IM SYLLABUS (2024)

ENGINEERING DRAWING AND GRAPHICAL COMMUNICATION

IM 09

SYLLABUS

Engineering Drawing and Graphical Communication	**IM 09**	(Available in September)
Syllabus		1 Paper (3 hours)

Aims

The aims of the syllabus are:

a) to explore and appreciate the significance of engineering drawing and graphical communication in a rapidly changing technological society;
b) to develop the ability to communicate engineering and other general information in established graphical ways;
c) to develop the skill to produce accurate and freehand drawings, conforming to appropriate methods of graphical representation;
d) to develop quality draughtsmanship that conforms with internationally recognised standards and conventions.

Assessment Objectives

Candidates will be required to:

a) demonstrate their ability to interpret standardised graphic representations;
b) apply their acquired body of knowledge in plane and descriptive geometries to solve 2D and 3D engineering problems;
c) employ their broad understanding of the design process and graphical communication in general towards the communication of tangible data or abstract information.
d) model, orthographically and in three dimensions, problem situations utilising the most appropriate methods and techniques;
e) produce neat, clear and proportional drawings consistent with recognised codes and conventions.

It is anticipated that this syllabus will form a two-year course with a time allocation of around 150 hours. This syllabus assumes knowledge of the SEC29 Graphical Communication syllabus.

Scheme of Assessment

Engineering Drawing and Graphical Communication shall be assessed by a written examination only. One three hour paper will be set. It shall have three sections.

Section A
Section A will cover the **Core** part of the syllabus. It will contain 5 questions of which the candidates are required to answer any four. Each question carries 13 marks i.e. the section carries 52% of the total marks. Candidates are advised to spend 90 minutes on this section.

Section B

Section B will cover the **Engineering Drawing** part of the syllabus. Two questions will be set, with the candidates required to choose one. This section carries 24% of the total marks. Candidates are advised to spend 45 minutes on this section.

Section C

Section C will cover the **Graphical Communication** part of the syllabus. Two questions will be set, with the candidates required to choose one. This section carries 24% of the total marks. Candidates are advised to spend 45 minutes on this section.

In any section, any question can test material from more than one topic.

The final grade (grade A to grade E) shall be based on the combined marks obtained in the three sections.

All questions will be answered on A2 size sheets, which will be provided.

Candidates are required to provide their own A2 size drawing board and draughting equipment. In particular, the candidates should have a superbow compass capable of handling measurements of around 160mm. Such a compass should also be expandable, by the fitment of a matching extension.

Only non-programmable calculators are allowed. The use of draughting aids is permitted.

All questions will be set in SI units and in accordance with the revised editions of PP8888-1 and PP8888-2.

Subject Content

1 Core

1.1 Plane geometry

1.1.1 Conic sections

The parabola as a section of a cone.
The parabola drawn in a rectangle.
Finding the focus of a given parabola.
The tangent and normal at a point on the parabola.
The parabolic evolute.
The parabola as a locus of a point.

The ellipse as a section of a cone.
The ellipse drawn in a rectangle.
Drawing the ellipse using the auxiliary circles.
Drawing the ellipse using the intersecting arc method, using $PF_1 + PF_2 = V_1V_2$.
The tangent and normal at a point on the ellipse.
The elliptical evolute.
The ellipse as a locus of a point.

The hyperbola (including the rectangular hyperbola) as a section of a cone.
The auxiliary circle. The asymptotes.
Drawing the hyperbola given the asymptotes and a point on it.
Drawing the hyperbola using the intersecting arc method, using $PF_1 - PF_2 = V_1V_2$. Drawing in the asymptotes and the directrices.
The tangent and normal at a point on the hyperbola.
The hyperbolic evolute.
The hyperbola as a locus of a point. The auxiliary circle. Drawing in the asymptotes.

1.1.2 Cycloidal curves

The construction of the cycloid, epicycloid, hypocycloid and all their trochoids.

1.1.3 Involute spur gears

The involute of a square and a circle.
The construction of a gear tooth profile utilising both the true involute form and approximate reproductive methods.
The design of a rack and pinion.
Gears in mesh are excluded.

1.1.4 Coplanar loci of points on moving mechanisms

Folding door mechanisms.
Slider crank mechanism; piston displacement diagrams.
Equal and unequal connected cranks.
Watt's straight line motion.

1.1.5 Cams

The construction of disc cam profiles to impart:

a) Uniform Velocity (UV)
b) Simple Harmonic Motion (SHM)
c) Uniform Acceleration (UA), Uniform Retardation (UR) and UAR

The knife-edge, flat- and roller-ended followers working in-line with the axis of the cam. Problems will be set to draw cam profiles from given cam data or vice versa.

1.1.6 Graphical statics

Coplanar concurrent and non-concurrent forces.
Use of Bow's notation, polar diagram and link polygon to determine the resultant/equilibrant of a system of coplanar forces.
Shear force and bending moment diagrams for light simply supported beams and cantilevers, loaded only with vertical concentrated loads. Hinged beams (i.e. beams made of two parts hinged together and resting on three supports) and frameworks are excluded.

1.2 Solid geometry

1.2.1 Orthographic projection of points, lines and simple solids.

1.2.2 The true length, true angle to the HP and VP.

1.2.3 Sections of solids inclined to one plane of reference.

1.2.4 First auxiliary projection in first and third angle projections.

1.2.5 Interpenetration of right geometrical prisms, pyramids, cylinders and cones at any angle, limited only to axes in the same plane. The interpenetration of a cone and a pyramid, two cones and two pyramids is excluded.

1.2.6 Developments of surfaces, to include: prisms, pyramids, cylinders, cones, oblique pyramids and oblique cones.

1.2.7 Development by triangulation of transition pieces having parallel vertical or parallel horizontal sections describing circles, squares, rectangles, hexagons and pentagons.

1.2.8 Right geometrical solids in contact with each other lying on the HP. The projection of the resulting points and lines of contact.

1.2.9 The helix: right-hand and left-hand; the true length of the helix; the helix angle, excluding its application as being the true angle of the tangent drawn at any point on the helix. Applications of the helix: the helical vane; round- and square-section springs; single-start, vee and square threads. Internal threads are excluded.

1.2.10 Isometric drawing with the use of the isometric scale. The sphere is excluded.

2 Engineering Drawing

Due importance is expected to be given to clear and neat dimensioning from centres and reference lines in the presentation of engineering drawings.

2.1 The presentation of orthographic engineering drawings makes use of various conventions. The conventions associated with the items listed below are assumed:

2.1.1 Sectional views, including full, half, part, revolved, removed and staggered.

2.1.2 Symmetry, repetitive information and long components.
Designation of plain holes, countersinks, counterbores and spotfaces.
Designation of metric screw threads.

2.1.3 Sectioning practice that applies for:

a) Bolts, nuts and washers.
b) Webs and ribs.
c) Shafts and pins.
d) Spokes and keys.

2.2 Candidates are expected to be familiar with:

a) Screw fasteners and screw threads.
b) Locking Devices.
c) Keys, keyways and splines.
d) Simple shaft couplings and shaft bearings**.**

2.3 Candidates are expected to be able to produce:

a) Freehand sketching without instruments from given views.
b) Assembly drawings from given exploded in-line pictorial views (up to a maximum of 10 separate parts) or from orthographic details of separate parts in full plan and elevation and/or in sectional views.

3 Graphical Communication

Work in this section will be based on graphical presentations found in the general environment, as a source of artefacts suitable for the application of graphical communication. The following listed areas are to be covered without specialised knowledge, as the given case studies will include the necessary information: logograms; ideograms and trade symbols; Advertising and display of products and themes via poster design.

3.1 Graphical analysis, comparison and presentation of data

An understanding of the values of graphs and charts for the rapid and effective communication of information, comparative information and statistics.
The selection and design of the following:
Charts: Flow, Layout, Pie, Bar.
Graphs: Line; Block.

3.2 Methods of graphical illustration

Planometric drawing, isometric drawing, estimated single and two-point perspective drawing applied to simple architectural plans of the local habitat.
Freehand sketching using all the above methods.

3.3 Presentation

The ability to select and use colour effectively.
Candidates are expected to use their own judgement in the choice of drawing materials and the methods best suited for the work in hand. Candidates should understand the variety of possibilities for graphic representation like portrait and landscape formats, detail drawing and part drawings.

3.4 The Design Process

The graphic design process as broken down in the following steps:

a) The Situation
b) The Design Brief
c) Written Analysis
d) Graphical Analysis
e) Design Synthesis
f) Final Realisation

Candidates are expected to appreciate the role of freehand drawing and graphical communication in general, while executing steps (d), (e) and (f) of the design process.

Reading list

Eanna O Broin	**Technical Draughtmanship**	ISBN: 9780717116522
Colin H Simmons et al	**Manual of Engineering Drawing**	ISBN: 9780080966526
Edward Jackson	**Advanced Level Technical Drawing**	ISBN: 9780582355255
Francis X Dalli	**Graphical Statics**	ISBN: 9789995702311