

SUBJECT: SECTION-B (SUBJECT SPECIFIC) SYLLABUS

Preamble: This syllabus is designed for the selection of Post Graduate Teachers in Engineering Graphics. It aims to assess the candidate's comprehensive understanding and proficiency in the fundamental and applied principles of engineering drawing and graphics in construction and explanation. The curriculum is interdisciplinary, covering essential topics from Mechanical Engineering, Civil Engineering, and Architecture to ensure a holistic evaluation of the candidate's capability to teach the subject effectively at the senior secondary level.

UNIT 1: INTRODUCTION

- Drawing equipment and instruments.
- Drawing sheet layout, sizes, Margin, Border Line, Grid reference, Bill of Material, Title Block;
- Lettering, Single Stroke Letters, Types of Single Stroke Letters, Size of Letters;
- Lines, Types of lines and their uses;
- Dimensioning, Dimensioning types, Principles of Dimensioning, Rules of dimension placement and tolerance indication;
- Conventions in drawing practice;
- Free hand sketching;
- Blueprint reading;
- B.I.S. Specification,
- Engineering Drawing for school and colleges as per SP-46 (2003).

UNIT 2: SCALES

- Introduction
- Sense of Proportioning
- Representative Fraction
- Types of Scales:
 - Plain Scales (Reducing and Enlarging Scales),
 - Diagonal Scales,
 - Comparative Scales,
 - Vernier Scales,
 - Scale of chords.
- Practical applications in reading maps, machine parts, and architectural plans.

UNIT 3: PLANE GEOMETRICAL CONSTRUCTIONS

- Geometry;
- Lines, Perpendiculars, Parallel Lines, Division;
- Angle, Types of Angle, Division;
- Plane Figure
 - Rectilinear Figures
 - Triangles
 - Quadrilaterals
 - Polygons
 - Curvilinear figures
 - Circle, Inscribing and circumscribing circles, locate the center,
 - Arc, reverse curve (ogee)
 - Tangents of Arcs and Circles, Internal tangent, External tangent, Normal,
 - Lengths of Arcs and Circles,
 - Circles and lines in contact,
 - Regular Figures around a given circle.
- Making different types of graphic designs/murals for interior/exterior decorations using the knowledge of geometrical figures.

UNIT 4: ENGINEERING CURVES & THEIR CONSTRUCTIONS

- Introduction,
- Terms and nomenclature;
- Loci of points: constant distance from point/line, rolling circle on line/circle;
- Conic sections
 - Ellipse
 - Parabola
 - Hyperbola
 - Tangent and normal to conics;
- Cycloidal curves: Cycloid, epicycloid, hypocycloid;
- Involute,
- Evolute,
- Spirals,
- Helix, Helix on cone and cylinder,
- Cam,
- Sine Curve,
- Practical Applications.

UNIT 5: PROJECTIONS

- Theory of Projection,
- Principle of projection,
- Classification of projections,
- Orthographic projections,
- Pictorial projections,
- Perspective projection,
- Oblique projection,
- Axonometric Projection
 - Isometric Projection
 - Dimetric Projection
 - Trimetric Projection

UNIT 6: ORTHOGRAPHIC PROJECTIONS

- Introduction
- Theory of Orthographic Projections
- Projection terms
- Planes of projection
 - Reference planes
 - Principal planes
 - Horizontal plane
 - Vertical plane
 - Auxiliary planes
- Reference line
- Projections in Quadrants
- Projections in Octants
- First Angle Projection
- Third Angle Projection,
- Symbol of First and Third Angle Projections
- Orientation of the object,
- Order of priority of coinciding lines,
- Three Views, Six Views,
- Direction of rotation of H.P. and P.P.,
- Coordinate axes,
- Position of an object for drawing its three orthographic projections
- Position of an observer

- Direction of sight for a profile or side view
- Use of a profile plane
- Methods of projecting profile view

UNIT 7: ORTHOGRAPHIC PROJECTIONS OF POINTS AND LINES

- Point – The simplest object,
 - Points in different quadrants
 - Point on auxiliary planes
- Lines,
 - Line parallel to one or both the planes
 - Line contained by one or both the planes
 - Line perpendicular to one of the planes
 - Line inclined to one plane and parallel to the other,
 - Line inclined to both the planes,
 - Line contained by a plane perpendicular to both the reference planes
 - Other typical cases:
 - three view projection of straight lines,
 - true length and angle orientation of straight line,
 - rotation method,
 - trapezoidal method and auxiliary plane method,
 - True length of a straight line and its inclinations with the reference planes,
 - Traces of a line,
 - Methods of determining traces of a line,
 - Traces of a line the projections of which are perpendicular to XY
 - Positions of traces of a line.

UNIT 8: ORTHOGRAPHIC PROJECTIONS OF PLANES AND LAMINAE

- Introduction,
- Types of planes
 - Perpendicular planes
 - Oblique planes
- Traces of planes,
- General conclusions (Traces, Projections),
- Projections of planes parallel to one of the reference planes.
 - When the plane is parallel to the H.P.
 - When the plane is parallel to the V.P.

- Projections of planes inclined to one reference plane and perpendicular to the other.
 - Plane inclined to the H.P. and perpendicular to the V.P.
 - Plane inclined to the V.P. and perpendicular to the H.P.
- Projections of oblique planes
- Locating a Point in a Plane.
- Projections of Plane Figures
 - Different cases of plane figure making different angles with one or both reference planes and lines lying in the plane figures making different given angles (with one or both reference planes)
- True shape of the plane figure by projection.

UNIT 9: ORTHOGRAPHIC PROJECTIONS OF SOLIDS

- Introduction,
- Important terms,
- Classification of solids,
 - Polyhedra,
 - Prisms,
 - Pyramids,
 - Solids of revolution,
 - Frustum of a solid
 - Truncated solid
- Positions of axis of a right solid.
- Projections of solids
 - Axis perpendicular to one plane and parallel to the other.
 - Axis parallel to both H.P. and V.P.
 - Axis inclined to H.P. and parallel to V.P.
 - Axis parallel to H.P. and inclined to V.P.
 - Axis inclined to both H.P. and V.P.
- Projection of combination of solids;
- Projection of Simple Machine Blocks.
- Functional planning and preparation of plan, elevation, and section for classroom, labs, living room, bedroom, kitchen etc. with drawing of different objects there in using principles of building planning: orientation, ventilation, lighting, circulation etc.

UNIT 10: SECTION OF SOLIDS

- Introduction,
- Basics of Sectioning,
- Terminology,
- Cutting Plane Line,
- Section Lining,
- Conventional Representation of Materials for Mechanical Engineering /Civil Engineering/Architecture.
- Symbols for building elements: doors, windows, ventilators, sanitary fittings, electrical points, furniture.
- Conventional Breaks,
- Types of Sections
 - Full Section
 - Half Section (Section in Two Intersecting Planes),
 - Off-set Section (Section in Two Parallel Planes),
 - Revolved Section,
 - Removed Section,
 - Partial or Broken Out Section,
 - Aligned View/Section,
 - Special Cases of Sectional Views (Conventions),
- Section planes,
- Apparent section,
- True section,
- Types of sections of solids
 - Section plane perpendicular to V.P. and parallel to H.P.
 - Section plane perpendicular to H.P. and parallel to V.P.
 - Section plane perpendicular to V.P. and inclined to H.P.
 - Section plane perpendicular to H.P. and inclined to V.P.
 - Section plane perpendicular to H.P. and V.P. both (P.P.)
- Auxiliary projections of solids showing true shape of section.

UNIT 11: DEVELOPMENT OF SURFACES

- Definitions,
- Purpose and methods
 - parallel line
 - radial line
 - triangulation
- Stretchout or Girth Line
- Development of lateral surfaces of simple solids

- Cube
- Prisms
- Pyramids
- Cylinders
- Cones
- Frustum of cones & pyramids
- Development of transition pieces
- Development of spheres
- Practical applications.

UNIT 12: MISSING LINE AND MISSING VIEWS

- Visualization
- Missing Line
- Missing Views

UNIT 13: ISOMETRIC PROJECTION

- Introduction
- Isometric scale
- Isometric axis
- Isometric Planes
- Isometric View
- Isometric projection
- Isometric projection of plane figures parallel to H.P. or V.P.
 - Triangle
 - Square
 - Pentagon
 - Hexagon
 - Circle
 - Semicircle
- Isometric Projection of Solids
 - Cube
 - Prisms
 - Pyramids
 - Cylinders
 - Cones
 - Frustums
- Isometric Projection of Combination of solids.

UNIT 14: PERSPECTIVE PROJECTION

- Introduction
- Classification of Perspective Projection
- Point of Sight (Vision Cone),
- Location and Position of the Projection Plane
- Projection Model
- Nomenclature and Symbols
- System of Lettering
- Perspective Projection of a Point,
- Construction of Parallel Perspective
- Parallel Perspective (Alternative A), Parallel Perspective (Alternative B),
Construction of Angular Perspective, Perspective of Inclined Lines,
Construction of Oblique Perspective

UNIT 15: OBLIQUE PROJECTION

- Introduction
- Projecting Lines
- Cavalier Projection
- Cabinet Projection
- Receding Axis
- General Oblique Projections
- Advantages of Oblique Drawings
- Conventional Constructions
- Representing Circles.

UNIT 16: CENTRE OF GRAVITY AND MOMENT OF INERTIA OF AREAS

- Introduction
- Centre of Gravity of Symmetrical Areas
- Centre of Gravity of Unsymmetrical Areas
- Moment of Inertia of Symmetrical Areas
- Moment of Inertia of Unsymmetrical Areas

UNIT 17: MACHINE PARTS

- Introduction
- Fasteners
- Classification of fasteners
- Helix,
- Thread

- Terms and nomenclature,
- Different thread profiles
- External threads and internal threads,
- Conventional and simplified representation of screw threads,
- Threads in section,
- Tapped holes
- Through holes
- Threaded fasteners
 - Bolts,
 - Nuts,
 - Washers,
 - Studs,
 - Screws,
 - Foundation Bolts,
- Rivets,
 - Types of Rivet heads
 - Rivet diameter
- Riveting – Caulking and Fullering,
- Riveted Joints,
 - Types of riveted Joints
 - Chain and Zig-Zag Riveting
- Welded Joints,
- Keys
 - Classification of Keys
- Cotters
- Pins.
- Concepts of limits, tolerance and allowance.

UNIT 18: ASSEMBLY AND DIS-ASSEMBLY DRAWINGS

- Introduction,
- Assembly of parts to make machines and their disassembly in sectional and non-sectional orthographic views.
- Bearings,
- Prevention of rotation of Brasses
- Types of bearings,
 - Open Bearing
 - Bushed Bearing

- Foot-step Bearing
- Rod Joints
 - Sleeve and Cotter Joint,
 - Gib and Cotter Joint
 - Socket and Spigot Joint
- Tie Rod or Turnbuckle
- Flange Pipe Joint
- Couplings
- Classification of Couplings
 - Protected Flange Coupling
 - Unprotected Flange Coupling
- Pulleys
 - V-Belt Pulley
 - Cast Iron Pulley.

UNIT 19: COMPUTER AIDED DESIGN AND DRAFTING

- Why create drawings with CAD?
- Hardware setup: CPU, input/output devices, plotters;
- Preparing the drawing environment
- Object selection
- Object snaps
- Coordinate system
 - Absolute coordinates
 - Relative coordinates
 - Polar coordinates
- Overview of CAD software: CollabCAD, AutoCAD;
- CAD interface: drawing area, toolbars, command line, status bar, UCS;
- Commands
 - Drawing Commands: Line, Circle, Arc, Ellipse, Polygon;

- Editing commands: Trim, Extend, Offset, Fillet, Chamfer, Array, Mirror, Move, Copy, Rotate;
- Construction of 2D objects, 3D objects and modelling of simple solids and generating orthographic, isometric, sectional views using CAD software.
- Dimensioning.

Topics of syllabus- Teaching Education and Methodology:

1. Learning & Teaching
2. Language across the curriculum
3. Understanding discipline and subject
4. Gender school and Society
5. Pedagogy of a school subject
6. Knowledge and curriculum
7. Assessment for learning
8. Creating an Inclusive school
9. Childhood and growing up
10. Drama and Art in Education