Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)- ME 201

Degree	Course Name	Course Code	Marks:100
Integrated B. Tech. + M. Tech. / M.B.A.	Material Science	ME 201	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
III	2	2-0-0	3 Hours

Unit - I

Introduction: Historical perspective of Materials Science. Why study properties of materials? Classification of materials:

a) Advanced and composite Materials; b) Modern Materials;

c) Future materials. **(05 Hours)**

Unit - II

Atomic Structure; Inter-atomic Bonding and Structure of Crystalline Solids: Atomic structure; Atomic bonding in solids; Crystal structures; Crystalline and non-crystalline; Materials. Miller indices. Anisotropic elasticity; Elastic behavior of composites; Structure and properties of polymers.

(05 Hours)

Unit - III

Imperfections in Solids and Strengthening Mechanisms: Point defects; Theoretical yield point; Line defects and dislocations; Interfacial defects; Bulk or volume defects; Atomic vibrations; Dislocation and plastic deformation.

Strengthening mechanisms in metals; Recovery; recrystallization and grain growth; Precipitation reactions and strengthening. **(05 Hours)**

Unit - IV

Mechanical Properties and Diffusion in Metals: Elastic deformation; Plastic deformation; Interpretation of tensile stress-strain curves Yielding under multiaxial stress; Yield criteria and macroscopic aspects of plastic deformation; Property variability and design factors.

Diffusion mechanisms; Steady and non-steady state diffusion; Factors that influence diffusion; Non-equilibrium transformation and microstructure.

(05 Hours)

Unit - V

Phase Diagrams: Equilibrium phase diagrams; Kinetics of nucleation and growth; The iron-carbon system; Phase transformations; Transformation rate effects and TTT diagrams; Microstructure and property changes in iron-carbon system; Heat treatment. **(05 Hours)**

Unit - VI

Failure Modes in Materials: Fracture - Ductile and brittle fracture; Fracture mechanics; Impact fracture; Ductile brittle transition; Fatigue - Crack initiation and propagation; Crack propagation rate; Creep; Generalized creep behavior; Stress and temperature effects; Corrosion of metals; Corrosion of ceramics; Degradation of polymers. **(05 Hours)**

Recommenced Books:

1 Fundamentals of Materials Science and Engineering; W. D. Callister; Wiley.
2 Mechanical Metallurgy; G E Dieter ; Tata Mc Graw Hill (2013).
3 Material Science; V. Raghvan; Prentice Hall of India.
4 Introduction to Materials Science for Engineers; James F. Shackelford; 7th Edition (2009); Pearson Prentice Hall.
5 Materials Science; K. M. Gupta; Umesh Publication.
6 Elements of Material Science & Engineering; Van Vlash; John Wiley & Sons.
7 Material Science; Narula; Tata Mc Graw Hill.
8 Science of Materials Engineering; Srivastava; Srinivasan; New Age Publication.
9 Physical Metallurgy; R. W. Cahn and P. Haasen; North Holland (1996)
10 Structure and Bonding in Crystalline Materials; G. Rohrer; Cambridge University Press (2001).
11 Characterization of Materials; Elton N. Kaufmann; 2nd Volume (2003); Set Wiley.

School of Engineering (Mechanical Engineering)- ME 203

Degree	Course Name	Course Code	Marks:100
Integrated B. Tech. + M. Tech. / M.B.A.	Manufacturing Technology - I	ME 203	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
III	3	3-0-0	3 Hours

Unit – I

Machine Tools:

(i) Lathe: Principle; Construction; Types; Operations; Turret/Capstan; Semi/Automatic; Tool layout.

(ii) Shaper; Slotter; Planer: Construction; Operations & drives.

(iii) Milling: Construction; Milling cutters; Up & down milling. Indexing (Dividing) head; Max chip thickness & power required.

(iv) Drilling and boring: Drilling; Boring; Reaming tools. **(08 Hours)**

Unit – II

Tool Materials: Properties of cutting tool Materials; Cutting tool Materials of common use; Advanced cutting tool materials; Concept of Machinability and its improvement; Failure of cutting tools and tool life; Cutting temperature – causes; effects; Cutting fluid application; Estimation of machining time.

(06 Hours)

Unit -III

Theory of Machining: Introduction to Manufacturing and Machining; Basic working principle; Configuration; specification and classification of machine tools; Geometry of single point cutting tool; twist drill and milling cutter; conversion of tool angles from one system to another; Mechanism of chip formation; types of chips and chip control including chip breaking; Mechanics of machining- orthogonal and oblique cutting;

Machining forces and Merchant's Circle Diagram (MCD); Analytical and experimental determination of cutting forces; Dynamometers for measuring cutting forces. **(09 Hours)**

Unit - IV

Abrasive Cutting and Finishing Processes: Surface roughness; Surface roughness terminology; Different methods of surface roughness measurement; Basic principle; purpose and application of grinding; Specification; Selection of grinding wheels and their conditioning; Classification of grinding machines and their uses; Super finishing processes; Honing; Lapping. **(08 Hours)**

Unit – V

Arc Welding Processes: Introduction; Principle of welding; General applications; Classification of welding processes; Brief description of Manual metal arc(MMA) or shielded metal arc (SMA) welding; Electrode coating constituents and their functions; Submerged arc welding (SAW) and field of applications; Gas metal arc welding (GMAW) or MIG/MAG welding; Shielding gases; TIG welding; shielding gases; Application of process. **(07 Hours)**

Unit – VI

Resistance welding: General principle of heat generation in resistance welding; Application of resistance welding processes; Working principle of spot; Seam and Projection welding; Electrode materials.

Soldering and brazing; Difference between both the processes; Consumables used; Methods of brazing; Fluxes used; Their purpose and flux residue treatment. **(07 Hours)**

Recommended Books:

1. Fundamentals of Modern Manufacturing: Materials; Processes and Systems; Mikell P. Groover; Publisher Willey.
2. Manufacturing Technology – Metal cutting and machine Tools (Volume -1 & 2); P. N. Rao; Tata McGraw hill; New Delhi.
3. Manufacturing Engineering & Technology; Kalpakjian; Pearson Pub.
4. Materials and Processes in Manufacturing; E. P. DeGarmo; J. T. Black and R.A. Kohser; Prentice Hall of India.

5. Manufacturing science; Ghosh and Malik; East West Press.
6. Principles of metal cutting; Sen and Bhattacharya; New Central Book.
7. Metal cutting principles; Shaw; MIT Press Cambridge.
8. Manufacturing analysis; Cook; Adisson-Wesley.

School of Engineering (Mechanical Engineering)- ME 205

Degree	Course Name	Course Code	Marks:100
Integrated B. Tech. + M. Tech. / M.B.A.	Kinematics of Machines	ME 205	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
III	3	2-1-0	3 Hours

Unit - I

Introduction: Mechanism and machines; Kinematics links; Kinematics pairs; Kinematics chains; Degree of freedom; Grubler's rule; Kinematics inversion; Equivalent linkages; Four link planar mechanisms; Straight line mechanisms; Steering mechanisms; Pantograph; problems. **(06 Hours)**

Unit - II

Kinematics Analysis of Plane Mechanisms: Displacement analysis; Velocity diagram; Velocity determination; Relative velocity method; Instantaneous center of velocity; Kennedy's theorem; Graphical and analytical methods of velocity and acceleration analysis; Problems. **(06 Hours)**

Unit - III

Cams and Followers: Classification; Types of motion curves and their analytical expressions; Graphical construction of cam profiles for different types of followers; Pressure angle and cam size; Cams with specified contours.

(05 Hours)

Unit - IV

Gears; Fundamental law of gearing; Classification and basic terminology; Spur gears; Other types of gears; Gear trains; Simple; compound and epicyclic gear trains. **(05 Hours)**

Unit - V

Kinematics synthesis of Mechanisms: Function generation; Path generation; Freudenstein's equation; Two and three position synthesis of four bar and slider crank mechanisms by graphical and analytical methods; Precision positions; Structural error; Chebychev spacing; Transmission angle; Problems.**(04 Hours)**

Unit - VI

Belts and pulleys: Open and cross belt drive; Velocity ratio; slip; Material for belts; Crowning of pulleys; Law of belting; Types of pulleys; Length of belts; Initial tension; Ratio of tension; Centrifugal tension; Power transmitted by belts and ropes. **(04 Hours)**

Recommended Books:

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok Kumar Malik; Third Edition Affiliated East-West Press.
2. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker; Jr. Second Edition; McGraw-Hill.
3. Theory of Machines; Thomas Bevan; 3rd Ed.; CBS Publishers.
4. Theory of Machines; Jagdish Lal.
5. Theory and Machines: S.S. Rattan; Tata McGraw Hill.
6. Mechanism and Machine Theory: J.S. Rao and R.V. Dukkipati Second Edition New age International.
7. Kinematics and Dynamics of Machines; Martin; G.H.; 3rd Ed.; McGraw-Hill.
8. Mechanics of Machines: Elementary Theory and Examples; J. Hannah and R. C. Stephens; 4^{th} Ed.; Viva Books.

School of Engineering (Mechanical Engineering)- ME 207

Degree	Course Name	Course Code	Marks:100
Integrated B. Tech. + M. Tech. / M.B.A.	Engineering Thermodynamics	ME 207	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
III	3	2-1-0	3 Hours

Unit - I

System; control volume; Surrounding; Boundaries; Universe; Types of systems; Macroscopic and microscopic viewpoints; Concept of continuum; Thermodynamic equilibrium; State; Property; Process; Cycle; Reversibility; Quasi–static process; Irreversible process; Causes of irreversibility; Energy in state and in transition; Work and heat; Point and path function. **(05 Hours)**

Unit - II

Zeroth Law of Thermodynamics; Temperature; Principles of thermometry; Reference points; Constant volume gas thermometer; Scales of temperature; PMM1; Joule's experiments; First law of Thermodynamics; Corollaries; First law applied to a Process; Applied to a flow system; Steady flow energy equation.

(06 Hours)

Unit – III

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. **(05 Hours)**

Unit - IV

Entropy; Principle of entropy increase; Availability and irreversibility; Derivation of Maxwell's equations.

(03 Hours)

Unit – V

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; Mollier charts; Various thermodynamic processes and energy transfer; Steam calorimeter.

(06 Hours)

Unit - VI

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.

(05 Hours)

Recommended Books:

1. Engineering Thermodynamics; 3rd Edition; P. K. Nag; Tata McGraw Hill.
2. Fundamentals of Thermodynamics; Sonntag; Borgnakke and Van Wylen; John Wiley & Sons (Asia) Pvt. Ltd.
3. Thermodynamics – An Engineering Approach; Yunus Cengel & Boles; Tata McGraw Hill.
4. Thermodynamics; J. P. Holman; Tata McGraw Hill.
5. An introduction to Thermodynamics; Y. V. C. Rao; New Age.
6. Engineering Thermodynamics; Jones & Dugan; Chapman and Hall.

School of Engineering (Mechanical Engineering) - **ME 209**

Degree	**Course Name**	**Course Code**	**Marks:100**
Integrated B. Tech. + M. Tech. / M.B.A.	Mechanics of Material - I	ME 209	SM+MT+ET 25+25+50
Semester	**Credits**	**L-T-P**	**Exam.**
III	4	3-1-0	3 Hours

Unit - I

Axial stress and strain: Concept of stress and strain; Hooke's law; Stress-strain diagram of ductile and brittle material; Statically determinate and indeterminate problems; Compound and composite bars; Problems involving temperature changes.

Shear Stresses: Shear Stresses in Beams; Shear stress formula for beams; Shear stress distribution in beams; Stresses in thin spherical shells; Thin cylinders; Symmetrically loaded plates with different loading conditions.

(08 Hours)

Unit - II

Theory of pure bending: Derivation of flexural formula for straight beams; Bending stress calculation for beams of simple and built up section.

Strain Energy and Theories of Failures: Introduction; Strain energy; Shear Strain energy; Stresses due to various types of loading; Theories of Failures; Graphical representation of theories of failures. **(08 Hours)**

Unit - III

Shear force and Bending moment diagrams: Types of load on beam; Classification of beams; Shear force and bending moment diagrams:

Simply supported; Overhang and cantilever beams subjected to any combination of point loads; Uniformly distributed and varying load and moment; Relationship between load; Shear force and bending moment. **(08 Hours)**

Unit - IV

Deflection of Beams: Governing differential equation for deflection of straight beams having constant flexural rigidity; Double integration and Macaulay's methods for slopes and deflection.

Columns: Introduction; Euler's theory; Equivalent length; Limitations of Euler's formula; Rankine's formula; Extension of Euler's formula to pin-ended columns and columns with other end conditions. **(08 Hours)**

Unit - V

Torsion of Circular Shafts: Basic assumptions; Torsion formula; Power transmission by shafts; Deformation and stress concentration in circular shafts; Design of transmission (solid and hollow) shafts based on strength and stiffness; **Springs:** Introduction to close- coiled helical springs; Springs in series and parallel; Open-coiled helical spring. **(07 Hours)**

Unit - VI

Analysis of Plane Stress and Strains: Transformation equations for plane stress and plane strain; Mohr's stress circle; Relation between elastic constants; Strain measurements; Strain rosettes. **(06 Hours)**

Recommended 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. Timoshenko; Van Nostrand; New York.
3. Introduction to Solid Mechanics; Egor P. Popov; Prentice Hall.
4. Advanced Mechanics of Solids; I. S. Srinath; Tata McGraw Hill.
5. Strength of Materials; S. S. Rattan; Tata McGraw Hill.
6. Fundamentals of Solid Mechanics; M. L. Ghambhir; Prentice Hall India.
7. Introduction to Solid Mechanics; Irving H. Shames; Prentice Hall India.
8. Strength of Materials; R. Subramanian; Oxford Higher Education.
9. Strength of Materials; S. Ramamurtham.
10. Solid Mechanics; S. M. A. Kazimi; Tata McGraw Hill.

School of Engineering (Mechanical Engineering) - ME 215

Degree	Course Name	Course Code	Marks:100
Integrated B. Tech. + M. Tech. / M.B.A.	Machine Drawing	ME 215	SM+EM 50+50
Semester	**Credits**	**L-T-P**	**Exam.**
III	3	1-0-3	3 Hours

Note: All drawing exercises should be performed on AutoCAD.

Unit – I

Introduction to BIS Specification SP: 46 – 1988 Code of Engineering drawing – Limits; fits and tolerance (Dimensional and Geometrical tolerance); Surface finish representation. **(05 Hours)**

Unit – II

Orthographic views from isometric views of machine parts / components. Sectioning of machine components. **(05 Hours)**

Unit – III

Gears: Gear terminology; I.S. convention representation of assembly of spur gears; Helical gears; Bevel gears; Worm and worm wheel. **(05 Hours)**

Unit – IV

Exercises on Coupling; Crankshaft; Pulley; Piston and connecting rod; Cotter and knuckle joint; Bolted, riveted joints and welded joints. **(09 Hours)**

Unit – V

Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Lathe tail stock; Stuffing box; Pedestal bearing.

(11 Hours)

Unit – VI

Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Steam stop valve; Drill jigs and Milling fixtures.

(10 Hours)

Note:

1. **In the semester examination; the examiner will set two questions from unit –I & II (each 25 marks); taking one question from each unit. The students will be required to attempt any one question out of two questions.**
2. **In the semester examination; the examiner will set two questions from unit –III & IV (each 25 marks); taking one question from each unit. The students will be required to attempt any one question out of two questions.**
3. **In the semester examination; the examiner will set two questions from unit –V & VI (each 50 marks); taking one question from each unit. The students will be required to attempt any one question out of two questions.**

Recommended Books:

1. Machine Drawing; N. D. Bhatt and V. M. Panchal; Charotar Publishing House.
2. Engineering Graphics with AutoCAD; D. M. Kulkarni; A. P. Rastogi; A. K. Sarkar; PHI Learning Private Ltd.
3. Engineering Graphics using AutoCAD; T. Jeyapoovan; Vikas Publishing House.
4. A Text Book of Machine Drawing; P. S. Gill Pub.: S. K. Kataria & Sons.
5. Engineering Graphics with Auto CAD 2002; James D. Bethune; Pearson Education.
6. A Text Book of Machine Drawing Laxmi Narayana and Mathur; M/s. Jain Brothers; New Delhi.
7. Machine Drawing by N. Sidheshwar; Kannaieh; V. S. Sastry; Tata McGraw Hills; New Delhi.
8. AutoCAD Tutor for Engineering Graphics; Alan Kalameja; Autodesk Pr.