

**IM SYLLABUS (2011)**

**ENGINEERING DRAWING  
AND GRAPHICAL COMMUNICATION**

**IM 09**

***SYLLABUS***

<b>Engineering Drawing and Graphical Communication</b> <b>IM 09</b> (Available in September) <b>Syllabus</b> 1 Paper (3 hours)
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### **Aims**

The aims of the syllabus are to further the ability to communicate information by graphical means and to develop an interest in engineering drawing and graphical communication at intermediate level. This will be achieved through the ability to visualise and understand spatial relationships; the ability to apply geometrical principles and to select and use appropriate graphical methods for communicating information, analysing engineering problems and representing design concepts.

It is anticipated that this syllabus will form a two-year course. This syllabus assumes knowledge of the SEC29 Graphical Communication syllabus.

### **The Examination**

The examination consists of one three hour paper having the following structure:

**Section A** covers the **Core** part of the syllabus where 5 questions are set to choose 4. Each question carries 13% of the marks i.e. 52% are allotted for the section (candidates are advised to spend 90 minutes on this section).

**Section B** covers the **Engineering Drawing** part of the syllabus where 2 questions are set, to choose 1. This section carries 24% of the marks (candidates are advised to spend 45 minutes on this section).

**Section C** covers the **Graphical Communication** part of the syllabus where 2 questions are set, to choose 1. This section carries 24% of the marks (candidates are advised to spend 45 minutes on this section).

Candidates will be provided with drawing sheets as specified by the examiners. The criteria of assessment will be those of clarity, proportion and uniformity in presentation.

Candidates are expected to provide their own A2 size drawing board and draughting equipment. Only non-programmable calculators are allowed. The use of draughting aids is permitted.

Questions will be set in SI units and in accordance with the following revised editions and their equivalent ISO standards:

BS 8888:2004; PP8888-1: 2005; BS EN ISO11091:1999.

Symbols and conventions used will conform to British Standards (BS) or their equivalent ISO standards.

# 1 Core

## 1.1 *Plane geometry*

### 1.1.1 Conic sections

The parabola as a section of a cone.  
The parabola inscribed to 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 inscribed to 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 shape utilizing the true involute profile. 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  
Uniform velocity (UV)  
Simple Harmonic (SHM)  
Uniform Acceleration and Retardation (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 profile from given cam data.

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 loaded with vertical concentrated loads. Cantilevers, 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 projection.

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 and 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 of contact.
- 1.2.9 The helix: Left and right hand; the true length; the helix angle. Applications: springs (square and round section); vane; threads (square and single start vee).
- 1.2.10 Isometric drawing with the use of the isometric scale.

## **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 rules 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, 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**

Studies in this section will be based on graphical presentations found in the general environment, as a source of artifacts suitable for the application of graphical communication. The following listed areas are to be covered without specialised knowledge as case studies will include the necessary information: simple local architectural plans of habitats; advertising and display of products.

#### 3.1 *Graphical analysis and information presentation*

An understanding of the values of graphs and charts for the rapid communication of 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; oblique drawing.

Estimated single and two-point perspective drawing. Freehand sketching using all types of pictorial drawing.

#### 3.3 *Presentation*

The ability to select and use colour effectively. Drawing with aids and stencils; tracing in pencil and ink.

Candidates are expected to use their own judgement in the choice of drawing materials and 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 *Design*

Candidates will be expected to show an understanding and appreciation of graphical communication as an essential part of the design process with emphasis on freehand drawing as used in showing design synthesis.

#### **Recommended Textbook:**

Broin, E.O. Technical Draughtsmanship. ISBN 01717116522

Publisher: Gill and Macmillan.