N.B. The parts of the syllabus which are in italics will not be examined at Ordinary Level.

As a form of graphical communication Technical Drawing provides the student with the opportunity of visualising and comprehending information presented verbally or graphically. The present revised syllabus aims to develop intellectual qualities of comprehension, analysis and problem solving as well as the physical skills of manipulation and dexterity and the development of overall design sensitivity. Part I contains topics requiring conceptual knowledge of a purely theoretical form and providing a study in spatial perception where drawings are used in analysing and solving two and three-dimensional problems by rigorous application of geometrical principles. Part II emphasises the role of Technical Drawing as the language of technology and contains topics which involve varied and interesting applications to the type of problem encountered in modern technology. Thus the course is an educational experience in the broadest sense as it provides the students with a body of knowledge and develops their intellect and creative abilities in topics which are appropriate and meaningful in a technological world.

A knowledge of the Intermediate Certificate course in Mechanical Drawing is presumed but there will be no restriction on a pupil who has not followed the latter syllabus from taking the Leaving Certificate syllabus. In such a case it is presumed that the necessary arrangements will be made to enable a pupil to make up the leeway.

The examination will consist of two papers, and candidates must attempt Part I, Part II (A) and Part II (B).

The titles of the respective papers will be:

- Part I: Plane and Solid Geometry
- Part II (A): Engineering Applications
- Part II (B): Building Applications

Part I and II will each be allowed 200 marks from the 400 assigned for this examination. Grading of results will be assessed by the aggregate of the marks obtained in both parts.

**Note:** Candidates studying Technical Drawing in the Leaving Certificate Vocational Programme may also study from the material in Appendix 1 as shown at the end of this section. Examination questions in relation to this appendix will be optional.
SYLLABUS

Part I: Plane and Solid Geometry.

SCALES
Construction and use of plain and diagonal scales: Selection and use of suitable scales. Construction and use of Vernier scale.

REGULAR AND IRREGULAR FIGURES
Construction of triangles, quadrilaterals and polygons from given data. Similar triangles and proportional figures. Reducing or increasing plane figures to similar figures with sides in given ratios. Inscribed, escribed and circumscribed figures. Circles to satisfy given conditions involving other circles, points and lines, the centres to be found by direct construction or by intersecting loci. Properties of intersecting chords. Properties of tangents and secants to circles. Angles in the same segment and in “alternate segment” of a circle. Angle between intersecting chord and tangent.

AREAS OF FIGURES
Construction of the mean proportional between two given lines: dividing a line in extreme and mean ratio. Reduction and enlargement of figures to similar figures, with areas in given ratio. Construction of triangles, rectangles, squares and polygons with equivalent areas. Dividing a given figure into a number of equal areas, by lines drawn through given points.

PROJECTION OF SOLIDS
Principles of projection: planes of reference, first and third angle projection, auxiliary planes, sectional planes. Points defined by their rectangular co-ordinates. Orthographic projection of solids such as cube, right and oblique prisms and pyramids and other simple irregular solids in various positions so that the axis of the solid is not inclined to more than one principal plane. True shape of sections. Auxiliary projections showing new plans and elevations. Projections of the five regular polyhedra. Inscribing and circumscribing spheres of the regular polyhedra.

DEVELOPMENTS

Note: Prisms and pyramids to include cylinders and cones.

CONIC SECTIONS
Definition of focal sphere, focal points, directrix and eccentricity. Drawing of conic sections. The ellipse, parabola and hyperbola as plane loci. Construction of tangents from points on the curve and from outside the curve. Principal properties of the conic sections. Centre of curvature and evolute of the conic sections. Construction of ellipse from conjugate diameter. Inscribing a parabola in a rectangle. Construction of hyperbola from foci and transverse axis. Properties of the asymptotes.

LOCI
Construction of the helix, spirals (conical, archimedian and logarithmic). Involute, roulettes, cycloids (including epicycloid and hypocycloid), trochoids. Construction of tangents and normals where appropriate. Use of trammel for plotting loci. Construction of catenary by trammel.

THE OBLIQUE PLANE
Determining the true length of a line from its projections: Inclination of a line to the planes of projection. Traces of a line. Determining angle between intersecting lines. Determining distances between skew lines. Determining the projections of a line from its inclinations. Representation of inclined and oblique planes by their traces. Projections of points and lines on oblique planes.
Inclination of oblique planes to the planes of projection. Conversion of oblique plane to inclined plane. Rabatment of oblique planes. Dihedral angle between intersecting planes. Determining the traces of an oblique plane having given inclinations to the planes of projection. Finding the traces of an oblique plane to contain given points and line. Determining an oblique plane to make a given angle with a given oblique plane. Projections of solids inclined to both planes of projection.

SURFACES IN CONTACT – TANGENT PLANES
Spheres in contact. The spheres in contact with cone and cylinder. Tangent planes to spheres, cones and cylinders. Tangent planes to surfaces to contain given points and lines.

INTERSECTIONS OF SURFACES OR INTERPENETRATION OF SOLIDS
Intersection of two planes. Intersection of planes and solids. Solution by cutting plane method or by auxiliary projections. Sections of solids by oblique planes. True shapes of solids cut by oblique planes. Lines of interpenetration between right prisms, right pyramids and spheres, their truncations and combinations.

PICTORIAL PROJECTION
Isometric projection of solids from given data, from models and from orthographic projection. Use of isometric scale: Principles of oblique projection: cavalier and cabinet. Oblique projection of solids from given data. Planometric projection.

Part II (A) Engineering Applications

STANDARD SPECIFICATIONS AND CONVENTIONS
Pd7308: B.S.I. Engineering Drawing Practice. Layout of drawings, lines and linework, lettering and numerals, systems of projection

Views on drawings, general, number of views, partial views, simplified representation of symmetrical parts, adjacent parts.

Sections, general, cutting planes, hatching, types of section, parts and features of parts not normally sectioned.

Conventional representations to be used on drawings.

Scales, general, recommended scale ratios.

Principles of dimensioning, general, functional dimensioning, projection lines, dimension lines and leaders

Dimensions, linear dimensions, angular dimensions, redundant dimensions.

Methods of dimensioning common features, diameters, radii, sizes of holes, positioning of holes and other features in circular arcs, counter-sinks, counterbores and spotfaces, bolts, nuts and washers, screw threads, keyways and taper features.

Abbreviations and symbols.

Toleranced dimensions, general, application of tolerances, tolerance on individual linear dimensions, tolerance on functional dimensions.
Machining and surface texture symbols, indication of surface texture.

ENGINEERING COMPONENTS AND ASSEMBLIES
Identification of standard pipe fittings, socket, tee, elbow, bend, cap

Compression, capillary, threaded and flanged couplings. Non return, safety, gate and globe valves
Drawing of flanged pipe couplings, expansion joints and bends used in pipe installations, simple valve constructions.

Interpretation of sectional drawings of: cylinder, vane and gear pumps; two-stroke and four-stroke I.C. engines, rotary engine, compressor, steam engine and other general engineering mechanisms and components.

Drawing of pistons, connecting rods, valves, couplings, universal joints, clutches, bearings, seals.

**FABRICATION**

Shape of standard steel sections: plate, bar, angle, tee, channel, beam.

Locked devices for screws, nuts and bolts.

Types of bolted, riveted and welded joints used in structural steelwork; standard specifications and symbols used.

Drawing of simple fabricated connections from roof trusses and lattice girders to given specifications.

Specifications of types of joints and methods of assembly used in sheet metalwork.

Development of machine covers and guards, ducting, hoppers and chutes.

Development of segmental bends from right prisms and cylinders.

Development of transition pieces between triangular, quadrilateral and circular openings.

Determination of bending angle.

**ORTHOGRAPHIC PROJECTION**

Use of standard specifications and conventions in producing engineering drawings to scale; in first or third angle projection, including auxiliary views and sections in the following cases:-

(i) Fully dimensioned freehand sketches of engineering components.
(ii) Working drawings of engineering components from given assembly drawings
(iii) Preparation of assembly drawings from given details of components.

**PICTORIAL PROJECTION**

Isometric and oblique projections of simple engineering components from given orthographic projection. Exploded drawings of simple assemblies. Sections and part sections of components.

Use of isometric scale and grid papers.

**MECHANISMS**

Construction from given data of helical springs and screw threads.

Construction of radial plate cams to give uniform velocity, simple harmonic motion, uniform acceleration and retardation to knife edge, roller and flat-type, in-line followers.

Construction of cam profiles and displacement diagrams.

Construction of displacement diagrams from given cam profiles.
Plotting locus of point in link mechanisms; connecting rod and crank, quick return mechanisms, four bar chain.

*Involute gear tooth profile; approximate method of construction*

*Gear terminology and basic proportions*

*Construction of gear tooth profile for spur gears, rack and pinion*

*Principles of other gear types.*

**DRAWING OFFICE PRACTICE**

Layout, detail and assembly drawings; interpretation of drawings

Production of inked tracings of pencilled drawings according to standard specification

Methods of copying drawings; dyeline (diazo) blueprint, microfilm

Awareness of developments in computer graphics.

**Part II (B): Building Applications.**

**BUILDING DRAWING PRACTICE**

BS 1192 Recommendations and corresponding ISO standards for Building Drawing Practice; types of drawings – sketch, location, component, assembly, scale; sizes of drawings, layout, types of line, sectioning, dimensions and levels, lettering, reference grids, graphical symbols, representation of materials.

Inking of drawings. Drawing office practice

Awareness of developments in computer graphics

**STRUCTURAL FORMS AND CONCEPTS**

Historical note on the basic types of structural forms. Line diagrams illustrating structural forms.

Solid structures: load-bearing walls; arches; domes; vaults.

Skeletal structures: post and beam construction; forms of multi-storey construction – conventional, propped, suspended and cantilevered; portal frames; pin-jointed trusses; three-dimensional space frames; *cable structures*;

Surface structures: cellular and curved; frame and slab; folded plate construction; shell construction – rotational, translational, cylindrical, northlight; *geodesic domes*

**BUILDING DETAIL**

Preparation of orthographic drawings from sketches, actual parts, models and given data. Sections and auxiliary views. Oblique and isometric views of building components. Planometric views of buildings and components. Freehand sketching of commonly used details
BUILDING ORNAMENT

Intersection of straight and curved mouldings in the same plane: Application of loci to the setting out of tracery panels. The shape and function of classical mouldings. The Classical column.

PERSPECTIVE PROJECTION


SHADOW PROJECTION


GEOMETRY OF SHELL STRUCTURES

Definition of rules surfaces; warped surfaces; the hyperbolic paraboloid as a warped parallelogram; orthographic projection (including cross-sections) of hyperbolic paraboloid shells; construction of hyperbolic paraboloids from directrices; construction of a conoid; orthographic projection (including sections) of conoidal roofs.

APPLIED GEOMETRY IN CONSTRUCTION TECHNOLOGY

Elliptic and parabolic arches and their joint lines; parallel curves; rampant elliptic arches; pointed parabolic arches; intersection of roofs of equal and unequal pitches; development of surfaces in roof intersections; determination of dihedral angles in hip and valley situations; geometry of structural frames; geometry of interpenetration of building components; true lengths and developments relating to building details.

CONTOURING AND APPLICATIONS

For a Leaving Certificate Vocational Programme the course in Technical Drawing will be that of the Leaving Certificate as set out in the Rules and Programme for Secondary Schools. The content of each of the two main sections of the course, (i) Plane and Solid Geometry and (ii) Engineering Applications or Building Applications, to be supported by the following general aims and objectives related to the use of new technology:

**General Aims**

(i) To use computer graphics to assist in achieving greater clarity in increased general understanding of geometric principles;
(ii) To achieve a practical understanding of the power of Computer Aided Design in the solution of problems;
(iii) To investigate the use of the computer as a communications tool in the graphics and design context.

**General Objectives**

The student will experience:

(i) the use of 2D CAD to solve linear and planar problems;
(ii) the use of 3D CAD to solve problems requiring surface and solid modelling;
(iii) the production of dimensioned drawings on screen, including design modifications and the production of finished hardcopy by plotter.