use and Application of Use of Optical Flat.
10. Measurement of Surface Roughness Values Using Surface Roughness Tester / Handysurf.

11. (a) To Study the Use and Application of Lathe Tool Dynamometer.

(b) To Study the Use and Application of Drill Tool Dynamometer.

12. To Study Calibration Process and Calibrate a Given Pressure Gauge.

13. (a) To Study Calibration Process and Calibrate a Given Load Cell.

(b) To Study Calibration Process and Calibrate a Given LVDT.

14. Determination of Modulus of Elasticity of a Mild Steel Specimen using Strain Gauges.

15. To Study Various Temperature Measuring Devices and to Calibrate a Given Thermocouples.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Automobile Engineering Lab	ME 220	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
IV	1	0-0-2	3 Hours

List of Experiments

Note: Minimum of Any 10 Experiments Should be Performed.

1. To Study and Prepare Report on the Constructional Details, Working Principles and Operation of the Following Automotive Engine Systems & Sub Systems. (a) Multi-Cylinder: Diesel and Petrol Engines; (b) Engine Cooling & Lubricating Systems; (c) Engine Starting Systems; (d) Contact Point & Electronic Ignition Systems.
2. To Study and Prepare Report on the Constructional Details, Working Principles and Operation of the Following Automotive Clutches. (a) Single Plate Clutch; (b) Multi Plate Clutch and (c) Cone Clutch.
3. To Study and Prepare Report on the Constructional Details, Working Principles and Operation of the Following Automotive Transmission Systems. (a) Synchromesh – Four Speeds Range and (b) Transaxle.
4. To Study and Prepare Report on the Constructional Details and Working of Transfer Case.
5. To Study and Prepare Report on the Constructional Details, Working Principles and Operation of the Following Automotive Drive Lines; (a) Rear Wheel Drive Line; (b) Front Wheel Drive Line and (c) 4 Wheel Drive Line.
6. To Study and Prepare Report on the Constructional Details, Working of Differential.
7. To Study and Prepare Report on the Constructional Details, Working Principles and Operation of the Following Automotive Suspension Systems; (a) Front Suspension System and (b) Rear Suspension System.
8. To Study and Prepare Report on the Constructional Details, Working Principles and Operation of the Following Automotive Steering Systems; (a) Manual Steering Systems, E.G. Pitman –Arm Steering, Rack & Pinion

Steering and (b) Power Steering Systems, E.G. Rack And Pinion Power Steering System.

9. To Study and Prepare Report on the Constructional Details, Working Principles and Operation of the Following Automotive Tyres & Wheels; (a) Various Types of Bias & Radial Tyres and (b) Various Types of Wheels.

10. To Study & Prepare Report on Constructional Details, Working Principles and Operation of Automotive Brake Systems; (a) Hydraulic & Pneumatic Brake Systems; (b) Drum Brake System; (c) Disk Brake System and (d) Antilock Brake System.

11. To Study and Prepare Report on the Constructional Details, Working Principles and Operation of Automotive Emission / Pollution Control Systems.

12. To Study and Prepare Report on the Constructional Details, Working of Semi Floating Axles, Fully Floating Axles and Three Quarter Floating Axles.

13. To Study Different Types of Constant Velocity Joints for Power Transmission.

14. To Study Purpose and Operation of Charging Systems used in Automobiles.

15. To Study Front Wheel Geometry & Wheel Alignment Viz. Caster, Camber, King Pin Inclination, Toe-In/Toe-Out.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Design of Machine Elements - I	ME 301	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
V	4	2-0-2	3 Hours

Unit - I

Introduction: Basic Procedure of Design of Machine Elements; Basic Requirements of Machine Elements; Design of Machine Elements; Traditional Design Methods; Design Synthesis; Use of Standards in Design; Selection of Preferred Sizes; Aesthetic Considerations in Design; Ergonomic Considerations in Design; Concurrent Engineering**[1]**. **(05 Hours)**

Unit – II

Design Against Static Load: Classification of Materials; Ductile and Brittle Materials; Modes of Failure; Factor of Safety; Stress–strain Relationship; Shear Stress and Shear Strain; Stresses Due to Bending Moment; Stresses Due To Torsional Moment; Eccentric Axial Loading; Design of Simple Machine Parts; Cotter Joint; Design Procedure for Cotter Joint; Knuckle Joint; Design Procedure for Knuckle Joint; Principal Stresses; Theories of Elastic Failure; Maximum Principal Stress Theory; Maximum Shear Stress Theory; Distortion-Energy Theory; Selection and Use of Failure Theories; Levers; Design of Levers; Thermal Stresses; Residual Stresses **[1]**. **(05 Hours)**

Unit – III

Threaded Joints: Threaded Joints; Basic Types of Screw Fastening; Cap Screws; Setscrews; Bolt of Uniform Strength; Locking Devices; Terminology of Screw Threads; ISO Metric Screw Threads; Materials and Manufacture; Bolted Joint—Simple Analysis; Eccentrically Loaded Bolted Joints in Shear; Eccentric Load Perpendicular to Axis of Bolt; Eccentric Load on Circular Base; Torque Requirement for Bolt Tightening; Dimensions of Fasteners; Design of Turnbuckle **[1]**. **(05 Hours)**

Unit – IV

Welded Joints: Welded Joints; Welding Processes; Stress Relieving of Welded Joints; Butt Joints; Fillet Joints; Strength of Butt Welds; Strength of Parallel Fillet Welds; Strength of Transverse Fillet Welds; Maximum Shear Stress in Parallel Fillet Weld; Maximum Shear Stress in Transverse Fillet Weld; Axially Loaded Unsymmetrical Welded Joints; Eccentric Load in the Plane of Welds; Welded

Joint Subjected to Bending Moment; Welded Joint Subjected to Torsional Moment; Strength of Welded Joint **[1]**.

Riveted Joints:

Riveted Joints; Types of Rivet Heads; Types of Riveted Joints; Rivet Materials; Types of Failure; Strength Equations; Efficiency of Joint; Caulking and Fullering; Longitudinal Butt Joint for Boiler Shell; Circumferential Lap Joint for Boiler Shells; Eccentrically Loaded Riveted Joints **[1]**. **(05 Hours)**

Unit – V

Design Against Fluctuating Load: Stress Concentration; Stress Concentration Factors; Reduction of Stress Concentration; Fluctuating Stresses; Fatigue Failure; Endurance Limit; Low-cycle and High-cycle Fatigue; Notch Sensitivity; Endurance Limit—Approximate Estimation; Reversed Stresses—Design for Finite and Infinite Life; Cumulative Damage in Fatigue; Soderberg and Goodman Lines; Modified Goodman Diagrams; Gerber Equation; Fatigue Design under Combined Stresses; Impact Stresses **[1]**. **(05 Hours)**

Unit – VI

Springs: Springs; Types of Springs; Terminology of Helical Springs; Styles of End; Stress and Deflection Equations; Series and Parallel Connections; Spring Materials; Design of Helical Springs; Spring Design—Trial-and-Error Method; Design against Fluctuating Load; Concentric Springs; Optimum Design of Helical Spring; Surge in Spring; Helical Torsion Springs; Spiral Springs; Multi-Leaf Spring; Nipping of Leaf Springs; Belleville Spring; Shot Peening **[1]**.**(05 Hours)**

Text Books:

[1] Design of Machine Elements; V. B. Bhandari; Tata Mcgraw Hill.

[2] Machine Elements in Mechanical Design; Robert L. Mott, Edward M. Vavrek, Jyhwen Wang; Pearson.

[3] A Text Book of Machine Design, R. S. Khurmi and J. K. Gupta; Eurasia Publishing House (Pvt.) Ltd.

[4] Machine Design; P. C. Sharma & D. K. Aggarwal; Katson Publisher.

Reference Books:

[1] Design of Machine Elements; M. F. Spotts; Prentice-Hall Inc.

[2] Machine Design; Joseph E. Shigley Tata Mcgraw Hill.

[3] Machine Design-An Integrated Approach; Robert Norten; Pearson.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Applied Thermodynamics	ME 303	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
V	4	3-1-0	3 Hours

Unit – I

Introduction:-Law of Thermodynamics; Thermodynamic Cycles- Analysis of Air-standard Carnot, Otto, Diesel, Dual, Ericsson, Stirling, Brayton and Reversed Carnot Cycles **[1].**

Fuels and Combustion:- Classifications of Fuels; Combustion in Boiler and I. C. Engines; Stoichiometric (or Chemically Correct) Air Fuel Ratio; Analysis of Products of Combustion; Conversion of Volumetric Analysis into Gravimetric Analysis and Vice Versa; Actual Weight of Air Supplied; Use of Moles for Solution of Combustion, Adiabatic Flame Temperature **[1]**. **(12 Hours)**

Unit - II

Properties of Steam and Steam Generators:- Pure Substance; Constant Pressure Formation of Steam; Steam Tables; Steam Generators Classification; Fire and Water Tube Boilers; Description of – Cochran, Locomotive, Lancashire, Babcock and Wilcox Boilers, Stirling Boiler; Mountings and Accessories; Economizer; Super Heater etc; Modern High Pressure Boilers; Characteristics of High Pressure Boilers; Advantages of Forced Circulation; Steam Accumulators; Boiler Performance-Equivalent Evaporation; Boiler Efficiency; Boiler Trail and Heat Balance Sheet **[1-2]**. **(12 Hours)**

Unit - III

Vapour Power Cycles:- Simple Rankine Cycle; Modified Rankine Cycle; Methods of Improving Efficiency of the Rankine Cycle; Reheat Rankine Cycle; Regenerative Rankine Cycle-Open Feed Water Heaters and Closed Feed Water Heaters; Combined Reheat Regenerative Cycle; Combined Power and Heating Cycles; Binary Vapour Cycles **[1].** **(08 Hours)**

Unit - IV

Nozzles:- Types and Utility of Nozzles; Flow of Steam Through Nozzles; Critical Pressure and Discharge; Area of Throat and Exit for Maximum Discharge; Nozzles off the Design Pressure Ratio; Effect of Friction and Nozzle Efficiency; Supersaturated Flow Through nozzle and its Effects **[1, 2]**. **(08 Hours)**

Unit - V

Steam Turbines:- Impulse Steam Turbines; General Description; Pressure and Velocity Compounding; Velocity Diagram and Work Done; Effect of Blade Friction on Velocity Diagram; Stage Efficiency and Overall Efficiency; Reheat Factor and Condition Curve **[2].**

Reaction Turbines:- Degree of Reaction; Velocity Diagrams; Blade Efficiency and its Derivation; Calculation of Blade Height; Back Pressure and Extraction Turbines and Cogeneration; Economic Assessment; Methods of Attachment of Blades to Turbine Rotor; Losses in Steam Turbines; Governing of Steam Turbines; Labyrinth Packing **[2].** **(12 Hours)**

Unit - VI

Condensers and Compressors:- Different Types; Dalton's Law to Condenser Problems; Condenser and Vacuum Efficiencies; Cooling Water Calculations; Effect of Air Leakage; Methods to Check and Prevent Air Infiltration; Types and Performance of Cooling Towers; Compressors-Reciprocating Compressors, Volumetric Efficiency and Multi-staging **[1-2].** **(8 Hours)**

Text Books:

[14] Engineering Thermodynamics; Cengel and Boles; Tata McGraw Hill.

[15] Applied Thermodynamics; D.S. Kumar; S.K. Kataria & Sons.

Reference Books:

[4] Basic and Applied Thermodynamics; P. K. Nag; Tata McGraw Hill.

[5] Applied Thermodynamics for Engineering Technologists; T. D. Eastop and A. McConkey; Pearson Education Ltd.

[6] Fundamentals of Thermodynamics; C. Borgnakke and R. Sonntag; Wiley India Pvt. Ltd.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Fluid Machines	ME 305	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
V	3	2-1-0	3 Hours

Unit - I

Introduction: Forces Due to Fluid Flow Over Flat Plates and Curved Vanes; Velocity Diagrams; Euler's Turbo-machinery Equation; Similarity Laws and Specific Speed; Aerofoil and Cascade Theory; Impulse and Reaction Principle; Degree of Reaction **[1, 2].** **(05 Hours)**

Unit – II

Hydraulic Turbines: Types- Pelton Wheel, Francis, Kaplan and Propeller Turbine; Draft Tube; Cavitation and Thoma's Cavitation Factor; Governing of Impulse and Reaction Turbines **[1, 2].** **(05 Hours)**

Unit – III

Rotodynamic Pumps: Classification; Centrifugal, Mixed and Axial Flow Pumps; Head, Power and Efficiency Calculations; System Losses; Impeller Slip and Slip Factor **[1, 2].** **(05 Hours)**

Unit – IV

Performance Characteristics of Fluid Machines: Head, Capacity and Power Measurement; Performance and Operating Characteristics; Muschal or Constant Efficiency Curves; Model Testing **[1, 2].** **(05 Hours)**

Unit – V

Hydrostatic Machines: Principle and Working of Positive Displacement Machines; Indicator Diagram; Volumetric Efficiency; Slip; Effect of Acceleration and Friction; Air Vessels; Two and Three Throw Pumps; Constant and Variable Delivery Pumps; Rotary Pumps **[1, 2].** **(05 Hours)**

Unit – VI

Hydraulic Power Transmission Devices: Fluid Coupling and Torque Converter; Hydraulic Jack, Press; Hydraulic Crane; Pressure Accumulator and Intensifier; Rigid Column Theory; Pressure Transients; Water Hammer; Surge Control **[1, 2].** **(05 Hours)**

Text Books:

[1] Fluid Mechanics and Hydraulic Machines; R. K. Bansal; Laxmi Publication.

[2] Hydraulics and Fluid Mechanics Including Hydraulics Machines; P. N. Rao and S. M. Seth; Rajsons Publications.

[3] Fluid Flow Machines; N. S. Rao; Tata McGraw Hill.

Reference Books:

[1] Turbomachinery: Basic Theory and Applications; E. Logan; CRC Press.

[2] Hydraulics and Fluid Mechanics; P. N. Modi and S. M. Seth; Rajsons Publications.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Dynamics of Machines	ME 307	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
V	3	2-1-0	3 Hours

Unit – I

Friction: Types of friction; Coefficient of Friction; Inclined Plane; Friction of Screw and Nuts; Pivot and Collar; Wedges; Uniform Pressure and Wear; Friction Circle and Friction Axis - Lubricated Surfaces; Friction Clutches - Single Disc or Plate Clutch; Multiple Disc Clutch; Cone and Centrifugal Clutch **[1].**

(06 Hours)

Unit – II

Gyroscope: Introduction of the Machine Dynamics; Gyroscopic Couple; Effect of Precession Motion on the Stability of Moving Vehicles - Motor Car; Aeroplanes and Ships; Stability of Four-wheeler and Two-wheelers Moving on Curved Path **[1].** **(04 Hours)**

Unit – III

Turning Moment Diagram and Flywheels: Turning Moment Diagram for Two-stroke and Four-stroke Engine; Fluctuation of Energy; Fly Wheels; Coefficient of Fluctuation of Speed; Energy Stored in Flywheel; Dimensions of Flywheel Rim and their Design **[1].** **(05 Hours)**

Unit – IV

Governors: Centrifugal Governors **-** Watt Governor; Porter Governor; Proell Governor; Spring Loaded Governors - Hartnell Governor; Hartung Governor with Auxiliary Springs; Properties of Governors - Sensitiveness; Isochronism and Hunting **[1].** **(06 Hours)**

Unit – V

Balancing of Rotating Masses: Balancing of Single Mass Rotating in Same Plane and Different Planes; Balancing of Several Masses Rotating in Same Plane; Balancing of Multiple Masses Rotating in Different Planes **[1].** **(04 Hours)**

Unit – VI

Balancing of Reciprocating Masses: Primary; Secondary; and Higher Balancing of Reciprocating Masses; Unbalanced Forces and Couples; Examination of Multi Cylinder in Line and Radial Engines for Primary and Secondary Balancing; Locomotive Balancing – Hammer Blow; Swaying Couple; Balancing of Radial and V-engines **[1].** **(05 Hours)**

Text Books:

[4] Theory of Machines: S. S. Rattan; Tata McGraw Hill.

[5] Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok Kumar Malik; Third Edition Affiliated East-West Press.

Reference Books:

[4] Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker; Jr. Second Edition; McGraw Hill.

[5] Theory of Machines; Thomas Bevan; 3rd Ed.; CBS Publishers.

[6] Theory of Mechanisms and Machines; Jagdish Lal; Metropolitan Book Co. (Pvt) Ltd.

[7] Kinematics and Dynamics of Machines; Martin; G.H.; 3rd Ed.; McGraw-Hill.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Heat & Mass Transfer	ME 309	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
V	4	3-1-0	3 Hours

Unit - I

Introduction to Heat Transfer: Concepts of the Mechanisms of Heat Flows; Conduction; Convection and Radiation; Effect of Temperature on Thermal Conductivity of Materials; Introduction to Combined Heat Transfer Mechanism; General Differential Heat Conduction Equation in Rectangular; Cylindrical and Spherical Coordinate Systems; Initial and Boundary Conditions **[1].**

(08 Hours)

Unit - II

Conduction: Steady State One-Dimensional Heat Conduction; Composite Systems in Rectangular; Cylindrical and Spherical Coordinates with and Without Energy Generation; Thermal Resistance Concept; Analogy Between Heat and Electricity Flow; Thermal Contact Resistance; Critical Thickness of Insulation; Heat Transfer From Extended Surfaces; Fins of Uniform Cross-Sectional Area; Errors of Measurement of Temperature in Thermometer Wells; Transient Heat Conduction; Lumped Capacitance Method; Time Constant; Unsteady State Heat Conduction in One Dimension Only; Heisler's Charts **[1].** **(07 Hours)**

Unit - III

Convection: Forced Convection; Hydrodynamic Boundary Layer; Thermal Boundary Layer; Approximate Integral Boundary Layer Analysis; Analogy Between Momentum and Heat Transfer in Turbulent Flow over a Flat Surface; Mixed Boundary Layer; Flow Over a Flat Plate; Flow across a Single Cylinder and a Sphere; Flow inside Ducts; Empirical Heat Transfer Relations; Relation between Fluid Friction and Heat Transfer **[1].** **(08 Hours)**

Unit - IV

Natural Convections: Physical Mechanism of Natural Convection; Buoyant Force; Empirical Heat Transfer Relations for Natural Convection over Vertical Planes and Cylinders; Horizontal Plates and Cylinders; and Sphere; Combined Free and Forced Convection; Introduction to Condensation and Boiling Phenomena **[1].** **(08 Hours)**

Unit - V

Thermal Radiation: Basic Radiation Concepts; Radiation Properties of Surfaces; Black Body Radiation; Planck's Law; Wein's Displacement Law; Stefan Boltzmann Law; Kirchoff's Law; Gray Body; Shape Factor; Black-Body Radiation; Radiation Exchange between Diffuse Non-Black Bodies in an Enclosure; Radiation Shields; Radiation Combined with Conduction and Convection; Absorption and Emission In Gaseous Medium; Solar Radiation; Green House Effect **[1].**

(07 Hours)

Unit - VI

Heat Exchanger: Types of Heat Exchangers; Fouling Factors; Overall Heat Transfer Coefficient; Logarithmic Mean Temperature Difference (LMTD) Method; Effectiveness-NTU Method; Compact Heat Exchangers.

Introduction to Mass Transfer: Introduction; Fick's Law of Diffusion; Steady State Equimolar Counter Diffusion; Steady State Diffusion Though a Stagnant Gas Film **[1].** **(07 Hours)**

Text Books:

[1] Fundamentals of Engineering Heat & Mass Transfer; R. C. Sachdeva; New Age International

[2] Heat and Mass Transfer; Yunus A. Cengel; Tata McGraw Hill.

[3] Fundamentals of Heat and Mass Transfer; F. P. Incropera & D. P. De Witt; John Wiley and Sons.

Reference Books:

[1] Heat Transfer; J. P. Holman; McGraw Hill International Edition.

[2] Principles of Heat Transfer; Frank Kreith; McGraw-Hill Book Co.

[3] Fundamentals of Momentum; Heat and Mass Transfer; James R. Welty; John Wiley & Sons (Pvt). Ltd.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Mechanical Vibrations	ME 311	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
V	3	3-0-0	3 Hours

Unit - I

Introduction: Introduction to Mechanical Vibrations; Important Terminology; Degrees of Freedom; Harmonic Motion; Derivation of Equation of Motions for 1-D Longitudinal; Transverse and Torsional Vibrations without Damping using Newton's second Law; D' Alembert's Principle and Principle of Conservation of Energy; Compound Pendulum and Centre of Percussion **[1].** **(07 hours)**

Unit - II

Single Degree Vibration Systems: Damped Vibrations of Single Degree of Freedom Systems; Viscous Damping; Under-damped; Critically Damped and Over Damped Systems; Logarithmic Decrement; Vibration Characteristics of Coulomb Damped and Hysteretic Damped Systems; Rotating Unbalance; Modelling of Stiffness and Damping **[1].** **(08 hours)**

Unit - III

Forced Vibrations: Forced Vibrations of Single Degree of Freedom Systems; Forced Vibration with Constant Harmonic Excitation; Frequency Response Curves and Phase Angle Plot; Forced Vibration due to Excitations; Vibration Isolation and Transmissibility; Force Transmissibility; Motion Transmissibility; Forced Vibration with Rotating and Reciprocating Unbalance; Materials used in Vibration Isolation **[1].** **(08 hours)**

Unit - IV

Two Degrees of Freedom: System with Two Degrees of Freedom; Principle Mode of Vibration; Mode Shapes; Undamped Forced Vibrations of Two Degrees of Freedom System with Harmonic Excitation; Vibration Absorber; Undamped dynamic Vibration Absorber **[1].** **(07 Hours)**

Unit - V

Multiple Degrees of Freedom: Multiple Degrees of Freedom Systems and their Analyses; Exact and Approximate Analyses Methods; Rayleigh's; Dunkerley's; Stodola's and Holzer's Methods; Vibrations of Continuous Systems; Transverse Vibration of a String; Longitudinal Vibration of a Bar; Torsional Vibration of a Shaft **[1].** **(08 hours)**

Unit - VI

Vibration Measurements: Working Principles of Various Vibration Measuring Instruments; Description of Vibration Standards; Vibration Monitoring Techniques; Case Studies Related to Industrial Problems **[1].** **(07 hours)**

Text Books:

[4] Mechanical Vibrations; S. S. Rao; Prentice Hall.

[5] Introductory Course on Theory and Practice of Mechanical Vibrations; J. S. Rao & K. Gupta; New Age International

Reference Books:

[1] Theory of Vibration with Applications; W. T. Thomson and M. D. Dahleh; Prentice Hall.

[2] Engineering Vibrations; D. J. Inman; Prentice Hall.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Fluid Machines Lab	ME 313	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
V	2	0-0-3	3 Hours

List of Experiments

Note: Minimum of Any 10 Experiments Should be Performed.

1. Determination of Impact of Jet on a Hemispherical Plate.
2. Performance Characteristics of a Pelton Wheel.
3. Performance Study of a Francis Turbine.
4. Performance Study of an Axial Flow- Kaplan Turbine.
5. Experiments on Variable Speed Centrifugal Pump.
6. Operation of Centrifugal Pumps in Parallel and in Series.
7. Performance Study of a Reciprocating Pump with Air Vessel.
8. Performance Study of a Gear Pump.
9. Performance Study of a Vane Pump.
10. Performance Study of a Radial Piston Pump.
11. Study of a Hydraulic Ram.
12. Study of a Hydraulic Power Plant Model.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Heat and Mass Transfer Lab	ME 315	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
V	2	0-0-3	3 Hours

List of Experiments

Note: Minimum of Any 10 Experiments Should be Performed.

1. Measurement of Thermal Conductivity of Insulating Powder.
2. Measurement of Thermal Conductivity of a Metal Rod.
3. Measurement of Thermal Conductivity of a Liquid.
4. Heat Transfer from Pin Fin.
5. Heat Transfer in Forced Convection.
6. Heat Transfer in Natural Convection.
7. Emissivity Measurement.
8. Heat Transfer through Composite Walls.
9. Heat Transfer through Lagged Pipe.
10. Stefan Boltzmann Constant.
11. Experiment on Shell & Tube Heat Exchanger.
12. Experiment on Parallel Flow and Counter Flow Heat Exchanger.
13. Study of Dropwise / Filmwise Condensation.
14. Study of Heat Pipe Demonstrator.
15. Experiment on Plate Type Heat Exchanger.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Dynamics of Machines & Vibrations Lab	ME 317	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
V	1	0-0-2	3 Hours

List of Experiments

Note: Minimum of Any 10 Experiments Should be Performed, 05 Experiments from Part A and 05 Experiments from Part B.

Part A

17. To Calculate the Mass Moment of Inertia and Radius of Gyration of the Compound Pendulum of Two Bodies Different in Shapes and Compare them to the Theoretical Values.

2 **a)** To Prove that the Center of Percussion of a Compound Pendulum is at Distance From the Point of Suspension Equal to its Equivalent Length. i.e.; $L = (K_g^2 + D^2)/ D$.

b) To Compare Between the Theoretical and Experimental Values of the Radius of Gyration.

3. To Study the Dynamic Characteristics of a Centrifugal Governor and to Determine (Watts & Porter Or Proell Or Hartnell Governors) its Controlling Force at Various Positions.

b) To Compare Between the Experimental and Theoretical Values.

4 To Study of Gyroscope Effect of a Rotating Disc and Determination of Gyroscopic Couple.

5 To Plot the Follower Displacement Vs Angle of Cam Rotation Curves for Different Cam Follower Pairs.

6 **a)** To Measure Epicyclic Gear Ratio Between Input Shaft and Output Shaft.

b) To Measure Input Torque, Holding Torque and Output Torque.

7 **a)** To Perform The Experiment for Static Balancing on Static Balancing Machine.

b) To Perform the Experiment for Dynamic Balancing on Dynamic Balancing Machine.

8 Study of Bifilar and Trifilar for

(a) To Determine the Radius of Gyration of Given Bar by Using Bi-Filar Suspension.

(b) To Conduct Experiment on Tri-Filar Suspension.

Part B

1. Study of the Simple Pendulum for
- **a)** To Investigate the Fundamental Physical Properties of a Simple Pendulum.
- **b)** To Compare Between Experimental and Theoretical Periods of Oscillations.
- **c)** To Determine the Acceleration due to Gravity "G" Using a Simple Pendulum.

2. Study of Undamped Dynamic Vibrations Absorber for
- **a)** To Demonstrate How a Tuned Vibration Absorber ss Used to Eliminate the Excessive Vibrations of A Single Degree Of Freedom System
- **b)** To Verify the Validity of The Absorber Equations.

3. Study of Mass-Spring System

To Determine the Stiffness of the Spring by Using Three Different Methods:
- **a)** Analytically by Using Spring Dimensions.
- **b)** By Performing Deflection Measurements due to Different Loading Conditions.
- **c)** By Performing Period Measurements for Different Loading Conditions.
- **d)** To Determine the Effective Mass of The Spring.
- **e)** To Determine the Gravitational Acceleration (G).

4. To Determine the Fundamental and Second Frequencies of a Rotating Shaft Exhibiting Whirling.

5 Damped Free Vibrations
- **a)** To Determine the Viscous Damping Coefficient *"C"* as a Function of the Dashpot Position in a Certain Dynamic System.
- **b)** To Learn How to Estimate the Damping Coefficient *"C" o*f a Dynamic System Experimentally.

6. Forced Vibrations
- **a)** To Determine the Natural Frequency of a Dynamic System using Different Methods.
- **b)** To Determine the Magnification Factor (X_d/X_s) .
- **c)** Plotting the Response Curve of the Dynamic System (Amplitude Against Excitation Frequency).

7 Lateral Vibration of Beams To Verify Dunkerley's Rule
- **a)** Determination of the Fundamental Natural Frequency af a Rectangular Beam Experimentally using Several Attached Masses and to Compare the Value Obtained with the Theoretical One.
- **b)** Determination of the Effective Mass of a Simply Supported Beam Experimentally and to Compare it with Theoretical Value.
- **c)** Determination of the Stiffness of the Beam Experimentally and to Compare it with the Theoretical Value.
- **d)** To Demonstrate How Dunkerley's 'S Equation Can be used to Determine the Natural Frequency of a Lumped Mass System Attached to a Beam.
- **e)** To Demonstrate How the Rayleigh's Method Can be used to Determine The Natural Frequency of a Simply Supported Beam.

8 Frequency Response

To Construct the Frequency Response Curve for a Simply Supported Beam Carrying in the Middle of its Span a Motor with Rotating Unbalance.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Design of Machine Elements - II	ME 302	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
VI	4	2-0-2	3 Hours

Note: Use of Design Data Book is Allowed in the Examination.

Unit – I

Belt Drives: Belt Drives; Belt Constructions; Geometrical Relationships; Analysis of Belt Tensions; Condition for Maximum Power; Condition for Maximum Power (Alternative Approach); Characteristics of Belt Drives; Selection of Flat-belts from Manufacturer's Catalogue; Pulleys for Flat Belts; Arms of Cast-iron Pulley; V-belts; Selection of V-belts; V-grooved Pulley; Belt-Tensioning Methods; Ribbed V-belts **[1]**. **(04 Hours)**

Unit – II

Chain Drives: Chain Drives; Roller Chains; Geometric Relationships; Polygonal Effect; Power Rating of Roller Chains; Sprocket Wheels; Design of Chain Drive; Chain Lubrication; Silent Chain**[1]**. **(04 Hours)**

Unit – III

Friction Clutches: Clutches; Torque Transmitting Capacity; Multi-disk Clutches; Friction Materials; Cone Clutches; Centrifugal Clutches **[1]**.

Brakes: Brakes; Energy Equations; Block Brake with Short Shoe; Block Brake with Long Shoe; Pivoted Block Brake with Long Shoe; Internal Expanding Brake; Band Brakes; Disk Brakes; Thermal Considerations **[1]**. **(05 Hours)**

Unit – IV

Shafts, Keys and Couplings: Transmission Shafts; Shaft Design on Strength Basis; Shaft Design on Torsional Rigidity Basis; ASME Code for Shaft Design; Design of Hollow Shaft on Strength Basis; Design of Hollow Shaft on Torsional Rigidity Basis; Flexible Shafts; Keys; Saddle Keys; Sunk Keys; Feather Key; Woodruff Key; Design of Square and Flat Keys; Design of Kennedy Key; Splines; Couplings; Muff Coupling; Design Procedure for Muff Coupling; Clamp Coupling; Design Procedure for Clamp Coupling; Rigid Flange Couplings; Design Procedure for Rigid Flange Coupling; Bushed-pin Flexible Coupling; Design Procedure for Flexible Coupling; Design for Lateral Rigidity; Critical Speed of Shafts **[1]**.

(05 Hours)

Unit – V

Spur Gears: Mechanical Drives; Gear Drives; Classification of Gears; Selection of Type of Gears; Law of Gearing; Terminology of Spur Gears; Standard

Systems of Gear Tooth; Gear Trains; Interference and Undercutting; Backlash; Force Analysis; Gear Tooth Failures; Selection of Material; Gear Blank Design; Number of Teeth; Face Width; Beam Strength of Gear Tooth; Permissible Bending Stress; Effective Load on Gear Tooth; Estimation of Module Based on Beam Strength; Wear Strength of Gear Tooth; Estimation of Module Based on Wear Strength; Internal Gears; Gear Lubrication **[1]**. **(06 Hours)**

Unit – VI

Rolling Contact Bearings: Bearings; Types of Rolling-contact Bearings; Principle of Self-aligning Bearing; Selection of Bearing-type; Static Load Carrying Capacity; Stribeck's Equation; Dynamic Load Carrying Capacity; Equivalent Bearing Load; Load-Life Relationship; Selection of Bearing Life; Load Factor; Selection of Bearing from Manufacturer's Catalogue; Selection of Taper Roller Bearings; Design for Cyclic Loads and Speeds; Bearing with Probability of Survival other than 90 Per Cent; Needle Bearings; Bearing Failure—Causes and Remedies; Lubrication of Rolling Contact Bearings; Mounting of Bearing.

(06 Hours)

Text Books:

[5] Design f Machine Elements; V.B. Bhandari; Tata Mcgraw Hill.

[6] Machine Elements in Mechanical Design; Robert L. Mott, Edward M. Vavrek, Jyhwen Wang; Pearson.

[7] A Text Book of Machine Design, R. S. Khurmi and J. K. Gupta; Eurasia Publishing House (Pvt.) Ltd.

[8] Machine Design; P. C. Sharma & D. K. Aggarwal; Katson Publisher.

Reference Books:

[4] Design of Machine Elements; M.F. Spotts; Prentice-Hall Inc.

[5] Machine Design; Joseph E. Shigley Tata Mcgraw Hill.

[6] Machine Design-An Integrated Approach; Robert Norten; Pearson

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Internal Combustion Engine and Gas Turbines	ME 304	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
VI	4	3-1-0	3 Hours

Unit – I

Air Standard Cycles: Internal and External Combustion Engines; Classification of I.C. Engines; Cycles of Operation in Four Stroke and Two Stroke I.C. Engines; Wankel Engines; Assumptions Made in Air Standard Cycle; Otto Cycle; Diesel Cycle; Dual Combustion Cycle; Comparison of Otto; Diesel and Dual Combustion Cycles; Sterling and Ericsson Cycles; Air Standard Efficiency; Specific Work Output; Specific Weight; Work Ratio; Mean Effective Pressure **[1]**.

(06 Hours)

Unit - II

Carburetion; Fuel Injection and Ignition Systems: Mixture Requirements for Various Operating Conditions in S.I. Engines; Elementary Carburetor; Requirements of A Diesel Injection System; Types of Injection Systems; Petrol Injection; Requirements of Ignition System; Types of Ignition Systems Ignition Timing; Spark Plugs **[1]**.

(07 Hours)

Unit - III

Combustion in I. C. Engines: S.I. Engines; Ignition Limits; Stages of Combustion in S.I. Engines; Ignition Lag; Velocity of Flame Propagation; Detonation; Effects of Engine Variables on Detonation; Theories of Detonation; Octane Rating of Fuels; Pre-Ignition; S.I. Engine Combustion Chambers; Stages of Combustion in C.I. Engines; Delay Period; Variables Affecting Delay Period; Knock in C.I. Engines; Cetane Rating; C.I. Engine Combustion Chambers, Adiabatic Flame Temperature **[2]**.

(08 Hours)

Unit - IV

Lubrication and Cooling Systems: Functions of a Lubricating System; Types of Lubrication System; Mist; Wet Sump and Dry Sump Systems; Properties of Lubricating Oil; SAE Rating of Lubricants; Engine Performance and Lubrication; Necessity of Engine Cooling; Disadvantages of Overcooling; Cooling Systems; Air Cooling; Water Cooling; Radiators **[1]**. **(07 Hours)**

Unit - V

Engine Testing; Performance and Air Pollution: Performance Parameters: BHP; IHP; Mechanical Efficiency; Brake Mean Effective Pressure and Indicative Mean Effective Pressure; Torque; Volumetric Efficiency; Specific Fuel Consumption (BSFC; ISFC); Thermal Efficiency; Heat Balance; Basic Engine Measurements; Fuel and Air Consumption; Brake Power; Indicated Power and Friction Power; Heat Lost to Coolant and Exhaust Gases; Performance Curves; Pollutants from S.I. And C.I. Engines; Methods of Emission Control; Fuels, Alternative Fuels for I.C. Engines; Blending of Fuels; Multi Point Fuel Injection System (MPFI); Emissions and Emission Control, EURO- (I-VI) Series & BHARAT Series**[2]**. **(11 Hours)**

Unit - VI

Gas Turbines: Brayton Cycle; Components of a Gas Turbine Plant; Open and Closed Types of Gas Turbine Plants; Optimum Pressure Ratio; Improvements of The Basic Gas Turbine Cycle; Multi Stage Compression with Inter-Cooling; Multi Stage Expansion with Reheating Between Stages; Exhaust Gas Heat Exchanger; Applications of Gas Turbines **[3]**. **(06 Hours)**

Text Books:

[16] Internal Combustion Engines; V. Ganesan; Publication; Tata McGraw-Hill.

[17] Internal Combustion Engines Fundamentals; John B. Heywood; Pub. McGraw Hill; New York.

[18] Gas Turbines; V. Ganesan; Tata McGraw Hill.

Reference Books:

[7] Engineering Fundamental of the I. C. Engines – Willard W. Pulkrabek; Publication: Prentice Hall of India.

[8] Internal Combustion Engines; Mathur and Sharma; Dhanpat Rai and Sons.

[9] I.C Engines & Air Pollution; E. F. Obert; Hopper & Row Pub; New York.

Gautam Buddha University, Greater Noida
School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Refrigeration and Air Conditioning	ME 306	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
VI	4	3-1-0	3 Hours

Unit - I

Introduction of Refrigeration: Introduction to Refrigeration System; Methods of Refrigeration; Carnot Refrigeration Cycle; Unit of Refrigeration; Refrigeration Effect & C.O.P. **[1]**.

Air Refrigeration Cycle: Open and Closed Air Refrigeration Cycles; Reversed Carnot Cycle; Bell Coleman or Reversed Joule Air Refrigeration Cycle; Aircraft Refrigeration System; Classification of Aircraft Refrigeration System; Boot Strap Refrigeration; Regenerative; Reduced Ambient; Dry Air Rated Temperature (DART) **[1]**.

(07 Hours)

Unit - II

Vapor Compression System: Single Stage System; Analysis of Vapor Compression Cycle; Use of T-S and P-H Charts; Effect of Change in Suction and Discharge Pressures on C.O.P; Effect of Sub Cooling of Condensate & Superheating of Refrigerant Vapor on C.O.P of the Cycle; Actual Vapor Compression Refrigeration Cycle**[1].** Multistage Vapor Compression System Requirement; Removal of Flash Gas; Intercooling; Different Configuration of Multistage System **[2]**; Cascade System **[3]**.

(07 Hours)

Unit - III

Vapour Absorption System: Working Principal of Vapour Absorption Refrigeration System; Comparison Between Absorption and Compression Systems; Elementary Idea of Refrigerant Absorbent Mixtures; Temperature–Concentration Diagram & Enthalpy–Concentration Diagram; Adiabatic Mixing of Two Streams; Ammonia – Water Vapor Absorption System; Lithium- Bromide Water Vapor Absorption System**[1]**. Vapour Jet, Thermos Electric and Vortex Tube Refrigeration System **[3]**.

Refrigerant: Classification of Refrigerants; Nomenclature; Desirable Properties of Refrigerants; Common Refrigerants; Secondary Refrigerants, CFC Free Refrigerants; Eco Friendly Refrigerant and Recent Substitute for Refrigerants **[3]**.

(10 Hours)

Unit - IV

Air Conditioning and Heat Pump: Introduction to Air Conditioning; Psychometric Properties and their Definitions; Psychometric Chart; Different Psychometric Processes; Thermal Analysis of Human Body; Effective

Temperature and Comfort Chart**[1].** Air Conditioning Systems and Their Types; Selection of System; Components and Controls of Air Distribution; Window Air Conditioners; Split Air Conditioners; Central Air Conditioners, Heat Pumps **[3]**.

(08 Hours)

Unit - V

Air-Conditioning Load Calculations: Cooling and Heating Load Calculations; Selection of Inside and Outside Design Conditions; Sources of Heating Load; Sources of Cooling Load; Heat Transfer Through Structure; Solar Radiation; Electrical Applications; Infiltration and Ventilation; Heat Generation Inside Conditioned Space; Internal Heat Gain; Sensible Heat Factor (SHF); By Pass Factor; Grand Sensible Heat Factor (GSHF); Apparatus Dew Point (ADP) **[1]**.

(06 Hours)

Unit - VI

Refrigeration Equipment and Application: Elementary Knowledge of Refrigeration and Air Conditioning Equipments E.G. Compressors; Condensers; Evaporators and Expansion Devices; Air Washers; Cooling; Towers and Humidifying Efficiency**[1].** Food Preservation; Cold Storage; Ice Plant; Water Coolers **[2]**. Elementary Knowledge of Transmission and Distribution of Air Through Ducts, Equal Friction Method of Duct Design and Fans; Basic Difference between Comfort and Industrial Air Conditioning **[3]**.

(07 Hours)

Text Books:

[19] Refrigeration and Air Conditioning; C. P. Arora; Tata McGraw Hill.

[20] Principles of Refrigeration; R. J. Dossat; Prentice Hall.

[21] Basic Refrigeration and Air Conditioning; P.N. Ananthanarayanan; Tata McGraw Hill.

Reference Books:

[1] Refrigeration and Air Conditioning; Domkundwar; Dhanpat Rai.

[2] Refrigeration and Air Conditioning; Manohar Prasad; New Age International.

[3] Refrigeration and Air Conditioning; P.L. Ballany; Khanna Publications.

[4] Air Conditioning System Design Handbook; Carrier Corporation; USA.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Computer Aided Design	ME 308	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
VI	3	2-1-0	3 Hours

Unit-I

Introduction to CAD/CAED/CAE, Elements of CAD, Essential Requirements of CAD, Concepts of Integrated CAD/CAM, Necessity and its Importance, Engineering Applications Computer Graphics-I CAD/CAM Systems **[1, 2]. (04 Hours)**

Unit-II

Computer Graphics-I: Graphics Input Devices-Cursor Control Devices, Digitizers, Keyboard Terminals, Image Scanner, Speech Control Devices and Touch, Panels, Graphics Display Devices-Cathode Ray Tube, Random and Raster Scan Display, Color CRT Monitors, Direct View Storage Tubes, Flat Panel Display, Hard Copy Printers and Plotters **[1, 2]. (05 Hours)**

Unit-III

Computer Graphics-II Graphics Software, Software Configuration, Graphics Functions, Output Primitives- Bresenham's Line Drawing Algorithm and Bresenham's Circle Generating Algorithm Geometric Transformations: World/Device Coordinate Representation, Windowing and Clipping, 2D Geometric Transformations-Translation, Scaling, Shearing, Rotation and Reflection Matrix Representation, Composite Transformation, 3D Transformations, Multiple Transformation **[1, 2]. (06 Hours)**

Unit-IV

Curves: Curves Representation, Properties of Curve Design and Representation, Interpolation Vs approximation, Parametric Representation of Analytic Curves,

Parametric Continuity Conditions, Parametric Representation of Synthetic Curves-Hermite Cubic Splines-Blending Function Formulation and its Properties, Bezier Curves-Blending Function Formulation and its Properties, Composite Bezier Curves, B-Spline Curves and its Properties, Periodic and Non-Periodic B-Spline Curves **[1, 2]. (05 Hours)**

Unit-V

3D Graphics: Polygon Surfaces-Polygon Mesh Representations, Quadric and Superquadric Surfaces and Blobby Objects; Solid Modeling-Solid Entities, Fundamentals of Solid Modeling-Set Theory, Regularized Set Operations; Half Spaces, Boundary Representation, Constructive Solid Geometry, Sweep Representation, Color Models; Basic Application Commands for 2D Drafting Software like AutoCAD/Draftsight (any one) and 3D Solid Modeling Software Solidworks/Autodesk Inventor/PTC Creo /CATIA (Any one) etc. **[1, 2]. (06 Hours)**

Unit-VI

Graphics Standard & Data Storage: Standards for Computer Graphics GKS, PHIGS; Data Exchange Standards –IGES, STEP – Manipulation of the Model - Model Storage **[1, 2]. (04 Hours)**

Text Books:

[1] CAD/CAM: Principles and Operations, by P. N. Rao, McGraw Hill.

[2] CAD/CAM- Computer Aided Design and Manufacturing, by M. Groover, E. Zimmers, Pearson.

[3] CAD/CAM – Principles and Applications, by J. Srinivas, Oxford Press.

Reference Books:

[1] CAD/CAM – Theory and Practice, by Ibrahim Zeid, McGraw Hill.

[2] Computer Aided Manufacturing, by Cheng, Pearson India.

[3] CAD/CAM: Concepts and Applications by Alavala, PHI India.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Computer Aided Manufacturing	ME 310	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VI	3	2-1-0	3 Hours

Unit - I

Computer Numerical Control: Fundamental Concepts, Classification and Structure of Numerical Control Systems; Coding Systems; NC Hardwares **[1].**

CNC Hardware: Structure of CNC Machines; Spindle Design; Drives; Actuation Systems; Feed Back drives; Axes- Standards **[2].** **(07 Hours)**

Unit - II

CNC Machine Tools, Control Systems: CNC Machining Centers; CNC Turning Centers; High Speed Machine Tools; Machine Control Units Support Systems; Tough Triggers Probe **[2]**. **(07 Hours)**

Unit - III

CNC Tooling: Cutting Tool Materials; Turning Tool Geometry; Milling Tool System; Tool Presetting; Automatic Tool Changers; Work Holding; Cutting Process Parameter Selection **[2]**. **(07 Hours)**

Unit - IV

CNC Programming: Part Programming Fundamentals; Manual Part Programming Methods; Preparatory Functions; Miscellaneous Functions; Program Number; Tool Length Compensation; Canned Cycle; Cutter radius compensation **[2]**. **(09 Hours)**

Unit - V

Turning Center Programming: Comparison Between Machining Center and Turning Centre; Tape Formats; Axes System; General Programming Functions; Motion Commands; Cut Planning; Thread Cutting; Canned Cycles **[2]**.

(09 Hours)

Unit - VI

Advanced Part Programming Methods: Polar Coordinates; Parameters; Looping and Jumping; Subroutines; Mirror Imaging and Scaling; Special Canned Cycles **[2]**. **(06 Hours)**

Text Books:

[4] Machine Tool Design and Numerical Control; N. K. Mehta; McGraw Hill Education (India) Private Limited, New Delhi.

[5] CAD/ CAM Principles and Applications; P. N. Rao; McGraw Hill Education (India) Private Limited, New Delhi.

[6] CNC Programming; Binit Kumar Jha; Vikas Publishing House Private Limited, Noida.

Reference Books:

[5] Numerical Control and Computer Aided Manufacturing; T. K. Kundra, P. N. Rao and N. K. Tewari; Tata McGraw-Hill, New Delhi.

[6] Computer Numerical Control – Concepts and Programming; W. S. Seames; Delmar Publishers Inc, New York, 1986.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Industrial Management	ME 312	(SM+MT) +ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VI	3	3-0-0	3 Hours

Unit - I

Introduction: Role of Industrial Engineering in an Organization; Production and Productivity; Factors Influencing Productivity (Internal or Controllable and External or Uncontrollable factors); Productivity Measurement Models; Productivity Improvement Technique, Total (TPM) and Partial Productivity Measures (PPM); Brief Introduction of Quality Management **[2]**. **(05 Hours)**

Unit - II

Work Study and Motion Study: Importance of Work Study; Objectives of Work Measurement; Techniques of Work Measurement; Scope of Method Study; Techniques of Method Study - Various Charts (Micro Motion Study Chart, SIMO Chart, Single Hand, Both Hands Charts) etc.; Diagrams and Symbols Used in Method Study; Micro Motion Study; Memo Motion Study; Recording Techniques of Motion Study; Principles of Motion Study; Steps in Making Time Study; Computation of Standard Time, Allowances, Relaxation etc. **[1, 2]**. **(08 Hours)**

Unit - III

Plant Location; Layout and Line Balancing: Need for Selecting a Suitable Plant Location; Factors Influencing Plant Location; General/ Specific Location Factors for Manufacturing and Service Organizations; Plant Layout Factors; Types of Manufacturing System; Types of Layouts; Plant Location Models; Factor Rating Method (Weighted Factor Rating Method, Load Distance Method etc.); Introduction of Assembly Line Balancing; Work Transport System; Line Pacing; Repositioning Loses; Line Balancing Algorithms (Largest Candidate Rule, Kilbridge and Wester Method etc.); Time – Distance relationship; Tolerance Time. **[2, 3]**. **(08 Hours)**

Unit - IV

Inventory Planning and Control: Meaning, Objectives and Benefits of Inventory Control; Introduction to Material Requirement Planning (MRP); Aggregate Production Planning; Master Production Schedule (MPS); Bill of Materials (BoM); Types of inventories; Inventory models; Determination of EOQ by Tabulation (Trial & Error Method); Determination of EOQ by Analytical Method; Process of Long and Short Term Capacity Planning; Measurement of Capacity Planning (Design, Capacity, System, Licensed, Installed and rated Capacity.) **[2, 4]**. **(08 Hours)**

Unit - V

Human Factor Engineering: Ergonomics and Human Engineering; Objectives of Human Engineering; Human Engineering Areas; Anthropometry; Use of Human Body; Arrangement of Work Place, Design of Tools and Equipments; Break Even Analysis, Fixed and Variable Costs; Computation of Break Even Point. **[2, 3]**. **(08 Hours)**

Unit - VI

Routing, Scheduling and Forecasting: Techniques of Routing (Route Card, Work-Sheet, Route Sheet, Move Order); Principles of Scheduling; Inputs to Scheduling; Forward and Back-word Scheduling Methodology; Gantt Charts and Boards, Priority Decision Rules; Introduction of Linear Programming; PERT and CPM; Forecasting Methods for Time-Series Analysis, Moving Average, Weighted Moving Average, Exponential Smoothing; Forecasting Errors; Delphi Method; Introduction of Just In Time (JIT) (Pull vs Push System); Lean Manufacturing. **[1, 3]**. **(08 Hours)**

Text Books:

[1] Industrial Engineering and Production Management; Martand Telsang; S. Chand.

[2] Industrial Engineering and Organization Management; S. K. Sharma and Savita Sharma.

[3] Industrial Engineering & Management; O. P. Khanna; Dhanpat Rai and Sons.

[4] Modern Production Operations Management; E. S. Buffa; Wiley Eastern.

Reference Books:

[1] Operations Management; Roger G. Schroeder; McGraw Hill ISE.

[2] Operation Management; Joseph G. Monks; McGraw Hill ISE.

[3] Industrial & Systems Engineering; W. C. Turner, J. H. Mie, Murray Chase; Prentice Hall Pub.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	IC Engines & Gas Turbines Lab	ME 314	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VI	2	0-0-3	3 Hours

List of Experiments

Note: Minimum of Any 10 experiments should be performed.

1. To Study the Constructional Details & Working Principles of Two-Stroke/ Four Stroke Petrol Engine.
2. To Study the Constructional Detail & Working of Two-Stroke/ Four Stroke Diesel Engine.
3. Analysis of Exhaust Gases from Single Cylinder/Multi Cylinder Diesel/Petrol Engine by Orsat Apparatus.
4. To Prepare Heat Balance Sheet on Multi-Cylinder Diesel Engine/Petrol Engine.
5. To Find the Indicated Horse Power (IHP) On Multi-Cylinder Petrol Engine/Diesel Engine by Morse Test.
6. To Prepare Variable Speed Performance Test of a Multi-Cylinder/Single Cylinder Petrol Engine/Diesel Engine and Prepare the Curves (a) Indicated Horse Power (IHP), (b) Brake Horse Power (BHP) and (c) Friction Horse Power (FHP), Vs Speed (d) Volumetric Efficiency & (e) Indicated Specific Fuel Consumption (SFC) Vs Speed.
7. To Find FHP of a Multi-Cylinder Diesel Engine/Petrol Engine by Willian's Line Method & Motoring Method.
8. To Perform Constant Speed Performance Test on a Single Cylinder/Multi-Cylinder Diesel Engine & Draw Curves of (a) BHP Vs

Fuel Rate, Air Rate and A/F and (b) BHP Vs MEP, Mechanical Efficiency & SFC.

9. To Measure CO & Hydrocarbons in the Exhaust of 2- Stroke / 4-Stroke Petrol Engine.
10. To Find Intensity of Smoke from a Single Cylinder / Multi-Cylinder Diesel Engine.
11. To Draw the Scavenging Characteristic Curves of Single Cylinder Petrol Engine.
12. To Study the Effects of Secondary Air Flow on BHP, SFC, Mechanical Efficiency & Emission of a Two-Stroke Petrol Engine.
13. To Study the Performance and Working of a Gas Turbine.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Refrigeration and Air Conditioning Lab	ME 316	(SM+MT)+ET 30+70
Semester	**Credit**	**L-T-P**	**Exam.**
VI	1	0-0-2	3 Hours

List of Experiments

Note: Minimum of Any 10 Experiments of the Following:

1. Experiment on Refrigeration Test Rig and Calculation of Various Performance Parameters.
2. Study of Different Types of Expansion Devices used in Refrigeration System.
3. Study of Different Types of Evaporators used in Refrigeration Systems.
4. Study of Different Types of Compressors used in Refrigeration Systems.
5. Experiment on Heat Pump Test Rig and Calculation of Various Performance Parameters.
6. Experiment on Vapour Absorption Refrigeration Test Rig and Calculation of Various Performance Parameters.
7. To Study Basic Components of Air-Conditioning System.
8. Experiment on Window Type Air-Conditioning Test Rig & Calculation of Various Performance Parameters.
9. Experiment on Split Type Air-Conditioning Test Rig & Calculation of Various Performance Parameters.
10. Experiment on Ice-Plant Test Rig & Calculation of Various Performance Parameters.
11. Study of Hermetically Sealed Compressor used in Refrigeration System.
12. Study of Air Washers with Psychometric Chart.
13. Study of Two Stage Reciprocating Compressor with its PV Diagram.
14. Visit of a Central Air Conditioning Plant and its Detailed Study.
15. Visit of Cold-Storage and its Detailed Study.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	CAD/CAM Lab	ME 318	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
VI	2	0-0-3	3 Hours

Note : Minimum of Any 10 Experiments are to Carried Out. Five Experiments Each from Section A and section B.

A. Computer Aided Design Experiments

1. Line Drawing or Circle Drawing Experiment: Writing and Validation of Computer Program.
2. Geometric Transformation Algorithm Experiment for Translation/Rotation/Scaling: Writing and Validation of Computer Program.
3. Design of Machine Component or Other System Experiment: Writing and Validation of Computer Program.
4. Understanding and Use af any 3-D Modeling Software Commands.
5. ProE/CATIA etc. Experiment: Solid Modeling of a Machine Component.
6. Writing a Small Program or FEM for 2 Spring System and Validation of Program or Using a FEM Package
7. Root Findings or Curve Fitting Experiment: Writing and Validation of Computer Program.
8. Numerical Differentiation or Numerical Integration Experiment: Writing and Validation of Computer Program.

B. Computer Aided Manufacturing Experiments

1. To Study the Characteristic Features of CNC Machine.
2. Part Programming (in Word Address Format) Experiment for Turning Operation (Including Operations Such as Grooving and Threading) and Running on CNC Machine.
3. Part Programming (in Word Address Format or ATP) Experiment for Drilling Operation (Point to Point) and Running a CNC Machine.

4. Part Programming (in Word Address Format or ATP) Experiment for Milling Operation (Contouring) and Running on CNC Machine.
5. Experiment on Robot and Programs.
6. Experiment on Transfer Line/Material Handling.
7. Experiment on Difference Between Ordinary and NC Machine, Study or Retrofitting.
8. Experiment on Study of System Devices such as Motors and Feed Back Devices.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Basics of Operations Research	ME 425	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VII	3	3-0-0	3 Hours

Unit – I

Introduction: Basic of Operation Research, Origin & Development of Operation Research, Applications.

Linear Programming: Introduction & Scope, Problem Formulation, Graphical Method, Simplex Methods, Primal and Dual Problem Sensitivity Analysis **[1-3].**

[07 Hours]

Unit – II

Transportation Problem: Methods of Obtaining Initial and Optimum Solution, Degeneracy in Transportation Problems, Unbalanced Transportation Problem.

Assignment Problem: Methods of Obtaining Optimum Solution, Maximization Problem, Travelling Salesman Problem**[1-3].** **[08 Hours]**

Unit – III

Game Theory: Two-Person Zero Sum Game, Solution with/without Saddle Point, Dominance Rule, Different Methods Like Algebraic, Graphical and Game Problem as a Special Case of Linear Programming **[1-3].**

Sequencing: Basic Assumptions, n Jobs through 2-3 Machines, 2 Jobs on m Machines **[1-3].** **[07 Hours]**

Unit – IV

Stochastic Inventory Models: Single & Multi Period Models with Continuous & Discrete Demands, Service Level & Reorder Policy **[1-3].**

Simulation: Use, Advantages & Limitations, Monte-Carlo Simulation, Application to Queuing, Inventory & Other Problems **[1-3].** **[07 Hours]**

Unit –V

Queuing Models: Characteristics of Queuing Model, M/M/1 and M/M/S System, Cost Consideration **[1-3].**

Project Management: Basic Concept of Network Scheduling, Rules for Drawing Network Diagram, Applications of CPM and PERT Techniques in Project Planning and Control; Crashing of Operations; Resource Allocation **[1-3]. [08 Hours]**

Unit – VI

Satirical Quality Control: Objectives of Quality Control; Steps in Quality Control programme; Advantages of Satirical Quality Control (SQC); Causes of Variation in Quality Control; Techniques in SQC; Control Charts – for Variables and Attributes; Inspection; Objectives and Types of Inspection; Product Control; Acceptance Sampling Plan; Single Sampling Plan; Opiating Characteristic Curve; Double Sampling Plan; Multiple or Sequential Sampling Plan **[1]. [08 Hours]**

Text Books:

[1] Operations Research; Prem Kumar Gupta & D. S. Hira; Third Edition; S Chand & Company Ltd.; New Delhi, 2005.

[2] Operations Research – Theory and Applications; J. K. Sharma; Laxmi Publications Pvt Ltd.

[3] Operations Research - An Introduction; H. A. Taha, Sixth Edition; Prentice Hall of India Private Ltd; New Delhi; 2004.

Reference Books:

[1] Principles of Operations Research; H. M. Wagner; Second Edition; Prentice Hall of India Private Limited; New Delhi; 2003.

[2] Operations Research; C. K. Mustafi; Third Edition; New Age International Pvt. Ltd.; New Delhi; 1996.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Production Planning and Control	ME 407	(SM+MT) +ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VII	3	3-0-0	3 Hours

Unit - I

Introduction: Types and Characteristics of Manufacturing Systems and Production Systems; Objective and Functions of Production, Planning & Control.
Preplanning: Forecasting & Market Analysis/Models; Factory Location & Layout; Equipment Policy and Replacement; Preplanning Production; Capacity Planning **[1]**. **(08 Hours)**

Unit – II

Production Planning: Product Development and Design; Break Even Point (BEP); Profit Volume Chart; Selection of Material; Methods, Machines & Manpower. Routing; Loading; Scheduling, Job Shop Scheduling, Scheduling algorithms for job shops; Sequencing of Production Operations; Line Balancing; Aggregate Production Planning **[1, 2]**.

(08 Hours)

Unit – III

Production Control: Dispatching Rules; Dispatching of Work Card; Move Card; Inspection Card and Reports; Control Boards and Charts; Expediting; Progress Reporting; Change in Schedules **[3]**. **(06 Hours)**

Unit – IV

Evaluation and Analysis: Elements of Network and its Development; Introduction to CPM And PERT Techniques **[1, 3]**.

(07 Hours)

Unit – V

Material Planning and Control: Field and Scope; Material Requirement Planning; Inventories, Types and Classifications, ABC Analysis, Economic Lot (Batch) Size, Lead Time and Reorder Point; Modern Trends in Purchasing; Store Keeping, Store Operations; Introduction to Manufacturing Resource Planning (MRP) and Enterprise Resource Planning (ERP) **[2]**.

(08 Hours)

Unit – VI

System operations and control: Applications of Statistical Methods for Product and Process Quality Control; Applications of Control Charts for Mean, Range, Percent Defective, Number of Defectives and Defects Per Unit; Quality Cost Systems; Management of Resources; System Improvement - Implementation of Systems such as Total Quality Management, Developing and Managing Flexible, Lean and Agile Organizations **[1, 2]**.

(08 Hours)

Text Books:

[1] Elements of Production Planning & Control; Samuel Eilon; Universal Publishing Corporation.

[2] Production Planning & Control & Industrial Management; K. C. Jain and L. N. Agarwal; Khanna Publishers.

[3] Modern Production/Operations Management; E. S. Buffa; Wiley.

Reference Books:

[1] Production System Planning, Analysis and Control; J. L. Riggs; Wiley.

[2] Production Planning and Inventory Management; J. F. Magee & David Morris Boodman; McGraw Hill.

[3] Industrial Engineering & Management; O. P. Khanna; Dhanpat Rai & Sons.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Tribology	ME 409	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VII	3	3-0-0	3 Hours

Unit - I

Introduction and Solid Surface Characterization:-Definition, History and Industrial Significance of Tribology; Origins and Significance of Micro/Nanotribology; The Nature of Surfaces; Physico-Chemical Characteristics of Surface Layers; Analysis of Surface Roughness; Measurement of Surface Roughness **[1].** **(07 Hours)**

Unit - II

Contact Between Solid Surfaces and Adhesion:- Analysis of the Contacts; Measurement of the Real Area of Contact; Solid–Solid Contact; Liquid-Mediated Contact **[1]**. **(07 Hours)**

Unit - III

Friction:- Introduction to Friction; Solid–Solid Contact (Stick-Slip Friction; Rolling Friction; Types of Slips); Liquid-Mediated Contact; Friction of Materials; Friction of Solid Lubricants; Effects of Operating Conditions **[1]**. **(08 Hours)**

Unit – IV

Wear:- Introduction to Wear; Types of Wear Mechanism; Adhesive Wear and Quantitative Equation; Abrasive Wear (by Plastic Deformation and Fracture) and Quantitative Equations; Fretting Wear; Rolling Contact Fatigue; Impact Wear; Erosion Wear (Solid Particle (Quantitative Equation) and Liquid Impingement Erosion); Cavitation Wear; Chemical Wear; Tribochemical Wear; Electrical-Arc-Induced Wear; Fretting and Fretting Corrosion; Types of Particles Present in Wear Debris; Wear of Materials **[1]**. **(10 Hours)**

Unit - V

Fluid Film Lubrication:- Introduction; Regimes of Fluid Film Lubrication (Hydrostatic Lubrication; Hydrodynamic Lubrication; Elastohydrodynamic

Lubrication, Mixed Lubrication and Boundary Lubrication); Viscous Flow and Reynolds Equation; Journal Bearings; Squeeze Film Bearings; Gas-Lubricated Bearings **[1]**. **(07 Hours)**

Unit - VI

Boundary Lubrication and Lubricants: - Introduction; Boundary Lubrication; Liquid Lubricants; Principal Classes of Lubricants; Physical and Chemical Properties of Lubricants; Additives; Greases.

Friction and Wear Screening Test Methods:- Design Methodology of a Friction and Wear Tester; Sliding Friction and Wear Tests; Abrasion Tests; Rolling-Contact Fatigue Tests; Solid-Particle Erosion Test; Corrosion Tests **[1].**

(03+03 Hours)

Text Book:

[22] Introduction to Tribology; Bharat Bhushan; John Wiley & Sons, Ltd.

Reference Book:

[10] Engineering Tribology; Gwidon W. Stachowiakand Andrew W. Batchelor, Butterworth Heinemann.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Power Plant Engineering	ME 411	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VII	3	3-0-0	3 Hours

Unit - I

Introduction: Power and Energy; Sources of Energy; Rankine and Brayton Cycles with Refrigeration and Reheat Process; Fuels and Combustion Calculations; Load Estimation; Load Curves; Various Terms and Factors Involved in Power Plant Calculations; Effect of Variable Load on Power Plant Operation; Selection of Power Plant Units; Effect of Plant Type on Costs; Rates; Fixed Elements; Energy Elements; Customer Elements and Investor's Profit; Depreciation and Replacement; Theory of Rates; Economics of Plant Selection; Other Considerations in Plant Selection **[1, 2].** **(08 Hours)**

Unit - II

Steam Power Plant: General Layout of Steam Power Plant; Power Plant Boilers Including Critical and Super Critical Boilers; Fluidized Bed Boilers; Boilers Mountings and Accessories; Different Systems such as Coal Handling System; Pulverizers and Coal Burners; Combustion System; Draft; Ash Handling System; Dust Collection System; Different Types of Turbines **[1, 2].** **(07 Hours)**

Unit - III

Power Plant Auxiliary Systems: Feed Water Treatment and Condenser and Cooling Towers and Cooling Ponds; Turbine Auxiliary Systems Such as Governing; Feed Heating; Reheating ; Flange Heating and Gland Leakage; Operation and Maintenance of Steam Power Plant; Heat Balance and Efficiency; Site Selection of a Steam Power Plant.

Electrical System: Generators and Generator Cooling; Transformers and their Cooling; Bus Bar; etc. **[1, 2].** **(07 Hours)**

Unit - IV

Diesel Power Plant: General Layout; Components of Diesel Power Plant; Performance of Diesel Power Plant; Fuel System; Lubrication System; Air Intake and Admission System; Supercharging System; Exhaust System; Diesel Plant Operation and Efficiency; Heat Balance; Site Selection of Diesel Power Plant; Comparative Study of Diesel Power Plant with Steam Power Plant **[1, 2].**

Gas Turbine Power Plant: Layout of Gas Turbine Power Plant; Elements of Gas Turbine Power Plants; Gas Turbine Fuels and their Analysis; Cogeneration; Auxiliary Systems such as Fuel; Controls and Lubrication; Operation and Maintenance; Combined Cycle Power Plants; Site Selection of Gas Turbine Power Plant **[1, 2].** **(08 Hours)**

Unit - V

Nuclear Power Plant: Principles of Nuclear Energy; Layout of Nuclear Power Plant; Basic Components of Nuclear Reactions; Nuclear Power Station; Nuclear Waste Disposal; Site Selection of Nuclear Power Plants.

Hydro Electric Station: Hydrology; Principles of Working; Applications; Site Selection; Classification and Arrangements; Hydro-Electric Plants; Run off Size of Plant and Choice of Units; Operation and Maintenance; Hydro Systems; Interconnected Systems **[1, 2].**

Non Conventional Power Plants: Introduction to Non-Conventional Power Plants (Solar; Wind; Geothermal; Tidal) etc. **[1, 2].** **(08 Hours)**

Unit - VI

Instrumentation: Purpose; Classification; Selection and Application; Recorders and their Use; Listing of Various Control Rooms.

Pollution: Pollution due to Power Generation **[1, 2].** **(07 Hours)**

Text Books:

[1] Power Plant Engineering; P.K. Nag; Tata Mcgraw Hill.

[2] Steam & Gas Turbines & Power Plant Engineering; R. Yadav; Central Pub. House.

Reference Books:

[1] Power Plant Engineering; Mahesh Verma; Metropolitan Book Company Pvt. Ltd. New Delhi.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Maintenance Engineering	ME 413	(SM+MT) +ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VII	3	3-0-0	3 Hours

Unit - I

Introduction: Definitions of Repair And Maintenance; Importance of Maintenance; Different Maintenance Systems - Breakdown, Preventive, Planned; Predictive Maintenance through Condition Monitoring; Maintainability; Failure Pattern; Availability of Equipment / Systems; Design for Maintainability.

Total Productive Maintenance (TPM): Definition, Objective & Methodology; Implementation of TPM; Lean Maintenance; Overall Equipment Effectiveness (OEE) **[1, 2].**

(08 Hours)

Unit – II

Organizational Structures for Maintenance: Objectives; Maintenance Functions and Activities; Organizational Requirements; Types **of** Maintenance Organizations; Manpower Planning; Engineering Stores & Inventory Management **[1, 2].**

(07 Hours)

Unit – III

Economic Aspect of Maintenance: Life Cycle Costing; Maintenance Cost & its Impact; Maintenance Budget; Cost Control; Maintenance Audit- Procedure, Tools, Planning, Reports **[1, 2].**

(07 Hours)

Unit – IV

Function and use of Maintenance Equipment, Instruments & Tools: Facilities like NDT; Painting; Coating and Cladding; Gas Cutting and Welding; Crack Detection; Vibration Monitor; Balancing Equipment; Compressor; Basic Machine Tools; Lubricators and Lubricants; Chain Pulley Block; Tools like Different Types of Wrenches; Torque Wrench; Pipe Wrench, Plier; Screw Driver; Dimension Measuring Instruments; Feeler Gauge; Scraper; Fitting Shop Tools;

Spirit Level; Hand Grinder & Drill; Screw Jack; etc. **[1, 2].**

(09 Hours)

Unit – V

Lubrication: Purpose & Importance; Type of Lubricants; Properties of Lubricants; Types of Lubrication and their Typical Applications; Lubrication Devices; Centralized Lubrication System; Gasket, Packing and Seals **[1, 2].**

(07 Hours)

Unit – VI

Repair & Maintenance Procedures: Repair of Cracks; Threads; Worn Shafts; Keyways; Bush Bearing; Damaged Gear Tooth; Assembly and Dismantling of Antifriction Bearing; Maintenance of Bearing, Clutches, Coupling; Brakes; Alignment of Shafts, Belt and Chain Drives, Gear Drives, Centrifugal Pump; Pipe and Pipe Fittings; Electrical Wiring, Isolators and Main Switches **[1, 2].**

(07 Hours)

Text Books:

[1] Maintenance Engineering and Management; R. C. Mishra and K. Pathak; Prentice Hall of India.

[2] Maintenance Engineering and Management; Sushil Kumar Srivastava; S. Chand & Company Ltd.; New Delhi.

Reference Books:

[1] Maintenance Engineering and Management; K. Venkataraman; Prentice Hall of India

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Experimental Stress Analysis	ME 415	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam;**
VII	3	3-0-0	3 Hours

Unit – I

Introduction to Experimental Methods of Stress Analysis: Strain Measurement; an Ideal Strain Gauge; Mechanical; Optical; Acoustical; Pneumatic; Dielectric and Electrical Strain Gauges; Differential Transformer and Piezoelectric Transducers. **[1-3].** **(06 Hours)**

Unit – II

Strain Gauges: Electrical Wire Resistance Strain Gauges; Bonded Type Gauges; Bonding Agents; Foil Gauges; Gauge Materials; Weldable Gauges; Strain Gauge Adhesive; Fixing of Gauges; Temperature Effects in Bonded Gauges; Gauge Factor and Gauge Sensitivity; Measurement of Stress and Strain **[1-3].**

(08 Hours)

Unit – III

Strain Gauge Circuits: Measuring Circuits and Strain Gauge Rosette; Potentiometer Circuit; Wheatstone Bridge; Circuit Sensitivity and Output; Temperature Compensation And Signal Addition; Rectangular; Delta and Tee-Delta Rosette; Application of Strain Gauge in Practical Problems **[1-3].**

(06 Hours)

Unit – IV

Photoelasticity: Whole Field Methods: Photo Elasticity; Stress Loci; Isoclinics; Isostatics and Isochromatics; Stress Optic Law and Strain Optic Law; Photoelestic Materials; Polarization Of Light; Plane Polarized and Elliptically Polarized Light; Brittle Coating; Crack Pattern and Crack Detection In Coating; Moire Fringe Geometry **[1-3].** **(12 Hours)**

Unit – V

Polariscope: Analysis of Photo Elasticity Data; Polariscope; Fringes Due to Principal Stress Direction and Difference; Model Making; Interpretation of

Isoclinics and Isochromatics and Fractional Fringe Order; Calibration Through Tension; Beam and Disc Models; Reflection Polariscopy **[1-3].** **(10 Hours)**

Unit – VI

Application and Case Studies: Application to Stress Concentration and Stress Intensity Factor; Separation of Stresses; Applications of the Frozen-Stress Method; Scattered-Light Method **[1-3].** **(03 Hours)**

Text Books:

[1] *E-Book* on Experimental Stress Analysis; K. Ramesh;Published By IIT Madras.

[2] Experimental Stress Analysis for Materials and Structures**;** Alesandro Freddi Giorgio Olmi Luca Cristofolini; Springer.

[3] Experimental Stress Analysis; Abdul Mubeen; Dhanpat Rai and Sons.

Reference Books:

[1] Experimental Stress Analysis; J.W. Dally And W.F. Riley; Mcgraw Hill.

[2] Experimental Stress Analysis and Motion Measurements; R.C. Dove and P. H. Adams; Prentice Hall.

[3] Elements of Experimental Stress Analysis; A. W. Hendryn; Pergamon Press.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Renewable Energy Resources	ME 417	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VII	3	3-0-0	3 Hours

Unit - I

Introduction:- Energy and Development; Energy Demand and Availability; Energy Crisis; Conventional and Non-Conventional; Renewable and Non-Renewable Energy Resources; Environmental Impact of Conventional Energy Usage; Basic Concepts of Heat and Fluid Flow Useful for Energy Systems**[1, 2]**. **(03 Hours)**

Unit - II

Solar Energy Systems:- Solar Radiations Data; Solar Energy Collection; Storage and Utilization; Solar Water Heating; Air Heating; Solar Cooking; Power Generation; Refrigeration and Air Conditioning; Solar Energy System Economics; Basic Principle of Working, Various Types of Fuel Cells, Performance and Limitations**[1]**. **(05 Hours)**

Unit - III

Hydro Energy Systems:- Resource Assessment of Micro and Small Hydro Power; Micro; Mini and Small Hydro Power Systems; Economics; Pump as Turbine; Special Engines for Low Heads; Velocity Head Turbines.

Hydrogen Energy:- Hydrogen Production Methods; Hydrogen Storage; Hydrogen Transportation; Utilization of Hydrogen Gas; Hydrogen as Alternative Fuel for Vehicles**[1, 2]**. **(04 Hours)**

Unit - IV

Biomass Energy Systems:- Availability of Biomass- Agro; Forest; Animal; Municipal and other Residues; Bioconversion Technologies; Cooking Fuels; Biogas; Producer Gas; Power Alcohol from Biomass; Power Generation; Internal

Engine Modifications and Performance; System Economics**[1]**. **(06 Hours)**

Unit - V

Wind Energy Systems:- Wind Data; Wind Energy Estimation; Horizontal and Vertical Axis Wind Mills; Wind Farms; Maximum Power and Efficiency; Performance and Economics of Wind Energy**[1]**.

Geothermal Energy:-Estimation and Nature of Geothermal Energy; Geothermal Sources and Resources- Hydrothermal, Geo-Pressured Hot Dry Rock, Magma; Advantages, Disadvantages and Application of Geothermal Energy; Prospects of Geothermal Energy in India. **[1, 2]**. **(06 Hours)**

Unit - VI

Ocean Energy:- Tidal Energy-Principle of working, performance and limitations; Wave Energy-Principle of working, performance and limitations; Ocean Thermal Energy-Availability, theory and working principle, performance and limitations.

Integrated Energy Systems:- Concept of Integration of Conventional and Non-Conventional Energy Resources and Systems; Integrated Energy System Design and Economics**[1, 2]**. **(06 Hours)**

Text Books:

[23] Non-Conventional Energy Sources; G. D. Rai; Khanna Publishers; Delhi

[24] Fundamental of Renewable Energy Systems; D. Mukherjee and S. Chakrabarti; New Age International.

Reference Books:

[11] Non-Conventional Energy Resources; B. H. Khan; Tata McGraw Hill.

[12] Energy: The Biomass Option; H. N. Bungay; John Wiley and sons; 1st Edition.

[13] Biofuels, Solar and Wind as Renewable Energy Systems: Benefits and Risks; D. Pimentel; Springer,1st Edition.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Non Conventional Machining Methods	ME 419	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VII	3	3-0-0	3 Hours

Unit - I

Introduction and Solid Surface Characterization:-Definition, Traditional Machining - Machining by Cutting and Machining by Abrasion; Nontraditional Machining - Single-Action Nontraditional Machining and Hybrid Machining **[1]**.

Mechanical Processes (Non Traditional):-

Ultrasonic Machining –Introduction, The Machining System, Material Removal Process, Factors Affecting Material Removal Rate, Dimensional Accuracy and Surface Quality, Applications. **Water Jet Machining –**Introduction, The Machining System, Process Parameters, Applications, Advantages and Disadvantages of WJM. **Abrasive Jet Machining:-** Introduction, Machining System, Material Removal Rate, Applications, Advantages and Limitations of AJM. **Abrasive Water Jet Machining:-** Introduction, The Machining System, Process Capabilities. **Ice Jet Machining:-** Introduction, Process Description.

Magnetic Abrasive Finishing:- Introduction, The Machining System, Material Removal Process, Applications **[1]**. **(09 Hours)**

Unit - II

Chemical Processes:-

Chemical Milling:- Introduction, Tooling for CHM, Process Parameters, Material Removal Rate, Accuracy and Surface Finish, Advantages, Limitations, Applications. **Photochemical Milling:-** Introduction, Process Description, Applications, Advantages. **Electropolishing:-** Introduction, Process Parameters, Applications, Process Limitations.

Electrochemical Processes:- Electrochemical Machining:- Introduction, Principles of Electrolysis, Theory of ECM, ECM Equipment, Basic Working Principles, Process Characteristics, Process Control, Applications, Micro-ECM, Advantages and Disadvantages of ECM, Environmental Impacts. **Electrochemical Drilling:-** Shaped Tube Electrolytic Machining, Electrostream (Capillary) Drilling, Electrochemical Jet Drilling, Electrochemical Deburring **[1]**.

(09 Hours)

Unit – III

Thermal Processes:-

Electrodischarge Machining:- Introduction, Mechanism of Material Removal, The Machining System, Material Removal Rates, Surface Integrity, Heat-Affected Zone, Applications, Process Control, EDM Automation, Environmental Impact. **Laser Beam Machining:-** Introduction, Material Removal Mechanism, Applications, Advantages and Limitations. **Electron Beam Machining:-**

Introduction, Basic Equipment and Removal Mechanism, Applications, Advantages and Disadvantages. **Plasma Beam Machining:-** Introduction, Machining Systems, Material Removal Rate, Accuracy and Surface Quality, Applications, Advantages and Disadvantages. **Ion Beam Machining:-** Introduction, Material Removal Rate, Accuracy and Surface Effects, Applications **[1]**. **(09 Hours)**

Unit – IV

Hybrid Electrochemical Processes:- Introduction

Electrochemical Grinding:-Introduction, Material Removal Rate, Accuracy and Surface Quality, Applications, Advantages and Disadvantages. **Electrochemical Honing:-** Introduction, Process Characteristics, Applications. **Electrochemical Superfinishing:-**Introduction, Material Removal Process, Process Accuracy.

Electrochemical Buffing:-Introduction, Material Removal Process. **Ultrasonic-Assisted ECM:-**Introduction, Material Removal Process. **Laser-Assisted ECM.**

Hybrid Thermal Processes:-Introduction; Electroerosion Dissolution Machining; Electrodischarge Grinding; Abrasive Electrodischarge Machining; EDM with Ultrasonic Assistance; Electrochemical Discharge Grinding; Brush Erosion-Dissolution Mechanical Machining **[1]**. **(06 Hours)**

Unit - V

Material Addition Processes:- Introduction; **Liquid-Based Techniques:-** Stereolithography; Holographic Interference Solidification; Beam Interference Solidification; Solid Ground Curing; Liquid Thermal Polymerization; Fused Deposition Modeling; Multijet Modeling; Ballistic Particles Manufacturing; Shape Deposition Manufacturing.

Powder-Based Processes:- Selective Laser Sintering; Laser Engineered Net Shaping; Three-Dimensional Printing.

Solid-Based Techniques:- Solid Foil Polymerization; Laminated Object Modeling **[1]**. **(06 Hours)**

Unit - VI

High Speed Machining and Micromachining:-

High-Speed Machining:-Introduction; History of HSM; Chip Formation in HSM; Characteristics of HSM; Applications; Advantages of HSM; Limitations of HSM.

Micromachining: Introduction; Conventional Micromachining -Diamond Microturning, Microdrilling; Abrasive Micromachining – Microgrinding, Magnetic Abrasive Microfinishing, Micro-Superfinishing, Microlapping, Micro-Ultrasonic Machining; Nonconventional Micromachining - Micromachining by Thermal Erosion, Micro-EDM, Laser Micromachining, Micromachining by Electrochemical Erosion; Combined Micromachining Processes - Chemical-Assisted Mechanical Polishing, Mechanochemical Polishing, Electrolytic In-Process Dressing of Grinding Wheels **[2]**. **(06 Hours)**

Text Books:

[1] Advanced Machining Processes; Hassan Abdel - Gawad El- Hofy; McGraw Hill.

[2] Fundamentals of Machining Processes, Conventional and Non Conventional Processes; Hassan Abdel - Gawad El- Hofy; CRC Press, Taylor and Francis.

Reference Books:

[1] Non Traditional Machining Processes; P. K. Mishra; Narosa Publishing.

[2] Advanced Machining Processes; V. K. Jain; Allied Publishers Pvt. Ltd.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Reliability Engineering	ME 421	(SM+MT) +ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VII	3	3-0-0	3 Hours

Unit - I

Fundamental Concepts of Reliability and Reliability Measures: Brief History; Concepts; Terms and Definitions; Applications; The Life Cycle of A System; Concept of Failure; Typical Engineering Failures and their Causes **[1]**.

Reliability Measures: Reliability Function–R(T); Cumulative Distribution Function (CDF)–F(T); Probability Density Function (PDF) – F(T); Hazard Rate Function-Λ(T); Mean Time to Failure (MTTF) and Mean Time Between Failures (MTBF); Typical Forms of Hazard Rate Function; Bathtub Curve **[2]**.

(08 Hours)

Unit – II

Probability Concepts and Failure Data Analysis: Theory of Probability; Rules of Probability; Introduction to Independence; Mutually Exclusive; Conditional Probability Random Variables; Discrete and Continuous Probability Distributions; Binomial, Normal Comparison of Probability Distributions; Lognormal, Weibull, Exponential, Standard Deviation, Variance, Mean, Mode and Central Limit Theorem **[2, 3]**.

(08 Hours)

Unit – III

Reliability Evaluation of Systems: Reliability Improvement Redundancy; Element Redundancy, Unit Redundancy, Standby Redundancy, Types of Stand by Redundancy, Parallel Components Single Redundancy, Multiple Redundancies; Cut and Tie Set Approach for Reliability Evaluation; Star and Delta Method; Matrix Method (Numericals) **[1, 2]**.

(07 Hours)

Unit – IV

Maintainability and Availability: Concept of Maintainability; Measures of Maintainability; Mean Time to Repair (MTTR); Analysis of Downtime; Repair Time Distributions; Stochastic Point Processes; Maintenance Concept and Procedures; Availability Concepts and Definitions; Important Availability Measures.

Introduction to Reliability Allocation or Apportionment; Reliability Apportionment Techniques-Equal Apportionment, AGREE, ARINC, Minimum Effort Method (Numericals) **[3]**. **(08 Hours)**

Unit – V

Design for Reliability and Maintainability: Reliability Design Process and Design Methods; Reliability Allocation; Failure Modes; Effects and Criticality Analysis (FMECA); Fault Tree and Success Tree Methods; Symbols Used; Maintainability Design Process; Quantifiable Measures of Maintainability; Repair Versus Replacement **[2]**. **(07 Hours)**

Unit VI

Reliability Testing: Introduction to Reliability Testing; Stress Strength Interaction; Introduction to Markov Model; Testing for Reliability and Durability - Accelerated Life Testing and Highly Accelerated Life Testing (HALT); Highly Accelerated Stress Screening (HASS) **[1, 2]**. **(07 Hours)**

Text Books:

[1] Reliability Engineering; Srinath L. S.; 1991; East West Press, New Delhi.

[2] An Introduction to Reliability and Maintainability Engineering; Ebling C. E.; 2004; Tata McGraw Hill Education Private Limited, New Delhi.

[3] Reliability Engineering: Theory and Practice; Birolini A.; 2010; Springer.

Reference Books:

[1] Practical Reliability Engineering; Patrick D. T.; Newton O'Conner; D., Bromley R., 2002 ; John Wiley and Sons.

[2] Reliability Based Design; Rao S. S.; 1992; McGraw-Hill.

[3] Reliability Engineering: Probabilistic Models and Maintenance Methods; Nachlas Joel A.; 2005; Taylor and Francis.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Design of Thermal Systems	ME 423	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
VII	3	3-0-0	3 Hours

Unit - I

Introduction: Introduction to Engineering Design; Thermal Systems, Basic Considerations in Design, Conceptual Design, Steps in the Design Process; Computer-Aided Design of Thermal Systems, Material Selection, Properties and Characteristics for Thermal Systems **[1, 2].** **(07 Hours)**

Unit - II

Modelling of Thermal Systems: Types of Models; Interaction between Models; Mathematical Modelling; Physical Modelling and Dimensional Analysis; Curve Fitting **[1, 2].** **(08 Hours)**

Unit - III

Numerical Modelling and Simulation: Solution Procedure, Numerical Model for a System, System Simulation, Methods for Numerical Simulation; Acceptable Design of a Thermal System, Design of System from Different Application **[1, 2].** **(07 Hours)**

Unit - IV

Economic Consideration: Introduction, Calculation of Interest, Worth of Money as a Function of Time, Series of Payments, Raising Capital, Economic Factor in Design, Cost Comparison, Rate of Return, Application to Thermal Systems **[1, 2].** **(08 Hours)**

Unit –V & VI

Optimization in Design: Basic Concepts, Mathematical Formulation, Optimization Methods, Calculus Methods, Search Methods, Optimization of Thermal Systems, Optimization of Unconstrained Problems, Conversion of Constrained to Unconstrained, Optimization of Constrained Problems **[1, 2].**

(12 Hours)

Text Books:

[1] Design and Optimization of Thermal Systems; Yogesh Jaluria; CRC Press.

[2] Optimization of Engineering Design; Kalyanmoy Deb; Prentice Hall of India.

Reference Books:

[1] Design of Thermal Systems; W. F. Stoecker; Tata McGraw Hill Publication.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Entrepreneurship Development	ME 418	(SM+MT) +ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VIII	3	3-0-0	3 Hours

Unit – I

Introduction to Entrepreneurship:

Understanding the Meaning of Entrepreneur; Characteristics and Qualities of an Entrepreneur; Entrepreneurs Vs. Entrepreneurs And Managers; Classification of Entrepreneurs; Factors Influencing Entrepreneurship; Entrepreneurial Environment; Entrepreneurial Growth; Problems and Challenges of Entrepreneurs; Entrepreneurial Scenario in India **[1] [2]**.

Unit – II

Micro, Small and Medium Enterprises (MSMES)

MSMES – Definition and Significance in Indian Economy; MSME Schemes; Challenges and Difficulties in Availing MSME Schemes, Forms of Business; Women Entrepreneurship; Rural Entrepreneurship; Family Business and First Generation Entrepreneurs **[1]**.

Unit – III

Idea Generation and Feasibility Analysis

Idea Generation; Creativity and Innovation; Identification of Business Opportunities; Market Entry Strategies; Marketing Feasibility; Financial Feasibilities; Political Feasibilities; Economic Feasibility; Social and Legal Feasibilities; Technical Feasibilities; Managerial Feasibility, Location and Other Utilities Feasibilities **[2]**.

Unit – IV

Business Model and Plan in Respective Industry

Business Model – Meaning, Designing, Analysing and Improvising; Business Plan – Meaning, Scope and Need; Financial; Marketing; Human Resource and Production/Service Plan; Business Plan Formats; Project Report Preparation and Presentation; Why Some Business Plan Fails? **[1]**

Unit – V

Financing and Start Up of a Business

Financial Opportunity Identification; Banking Sources; Non-Banking Institutions and Agencies; Venture Capital – Meaning and Role in Entrepreneurship; Government Schemes for Funding Business; Pre-Launch; Launch and Post Launch Requirements; Procedure for Getting License and Registration; Challenges and Difficulties in Starting an Enterprise **[1] [2]**.

Unit – VI

Project Management

Negotiation and Networking; Delegation of Authority and Work Effort **[2]**.

Basic Accounting Terms

Assets; Liability; Income; Expense; Books of Accounts; General Ledger (GL); Subsidiary Ledger (SL); Various Ratios and Interpretations **[1]**.

Text Books:

[1] Entrepreneurial Development; Jayshree Suresh; Margham Publishers, Chennai.

[2] Entrepreneurship Development Small Business Enterprises; Poornima M Charantimath; Pearson,2013.

Reference Books:

[1] The Design of Business; Martin Roger; Harvard Business Publishing, 2009.

[2] Entrepreneurship; Roy Rajiv; Oxford University Press, 2011.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Total Quality Management	ME 416	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VIII	3	3-0-0	3 Hours

Unit – I

Introduction and Quality Concepts: Evolution of Quality Control, Concept Change, TQM Modern Concept, Quality Concept in Design. Procurement of Various Products, Evaluation of Supplies, Capacity Verification, Development of Sources, Procurement Procedure **[1-3].** **(07 Hours)**

Unit – II

Manufacturing Quality and Management: Methods and Techniques for Manufacture, Inspection and Control of Product, Quality in Sales and Services, Guarantee, Analysis of Claims. Organization Structure and Design, Quality Function, Decentralization, Designing and Fitting Organization for Different Type Products and Company, Economics of Quality Value and Contribution, Quality Cost, Optimizing Quality Cost, Seduction Programme **[1-3].** **(09 Hours)**

Unit – III

TQM Principal: Leadership, Strategic Quality Planning; Quality Councils-Employee Involvement, Motivation; Empowerment; Team and Teamwork; Quality Circles, Recognition and Reward, Performance Appraisal; Continuous Process Improvement; PDCE Cycle, 5S,Kaizen; Supplier Partnership, Partnering, Supplier Rating & Selection **[1-3].** **(06 Hours)**

Unit – IV

TQM Tools and Techniques: Seven QC Tools (Histogram, Check Sheet, Ishikawa Diagram, Pareto, Scatter Diagram, Control Chart, Flow Chart); Theory of Control Charts, Measurement Range, Construction and Analysis Of R Charts, Process Capability Study, Use of Control Charts, P-charts and C-charts **[1-3].** **(10 Hours)**

Unit – V

Defects Diagnosis and Prevention: Defect Study, Identification and Analysis of Defects, Corrective Measure, Factors Affecting Reliability, MTTF, Calculation of

Reliability, Building Reliability In Product, Evaluation of Reliability, Interpretation of Test Results, Reliability Control, Maintainability, Zero Defects, Quality Circle **[1-3].** **(07 Hours)**

Unit – VI

ISO and Its Concept of Quality Management: Quality Systems, Need for ISO 9000, ISO 9001-9008; Quality System- Elements, Documentation, Quality Auditing, QS 9000, ISO 14000- Concepts, Requirements and Benefits; TQM Implementation in Manufacturing and Service Sectors, Auditing, Taguchi Method, JIT In Some Details **[1-3].** **(06 Hours)**

Text Books:

[1] **B**. Janakiraman and R. K. Gopal; Total Quality Management, Prentice Hall India, 2006.

[2] H. G. Menon; TQM in New Product Manufacturing; McGraw Hill, 1992.

[3] Dale H. Besterfield, Glen H. Besterfield, Mary Besterfield-sacre; Total Quality Management; Pearson Education Asia.

Reference Books:

[1] J. R. Evans and W. M. Lindsay; The Management and Control of Quality, Cengage Learning.

[2] L. Suganthi and A. Samuel, Total Quality Management, Prentice Hall India.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Industrial Automation and Robotics	ME 404	(SM+MT) +ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VIII	3	3-0-0	3 Hours

Unit I

Introduction to Automation: Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automation, Process Industries Versus Discrete Manufacturing Industries, Continuous Versus Discrete Control, Computer Process Control. Hardware Components for Automation and Process Control, Sensors, Actuators, Analog to Digital Converters, Digital to Analog Converters, Input/Output Devices for Discrete Data **[1].** **[8 Hours]**

Unit II

Automated Production Lines: Fundamentals of Automated Production Lines, Application of Automated Production Lines, Analysis of Transfer Lines, Automated Assembly Systems, Fundamentals of Automated Assembly Systems, Quantitative Analysis of Assembly Systems, Automatic Identification Methods, Barcode Technology, Radio Frequency Identification, Other AIDC Technologies **[1].** **[8 Hours]**

Unit III

Group Technology and Cellular Manufacturing: Part Families and Machine Groups; Cellular Manufacturing; Applications of Group Technology; Analysis of Cellular Manufacturing. Opitz Parts Classification and Coding System.

Flexible Manufacturing Cells and Systems: Introduction to Flexible Manufacturing System; FMC/FMS Components; FMS Application Considerations; Analysis of Flexible Manufacturing Systems; Alternative Approaches to Flexible Manufacturing **[1]**. **[8 Hours]**

Unit IV

Product Design and CAD; CAM, CAD/CAM, and CIM; Quality Function Deployment.

Machine Vision - Image Acquisition and Digitization, Image Processing and Analysis, Interpretation, Training the Vision System; Machine Vision Applications **[1]**. **[6 Hours]**

Unit V

Industrial Robotics: Robotic Configuration, Robot Anatomy and Related Attributes, Robot Control Systems, End Effectors, Sensors in Robotics, Industrial Robot Applications, Robot Accuracy and Repeatability, Different Types of Robotics, Various Generations of Robots, Degrees of Freedom – Asimov's Laws of Robotics Dynamic Stabilization of Robots **[2]**. **[7 Hours]**

Unit VI

Methods of Robot Programming: Leadthrough Programming Methods; A Robot Program as a Path in Space; Motion Interpolation; Wait, Signal, and Delay Commands; Branching; Capabilities and Limitations Of Leadthrough Methods.

Robot Languages: The Textual Robot Languages; Generations of Robot Programming Languages; Robot Language Structure; Constants, Variables, and Other Data Objects; Motion Commands; End Effector and Sensor Commands; Computations and Operations; Program Control and Subroutines; Communications and Data Processing; Monitor Mode Commands **[2]**. **[8 Hours]**

Text Books:

[5] Automation, Production Systems, and Computer Integrated Manufacturing; Mikell P. Groover Fourth Edition, Pearson 2015.

[6] Industrial Robotics – Technology, Programming and Applications; Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey, Ashish Dutta, Second Edition, Tata McGraw Hill Education Private Limited, New Delhi.

[7] Introduction to Industrial Robotics; Ramachandran Nagarajan; Pearson 2016.

Reference Books:

[4] Robotics for Engineers –Yoram Koren, McGraw Hill International, 1st Edition, 1985.

[5] Robotic Engineering - An Integrated approach, Klafter, Chmielewski and Negin, PHI, 1st edition, 2009.

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Engineering Optimization	ME 406	(SM+MT)+ET (15+15)+70
Semester	**Credits**	**L-T-P**	**Exam.**
VIII	3	3-0-0	3 Hours

Unit – I

Introduction: Introduction to Optimization: Engineering Application of Optimization – Statement of an Optimization Problem - Optimal Problem Formulation - Classification of Optimization Problem. Optimization Techniques; Engineering Optimization Literature**[1, 2].** **(06 Hours)**

Unit – II

Linear Programming: Introduction to Linear Programming Problem (LPP); Formulation of Mathematical Model; Simplex Method and its Variants; Dual Simplex Method; Sensitivity Analysis; Transportation Problem and its Applications; Solution Methods for Transportation Problem; Transshipment Problem; Assignment Problem and its Applications **[1, 2].** **(09 Hours)**

Unit – III

Project Management: Introduction and Terms used in Project Management; Construction of Network Diagram; Deterministic Network Model - CPM; Probabilistic Network Model – PERT; Crashing of Network; Resource leveling and Smoothing Techniques **[3, 4].** **(8 Hours)**

Unit – IV

Queuing Theory: Introduction and Terms used in Queuing Models; Kendall's Notations; Classification of Queuing Models; Mathematical Analysis of Queuing System using various Models; Queuing Costs **[1, 2].** **(09 Hours)**

Unit – V

Optimal Control and Optimality Criteria Methods: Introduction; Calculus of Variations; Optimal Control Theory; Optimality Criteria Methods **[1].**

(07 Hours)

Unit – VI

Modern methods of Optimization: Genetic Algorithms - Simulated Annealing - Ant Colony Optimization - Tabu Search – Neural-Network based Optimization – Fuzzy Optimization Techniques – Applications **[1]**. **(06 Hours)**

Recommended Books:

Text Books:

[1] S. S. Rao; Engineering Optimization, Theory and Practice; New Age International Publishers; 4th Edition (2012).

[2] H. A. Taha; Operations Research: An Introduction; Pearson, 2010.

[3] J. K. Sharma; Operation Research: Theory and Application; Macmillan India Ltd.

Reference Books:

[1] E. S. Buffa and R. K. Sarin, Modern Production/Operations Management, Wiley, 1987.

[2] David G. Luerbeggan; Introduction to Linear and Non Linear Programming; Addison Wesley Publishing Co. 1973.

[3] Hadley G.; Nonlinear and – Dynamic programming; Addison Wesley Publishing Co. 1964.

[4] Cordan C. C. Beveridge and Robert S. Schedther; Optimization, Theory and Practice; McGraw Hill Co.1970.

[5] Harndy A. Tahh; Operations Research, An Introduction; Macmillan Publishers Co.NewYork,1982.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
B. Tech. (Mechanical Engineering)	Solar Energy Technology	ME 408	(SM+MT)+ET (30+70)
Semester	**Credits**	**L-T-P**	**Exam**
VII	3	3-0-0	3 **Hours**

Unit – I

Introduction: Solar Energy, Extraterrestrial Solar Radiation, Components of Radiation, Geometry of Earth and the Sun, Geometry of Collector and the Solar Beam, Atmospheric Transmission, Absorption and Reflection, Measuring Solar Radiation **[1, 2]** **(05 Hours)**

Unit – II

Flat Plate Collectors: Introduction, Materials For Flat Plate Collectors, Efficiency of Flat Plate Collector, Flat Plate Air Heating Collectors, Solar Collector Losses And Loss Estimation **[1, 2]** **(04 Hours)**

Unit – III

Solar Water Heating: Introduction, Calculation of Heat Balance, Flat Plate Collectors, System with Separate Storage, Selective Surfaces, Evacuated Collectors, Social and Environmental Aspects **[1, 2]** **(04 Hours)**

Unit – IV

Solar Desalination: Introduction, Simple Solar Still, Basics of Solar Still, Material Problem in Solar Stills, Performance Prediction of Basin-Type Still, Experiments On Different Solar Still, Solar Disinfection **[1, 2]** **(06 Hours)**

Unit – V

Solar Thermal Energy Storage: Introduction; Need of Thermal Energy Storage; Size and Duration of Storage, Methods of Sensible Heat Storage, Methods of Storage in Phase Change Materials, Working Principle; Application and Limitations **[1, 2]** **(05 Hours)**

Unit – VI

Photovoltaic (PV) Power Technology: Introduction; Fundamentals of Photovoltaic Conversion, Efficiency of Solar Cells, Silicon Solar Cell, Balance of System (BoS), PV System, Applications of Photovoltaic **[1, 2]** **(06 Hours)**

Text Books:

[4] Renewable Energy Resources; Twidell and Weir; 3rd Editions: Taylor & Francis.

[5] Solar Energy: Fundamental and Applications; Garg and Prakash; 1st Editions; Tata McGraw Hill; 2006.

[6] Principles of Solar Engineering; Kreith and Keride; Taylor & Francis;

Reference Books:

[6] Solar Engineering of Thermal Processes; Duffie & Beckman; John Wiley and sons; 4th Edition; 2013.

[7] Solar Energy; S. P. Sukhatme; Tata McGraw Hill; 1st Edition; 2008.

[8] Solar Energy Conversion: The Solar Cell; R. C. Neville; Elsevier; 2nd Edition; 1995.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Financial Management	ME 410	(SM+MT) +ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VIII	3	3-0-0	3 Hours

Unit - I

Nature and Scope: Function of Finance, Jobs of a Financial Manager, Objectives of FM, Various Forms of Business Organizations; Source of Finances: Short Term Finance, Term Credit, Accrued Expenses and Deferred Income; Bank Finance for Working Capital: Long Term Finance, Common Shares, Right Issues, Debentures, Preference Shares, Lease Financing, Term Loan **[1]**.

(12 Hours)

Unit – II

Financial Accounting and Working Capital Management: Purpose, Functions, Difference Between Financial and Management Accounting. Concepts, Needs, Determination, and Dimension Of Working Capital Management, Estimation of Working Capital Needs, Financing Current Assets **[1, 3]**.

(05Hours)

Unit – III

Financial Statement Analysis: Purpose, Objective and Meaning of FSA; Ratio Analysis: Types of Ratio, Liquidity Ratio, Leverage Ratio, Profitability Ratios, and Activity Ratios **[2]**. **(05 Hours)**

Unit – IV

Cost: Nature and Classification of Costs in a Manufacturing Firm, Cost Concept, Cost Allocation**[2]**.

(03Hours)

Unit – V

Cost-Volume-Profit Analysis and Capital Budgeting: Break-Even Analysis (BEA), Operating Leverage, Effect of Change in Profit, Utility and Limitation of BE Analysis. Meaning, Importance and Difficulties of CB, Kinds of Capital Budgeting Decisions, Cash in Flow and out Flow Estimates **[1]**.

(10Hours)

Unit – VI

Financing And Dividend Decision: Meaning and Measure of Financial Leverages, Effect on the Share Holders Return, Dividends, Dividend Policy, Practical Consideration, Constraints of Paying Dividends, Advantages and Disadvantages of Bonus Shares etc.**[1, 3]**.

(10Hours)

Text Books:

[1] Fundamental of Financial Management; D. C. Bose; Prentice-Hall.

[2] Financial Management Principles and Applications; Martin, K. and Scott Jr., 10thEd.;Academic Internet Publishers.

[3] Analysis for Financial Management; Higgins, R. C.; 8th Ed.;Mcgraw-Hill.

Reference Books:

[1] Financial Management: Theoryand Practice with Thomson One; E. F. Brigham and M. C. Ehrhardt; 11thEd;South-Western College Pub.

[2] Financial Management Policy; J. C. V. Horne; Pearson.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Advanced Synthesis of Mechanisms	ME 412	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam.**
VIII	3	3-0-0	3 Hours

Unit - I

Kinematics in Machine Elements; Constrained Motion in Kinematic Chains; Classification of Mechanisms; Mechanisms with Lower and Higher Pairs; Planar and Space Mechanisms; Miscellaneous Mechanisms; Motion Analysis in Complex Mechanisms; Chebyshev Polynomial; Chebyshev Spacing of Accuracy Points **[1, 2, 3]. (08 Hours)**

Unit - II

Four Bar Coupler Curve- Equation of Couper Curves; Transmission Angle; Robert - Chebyshev Theorem; Cognate Linkages; Double Points and Symmetry Hartmann Construction; Euler-Savary Equation; Inflection Circle; Bobillier Construction; Cubic Stationary Curvature **[1, 3]. (07 Hours)**

Unit - III

Synthesis Of Mechanisms **–** Number; Type And Dimensional Synthesis Of Mechanisms; Synthesis Of Mechanisms For Function Generation; Least-Square Technique; Path Generation; And Rigid Body Guidance; Dead Centre Problems; Branch And Order Defects **[2, 3]. (08 Hours)**

Unit – IV

Geometric Methods of Synthesis of Planar Mechanisms- Poles of the Four Bar Linkages; Relative Poles of the Four Bar Linkages; Synthesis with Three Accuracy Points; Pole Triangles; Cardinal Point; Image Poles of a Pole Triangle; Opposite Poles; Circle Points; Four Positions of a Plane; Centre-Point Curves; Synthesis with Four Accuracy Point;. Analysis of Mechanical Error in Linkages **[1]. (06 Hours)**

Unit - V

Displacement Equation of the Four Bar Linkages; Synthesis with Three Accuracy Points; Crank and Follower Synthesis- Angular Velocities and Accelerations; Generalization of The Synthesis Method by Linear Equation; Synthesis of the Slider Crank Mechanism with Three Accuracy Points; Synthesis of the Slider Crank Mechanism with Four Accuracy Points; Crank and Follower Synthesis with

Five Accuracy Points; Analysis of Mechanical Errors in Linkages; Mechanical Errors in Four Bar Linkages **[1]**. **(08 Hours)**

Unit - VI

Introduction to Spatial Linkages; Kinematics of Spatial Chains- Matrix Method; Coordinate Transformation; Coordinate System; Link Coordinate Systems; Homogeneous Transformation Matrix; Loop-Closure Equation; Kinematics of Open Chains **[2].**

Dynamics of Mechanisms; Stresses in Moving Members; Dynamic Motion Analysis; Dynamic Force Analysis; Dynamics of Slider-Crank Mechanism; Dynamic Analysis of Plane and Space Mechanisms **[2]**. **(04+04 Hours)**

Text Book:

[1] Kinematic Synthesis of Linkages; Hartenburg & Denavit, Mcgraw Hill.

[2] Theory of Mechanisms and Machines; Amitabh Ghosh and Ashok Kumar Malik; EWP.

[3] Theory of Machines; S.S. Rattan; Tata Mcgraw Hill.

Reference Book:

[1] Mechanism Design: Analysis & Synthesis Vol. 1 & Vol. 2, Erdman & Sandor, Prentice Hall.

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	**Course Name**	**Course Code**	**Marks:100**
B. Tech. (Mechanical Engineering)	Advanced Gas Dynamics	ME 414	(SM+MT)+ET 30+70
Semester	**Credits**	**L-T-P**	**Exam**
VIII	3	3-0-0	3 Hours

Unit - I

Introduction of Gas Dynamics: Introduction and Definition of Compressible Viscous Flow; Integral Forms of Conservation Equations – Continuity; Momentum and Energy Equations **[1, 2].** **(07 Hours)**

Unit - II

Compressible Flow: Speed of Sound and Mach Number; Basic Equations for One Dimensional Flows; Isentropic Relations; Flow though Nozzle and Diffusers. Flow with Friction – Fanno Flow; Flow With Heat Transfer– Rayleigh Flow **[1, 2].** **(08 Hours)**

Unit - III

Shock Waves: Normal and Oblique Shocks and Relations; Mach Waves; Prandtl–Meyer Expansion; Rankine–Hugnoit Relation; Application of Method of Characteristics Applied to Two Dimensional Cases; Examples **[1, 2].(07 Hours)**

Unit - IV

Wind tunnel; Nozzles and One dimensional flow: Design of Supersonic Wind Tunnel and Nozzle. Off-Design Performance of Nozzles; Quasi-One Dimensional Flows; Area-Velocity Relationship; Isentropic Flow Thorough Variable Area Ducts **[1, 2].** **(08 Hours)**

Unit -V

Prandtl–Meyer Flow: Interaction and Intersection of Shocks; P-M Expansions and Boundary Layers; Reflection of Shocks And Prandtl–Meyer Expansion from Solid Surfaces and Fluid Surfaces **[1, 2].** **(07 Hours)**

Unit - VI

Propulsion Systems: Propulsion Engines; Air Breathing Propulsion System; Rocket Propulsion System; Supersonic Diffusers; Application to Simple Problems Related To Propulsion and Flow through Turbo-Machines **[1, 2].** **(08 Hours)**

Text Books:

[4] Fundamentals of Compressible Flow; S. M. Yahya; 3rd Edition; New Age Publishers.

[5] Gas Dynamics; T. Radhakrishnan; 1st Edition; Prentice Hall.

Reference Books:

[3] The Dynamics of Compressible Flow; A. F. Shapiro; 1st Edition; The Ronald Press Company.

[4] Modern Compressible Flow; J. D. Anderson; 3rd Edition; McGraw Hill.

[5] The Dynamics and Thermodynamics of Compressible Fluid Flow; A. H. Shapiro; Ronald Press Company.

[6] Fundamentals of Gas Dynamics; R. D. Zucker; O. Biblarz; 1st Edition; Wiley and Sons.