

TECHNICAL DESIGN

GRAPHICAL COMMUNICATION OPTION

SYLLABUS

FORM 1 - FORM 5

The Syllabus has been drawn within the parameters of the S.E.C. 29 Syllabus for Technical Design / Graphical Communication Option 2002 - 2005. It would be advisable to check the S.E.C. syllabus at the beginning of each year and include any revisions, which may have taken place.

Hereunder is the amended Technical Design Syllabus as agreed to by the subject teachers who attended the in-service course held in July 2000.

This syllabus, which is to be used in both the Junior Lyceums and Area Secondary Schools, reflects the new S.E.C. syllabus for 2002-2005. Provisions for students who choose the subject in the third year in Junior Lyceums or in the fourth year in Area Secondary schools are also included.

C. SPITERI
Education officer
Design and Technology

AIMS AND OBJECTIVES

Amongst other aims the syllabus should:

- Contribute to the pupil's personal development and overall education.
- Develop the pupil's ability to interpret, reason and communicate graphically.
- Stimulate an interest in and enjoyment of the study of graphical techniques and their application.

Throughout the course the student is expected to be able to demonstrate

- Knowledge
- *Comprehension
- Application
- Analysis
- Technique.

Knowledge of

- Drawing equipment
- Constructions, terminology and conventions applicable to the subject.
- Principles of orthographic and pictorial projections.

Comprehension

- Interpretation of the information given (verbally, in written form, graphically, or a combination of two or more), so as to represent design concepts.
- Consideration and representation of plane and solid shapes.
- Understanding and visualizing spatial relationships.

Application

- Production of suitable drawings from information given.
- Application of the principles of plane and solid geometry to the solution of problems.
- Application of the principles of orthographic and pictorial projection.

Analysis

- Comparison and use of the appropriate graphical methods of communicating information and ideas.
- Analysis of and solutions to a problem graphically.

Technique

- Accuracy in questions answered.
- Ability to sketch freehand and in good proportions.
- Presentation of good draughtsmanship (presentation, cleanliness, finishing, spacing etc.)
- Use of available aids and media to enhance the presentation where appropriate.

Note:

Neatness, presentation and accuracy should be stressed regularly throughout the whole course. Technical terms and details should be used when encountered

FORM 1

1 THE EQUIPMENT

- 1.1 Pencils** Types of pencils - common and clutch. Codes used on pencils (6H----H HB B---6B). Pencils used in the subject. Sharpening of pencils: pencil point should always be sharp for accuracy, neatness and presentation.
- 1.2 Erasers** Types of. Synthetic and natural rubber. Soft and hard.
- 1.3 Rulers** Common types: wooden, plastic (metal should not be used). Attention when measuring to avoid errors.
- 1.4 Paper** Types of. Grading by weight and surface finish. Common metric sizes, A sizes.
- 1.5 Drawing boards** Types of boards: wooden or plastic used by students, and drafting machines and plotters used in drawing offices. Sizes.
- 1.6 Board clips** Their use and alternatives. Drafting tape or sellotape, pins, other fasteners.
- 1.7 Tee-squares** Wooden or plastic. Fixed or adjustable. Sizes
- 1.8 Set squares** Types of. Material–sizes–names (30/60 and 45).
Safe use. Students should be taught how to handle and use the setsquares and how to draw angles with one or two setsquares (30° and $45^{\circ}=75^{\circ}$).

1.9 The protractor

Proper use of. Inside and outside reading. Right-handed and left-handed reading. Reading of angles on perpendicular, vertical and inclined bases.

1.10 Compasses

Types: spring, small, wheel operated, etc. Emphasis on having good quality instruments. Two compasses, one for small circles, should be encouraged. Safe use of these instruments.

1.11 Dividers

Use of. Safe and proper handling of.

1.12 Other equipment

Drawing aids: French curves, flexi curve, radius curves, templates, others. These should not be encouraged at this stage but should be mentioned as general knowledge. They can be used later on after acquiring drafting skills.

2 DRAWING TECHNIQUES

2.1 Lines

Types of. **Outlines** - bold and dark - H or HB pencil. **Construction / projection / dimension** lines - thin and faint (feint) - 2H pencil. Emphasis on difference. The other types of lines should be dealt with as they come along.

2.2 Borders

Borderlines and title block/panel. All necessary information to be included when appropriate: name, class date, drawing number, scale and projection.

2.3 Lettering

Simple block lettering. Freehand and between guidelines for uniformity (note that 3mm to 5mm is the ideal height). Lettering should be checked regularly. Stencils or dry transfers should not be encouraged.

2.4 Measuring out

Proper method of measuring out with the use of dividers and ruler. Direct transfer of measurement from the ruler to the drawing should be discouraged.

3 GEOMETRICAL CONSTRUCTION

3.1 Bisection

Bisection of horizontal, vertical and inclined lines using the compasses. Multiple bisections -4,8 etc. Attention should be drawn to the fact that a perpendicular (90°) is produced.

3.2 Perpendiculars

Erection from a central point on a line. Erection from a point near the edge of a line. Dropping a perpendicular from a point above the line. Erection of a perpendicular to one end of the line. The line could be in a vertical, horizontal or inclined position.

3.3 Division of lines

Division of a line into a number of equal parts. Use of set squares, compasses and dividers. Accuracy should be emphasized. Practising of parallel lines with the use of set squares.

3.4 Angles

Right angle, acute, obtuse and reflex. **Construction** of angles with the use of set squares ($30^{\circ}+45^{\circ}=75^{\circ}$), protractor and/or compasses. **Bisection** of angles by means of set squares and compasses.

3.5 Triangles

Types of triangles: right angled, obtuse angled, acute angled, equilateral, isosceles, scalene. **Technical names:** vertex, base, altitude. **Properties** of triangles: triangles in a semicircle, triangles between parallels. **Construction** of triangles from given data.

3.6 Quadrilaterals

Types of: square, rectangle, parallelogram, rhombus, trapezium, kite, etc. Their properties. Their construction.

3.7 The circle

Parts of the circle: circumference, radius, sector, quadrant, diameter, centre, segment, chord, arc, semicircle, etc.

3.8 Polygons

Pentagon, hexagon, heptagon and octagon. Regular and irregular. Properties of regular polygons. Their construction by protractor angles.

3.9 The hexagon

Construction: by means of Set squares and Tee square. Inscribed in a circle using the compasses; Inscribed in a circle using the 60° set square. Circumscribed around a circle using the set squares, etc.

3.10 The octagon

Construction of the octagon in a circle and in a square.

3.11 The Pentagon

Construction of the pentagon and heptagon by means of the protractor.

3.12 Application

Application of the above geometrical constructions in practical examples.

4 ORTHOGRAPHIC PROJECTION

- 4.1 Orth. Proj.** Introduction to orthographic projection. **1st angle** projection with straight lines only and including vertical, horizontal and inclined lines. End elevation to be drawn on either side of the front elevation (also drawn on both sides of the front).
- 4.2 Hidden lines** Blocks with hidden edges (**dotted lines**), drawn according to the B.S. - slots and square / rectangular holes.
- 4.3 Free-hand** Free-hand sketches of elevations on squared (grid) paper. Several examples could be given where two views are given and the third is to be added. Enlargement of figures / drawings using grids.

5 PICTORIAL PROJECTION

- 5.1 Isometric** Simple blocks such as cubes, rectangular and stepped blocks, etc. Vertical and horizontal lines only and from pictorial to isometric. Isometric paper can be used.

6 IDEOGRAMS

- 6.1 Ideograms** Introduction to 'information graphics'- Traffic and Safety signs - Introduction to shading and colours.

FORM 2

Revision of Form 1 Syllabus. Problems and exercises.

1 GEOMETRICAL CONSTRUCTION

- 1.1 Division of lines** Division of straight lines into a given ratio.
- 1.2 Polygons** Construction of regular polygons in a given circle.
Construction of regular polygons on a given line (one side given).
- 1.3 The circle** Parts of the circle. Problems related to the circle.
Finding the centre of a circle. Circles inscribed in triangles, squares and polygons. Circumscribed circles. Escribed circles.
- 1.4 Application** Application of the above geometric constructions in practical examples.

2 ORTHOGRAPHIC PROJECTION

- 2.1 Orthog. Proj.** Further exercises regarding blocks with straight lines only and including horizontal, vertical and inclined lines/slopes. Blocks with **hidden edges** and with square or rectangular holes. (as in Form 1- 4.2) Introducing curved lines, holes and **centerlines**. Introducing **3rd angle** orthographic projection. Both projections should be used regularly.

3 PICTORIAL PROJECTION

3.1 Isometric Projection Straight lines including vertical, horizontal and inclined. To be drawn from given isometric, oblique and simple orthographic views.

3.2 Oblique Projection Introduction. (Similar to 3.1) To be in **CABINET** form with the 3rd axis at 45° and half- true length. **CAVALIER** oblique to be mentioned as general knowledge only.

4 SOLID GEOMETRY

4.1 Prisms Square, hexagonal, octagonal, triangular and rectangular. Three elevations and development of mentioned prisms without truncations. **Fold lines.**

4.2 Pyramids As 4.1, but using examples of pyramids with true length in elevation.

5 IDEOGRAMS

5.1 Ideograms Continuation of work done in Form with emphasis on preliminary sketches of different ideas, presentation and colour/shading.

FORM 3

Note: As you are aware students may opt to start Technical Design in Form three in Junior Lyceums. These should preferably be held in separate classes as is being done in the case of foreign languages. The syllabus should be covered in 3 years. **See appendix 1 at the end of syllabus.**

Revision of Form 1 and 2 syllabi. Problems and exercises.

1 GEOMETRICAL CONSTRUCTION

- | | |
|------------------------------|--|
| 1.1 The circle | Circles touching; two and three circles touching; internal and external; tangential arcs. |
| 1.2 Tangents | To a point on the circumference. From a point outside the circle. Tangents to equal and unequal circles (external and internal tangents). |
| 1.3 Polygons | General revision. Regular and irregular polygons drawn from given data. |
| 1.4 Division of lines | Proportional division of lines. Its application in drawing figures (e.g. Triangle with sides 2:4:5-perimeter 200), etc. |
| 1.5 Enlargement | Linear enlargement and reduction of regular or irregular figures with straight lines only. Use of radial method to a given measurement or ratio (see 1.4). |

1.6 The ellipse

Construction of the ellipse. Five methods: Auxiliary circles or Concentric circles, Trammel, Intersecting lines or Rectangle, Intersecting arcs or Foci or Radial interceptors and Compasses or Approximate. Construction of circles and lines tangential to the ellipse.

2 ORTHOGRAPHIC PROJECTION

2.1 Orthog. Proj.

Further examples of 1st and 3rd angle, including webs etc. Introducing the projection of the third view from the given two elevations.

2.2 Sectioning

Introducing simple whole sectioning. **Section lines** at 45° and equally spaced.

3 SOLID GEOMETRY

3.1 Prisms

Square, rectangular, hexagonal, etc. truncated at different angles - including elevations, true shape of section and development. Truncation may be sectioned.

3.2 The Cylinder

Truncated at different angles and as 3.1

3.3 Pyramids

Square, rectangular, hexagonal, etc. truncated at different angles - including elevations, **true shape** of section and development. Introducing **true lengths**.

3.4 The Cone

Truncated at different angles and as 3.3.

3.5 Inclined Prisms and cylinders standing inclined at an angle to one of the principal planes – to project the other two elevations.

4 PICTORIAL PROJECTION

4.1 Isometric Construction of isometric projections including circles and arcs by the use of a grid, ordinates and approximate (compasses) method.

4.2 Oblique Cabinet with straight and curved lines.

5 GRAPHICS

5.1 Logos Introduction to. 3 types – Monograms (letters), Designs, and Combination of monograms and Designs.

5.2 Ideograms Harder examples and exercises

5.3 Graphs Introduction to. Line, bar, pie, block, pictographs, percentage bar, etc. Keys / Legends and colour coding.

5.4 Maps Introduction to map reading. Route walks. One-way routes. Networks (train, buses etc). Keys/Legends and colour coding.

FORM 4

Note: As you are aware students may opt to start Technical Design in Form Four in Secondary Schools. These should preferably be held in separate classes as is being done in the case of foreign languages. The syllabus should be covered in 2 years. **(See appendix 2 at the end of syllabus)**

Revision - problems and exercises. **Emphasis on time management.**

1 GEOMETRICAL CONSTRUCTION

- 1.1 Enlargement** Linear enlargement and reduction of figures having straight and curved lines. Different methods to be used - radial, pole, proportional and grids.
- 1.2 Areas** **Conversion** of areas. Polygon to quadrilateral, triangle, rectangle, square. Rectangle to rectangle. Rectangle to square, etc.
- 1.2 Areas** **Determination** of areas of regular or irregular figures bound by straight and curved lines. Both squares and parts of and mid-ordinate methods are to be used.
- 1.3 Loci** Loci of simple moving parts/mechanisms. Circular and reciprocating co-planar motion. Glissette, Cranks, Cycloids, Involutives, Archimedean spiral and **Helix.**

1.4 Helix To cover simple line helices with one or more revolutions. Its application. Springs (circular, rectangular or square). Handrails, etc. (threads not considered.)

1.5 Scales Simple or plain scale and its application.

2 SOLID GEOMETRY

2.1 Conic sections The ellipse, the parabola and the hyperbola as conic sections and using the **radial and sections** method. Developments - radial method.

Projection of elevations from given developments.

2.2 Inclined See Form 3: 3.5.

3 ORTHOGRAPHIC PROJECTION

3.1 Assembly Orthographic projection of assembled components from: in-line exploded pictorial projection, from orthographic views, and combination of.

3.2 Sectioning Whole, half, part, staggered, removed, revolved.

3.3 Conventions Simple B.S. drawing conventions to represent components in engineering drawing and including dimensioning. Refer to PD7308.

3.4 Free hand Freehand sketching of orthographic views, with straight and curved lines, in good proportion.

4 PICTORIAL PROJECTION

- 4.1 Planometric** Introduction to planometric projection. Horizontal axis of the object to be $45^{\circ} / 45^{\circ}$ or $60^{\circ} / 30^{\circ}$. In the case of $45^{\circ} / 45^{\circ}$ the height may be reduced depending on height of object. Including straight and curved lines.
- 4.2 Perspective** Introduction to perspective projection. **Estimated** only. Single-point and two points perspective. Shading.
- 4.3 Free hand** Freehand sketching of pictorial views with straight and curved lines in good proportion and either shaded or unshaded.

5 GRAPHICS

- 5.1 Ideograms** Harder examples. Past papers
- 5.2 Logos** Harder examples. Past papers
- 5.3 Maps** Harder examples. Past papers.
- 5.4 Electricity** Introduction to electrical circuits.
- 5.5 Graphs** Harder examples. Past papers.

5.6 Flow Charts

Simple flow charts of practical nature with symbols for Terminals, Processes, Inputs / Outputs, Decisions and Connectors.

5.7 Design.

Design in relation to graphical presentation. To find and draw a solution to a given simple problem in design. See specimen paper S. E. C. 2002 -2005 syllabus.

FORM 5

Revision as in previous years with emphasis on time management.

1 GEOMETRICAL CONSTRUCTIONS

- 1.1 Scales** Revision of the simple scale and introduction to diagonal scales.
- 1.2 Vectors** Simple vectors. Triangle and polygon of forces. Coplaner and concurrent only.

2 SOLID GEOMETRY

- 2.1 Interpenetration** Interpenetration of solids. Lines of intersections, between prisms and cylinders, equal and unequal in diameter. Interpenetrations to be restricted to solids whose axes are perpendicular. These axes may either lie in the same vertical plane or offset, but always parallel to the vertical plane. Developments.

3 ORTHOGRAPHIC PROJECTION

- 3.1 Auxiliary** Auxiliary views of simple objects. Auxiliary plan and auxiliary elevation. Given auxiliary elevation and plan to draw the front and side elevations.
- 3.2 Lines** Lines in space. Finding their true length by rotation or auxiliary projection. Lines to be drawn in isometric in relation to the vertical and horizontal planes.

4 GRAPHICS

- 4.1 Ideograms** Harder examples. Past papers.
- 4.2 Maps** Harder examples. Past papers.
- 4.3 Logos** Harder examples. Past papers.
- 4.4 Electricity** Harder examples. Past papers.
- 4.5 Symbols** Building symbols. Simple plans of dwellings / buildings and contents.
- 4.6 Charts** Sequence of work. (as in Do-it-Yourself Kits)
- 4.7 Design** See Form 4: 5.7.

Revision of work through past papers with emphasis on accuracy, presentation and time management.

APPENDIX 1

TECHNICAL DESIGN - Taken as a third-year option in Junior Lyceums.

FORM 3 year 1

1 THE EQUIPMENT

- 1.1 Pencils** Types of pencils, common and clutch. Codes used on pencils (6H----H HB B---6B). Pencils used in the subject. Sharpening of pencils. Pencil point should always be sharp for accuracy, neatness and presentation.
- 1.2 Erasers** Types of. Synthetic and natural rubber, soft and hard.
- 1.3 Rulers** Common types: wooden, plastic (metal should not be used). Attention when measuring to avoid errors.
- 1.4 Paper** Types of: Grading by weight and surface finish. Common metric sizes: A sizes.
- 1.5 Drawing boards** Types of boards: wooden or plastic used by students and drafting machines used in drawing offices. Sizes.
- 1.6 Board clips** Their use and alternatives. Drafting tape or sellotape, pins, other fasteners.
- 1.7 Tee-square** Wooden or plastic. Fixed or adjustable. Sizes.

1.8 Set squares

Types of. Material - sizes - names (30 / 60 and 45). Safe use. Students should be taught how to handle and use the set squares. How to draw angles with one or two set squares (30° and $45^{\circ} = 75^{\circ}$).

1.9 The protractor

Proper use of. Inside and outside reading. Right- and left-handed reading. Reading of angles on perpendicular, vertical and inclined bases.

1.10 Compasses

Types: Spring, small, wheel operated, etc. Emphasis on having good quality instruments. Two compasses with one for small circles, should be encouraged. Safe use of these instruments.

1.11 Dividers

Use of. Safe and proper handling of.

1.12 Other equipment

Drawing aids: French curves, flexi curve, radius curves, templates, others. They should not be encouraged at this stage - should be mentioned for general knowledge - can be used later on after acquiring drafting skills.

2 DRAWING TECHNIQUES

2.1 Lines

Types of: **Outlines** - bold and dark - H pencil or an HB. **Construction / projection / dimension lines** - thin and faint (feint)-2H pencil. Emphasis on difference. The other types of lines will be dealt with as they come along.

2.2 Borders

Borderlines and title block / panel. All necessary information to be included when appropriate: Name, class date, drawing number, scale and projection.

2.3 Lettering

Simple block lettering. Freehand and between guidelines for uniformity (note that 3mm to 5mm is ideal height). Lettering should be checked regularly. Do not encourage stencils or dry transfers.

2.4 Measuring out

Proper method of measuring out with the use of the dividers and ruler. Discourage direct transfer of measurement from the ruler to the drawing.

3 GEOMETRICAL CONSTRUCTION

3.1 Bisection.

Bisection of horizontal, vertical and inclined lines using the compasses. Multiple bisections: 4, 8, etc. Attention should be drawn to the fact that a perpendicular (90°) is produced.

3.2 Perpendiculars

Erection from a central point on a line. Erection from a point near the edge of a line. Dropping a perpendicular from a point above the line Erection of a perpendicular to one end of the line The line can be in a vertical, horizontal or inclined position.

3.3 Division of lines

Divide a line into a number of equal parts. Use of set squares, compasses and dividers. Accuracy emphasized. Practising parallel lines with the use of set squares. Division of straight lines to a given ratio. Its application in drawing figures.

3.4 Angles

Right angle, acute, obtuse and reflex. **Construction** of angles with the use of set squares ($30^{\circ} + 45^{\circ} = 75^{\circ}$) protractor and/or compasses. **Bisection** of angles by means of set squares and compasses.

3.5 Triangles

Types of triangles: right angled, obtuse angled, acute angled, equilateral, isosceles, scalene. **Technical names:** vertex, base, altitude. **Properties** of triangles: triangles in a semicircle, triangles between parallels. **Construction** of triangles from given data.

3.6 Quadrilaterals

Types of: square, rectangle, parallelogram, rhombus, trapezium, kite, etc. Their properties. Their construction.

3.7 Polygons

Pentagon, hexagon, heptagon and octagon. Regular and irregular. Properties of regular polygons. Their construction by protractor angles.

3.8 The Octagon

Its construction in a circle and in a square.

3.9 The Hexagon

Construction by means of: Set squares and Tee square: Inscribed in a circle using the compasses: Inscribed in a circle using the 60° set square. Circumscribed around a circle using the set squares, etc.

3.10 The Pentagon

Construction of the pentagon and heptagon by means of the protractor. .

3.11 Polygons

Construction of regular polygons in a given circle.
Construction of regular polygons on a given line (one side given).

3.12 The Circle

Parts of the circle: circumference, radius, sector, quadrant, diameter, centre, segment, chord, arc, semi circle, etc. Problems related to the circle. Finding the centre of a circle. Circles inscribed in triangles, squares and polygons. Circumscribed circles. Escribed circles.

Tangents: To a point on the circumference. From a point outside the circle. Tangents to **equal and unequal circles** (external and internal tangents). Circles touching - two and three circles touching internal and external - tangential arcs.

3.13 Enlargement

Linear enlargement and reduction of regular or irregular figures with straight lines. Use of radial method to a given measurement or ratio (see 3.3).

3.14 Application

Application of the above geometrical constructions in practical examples.

4 ORTHOGRAPHIC PROJECTION

4.1 Orth. Proj.

Introduction to orthographic projection. 1st angle and 3rd angle orthographic projection. Both projections should be used regularly. Projection with straight lines and including vertical, horizontal and inclined lines. End elevation to be drawn on either side of the front elevation (can also be drawn on both sides of the front).

- 4.2 Hidden details** Blocks with hidden edges (**dotted lines**) drawn according to the B.S., slots and square/rectangular holes. Introducing curved lines, holes and **centerlines**.
- 4.3 Sectioning** Introducing simple whole sectioning. Section lines are equally spaced and at 45° .
- 4.4 Free-hand** Free-hand sketches of elevations on squared (grid) paper. Several examples can be given where two views are given and the third is to be added. Enlargement of figures / drawings using grids.
- 5 SOLID GEOMETRY**
- 5.1 Prisms** Square, rectangular, hexagonal, etc. truncated at different angles and including elevations. True shape of section and development (**fold lines**). Truncation may be sectioned.
- 5.2 The Cylinder** Truncated at different angles and as in 5.1
- 5.3 Pyramids** Square, rectangular, hexagonal, etc. truncated at different angles and including: elevations, **true shape** of section and development. Introducing **true lengths**.
- 5.4 The Cone** Truncated at different angles and as in 5.3.
- 5.5 Inclined** Prisms and cylinders standing inclined at an angle to one of the principal planes. To project side elevation and plan.

6 PICTORIAL PROJECTION

6.1 Isometric Projection

Introduction. Straight lines, including vertical, horizontal and inclined. To be drawn from given isometric, oblique and simple orthographic views.

Curved lines including circles, arcs and cylinders.

Use of grid, ordinates and approximate (compasses) method

6.2 Oblique Projection

Introduction. Similar to 6.1. To be in **CABINET** form with the 3rd axis at 45° and half true length.

CAVALIER oblique to be mentioned for general knowledge only.

1 GEOMETRICAL CONSTRUCTION

- 1.1 The Ellipse** Construction of the ellipse. Five methods - Auxiliary circles or Concentric circles, Trammel, Intersecting lines or Rectangle, Intersecting arcs or Foci or Radial interceptors and Compasses or Approximate. Construction of lines and circles tangential to the ellipse.
- 1.2 Loci** Loci of simple moving parts/mechanisms. Circular and reciprocating co-planar motion. Glissette, Cranks, Cycloids, Involutives, Archimedean spiral and **Helix**.
- 1.3 Helix** To cover simple line helices with one or more revolutions. Its applications such as Springs - circular, rectangular or square. Other applications (threads not considered).
- 1.4 Scales** Simple or plain scale. Its application.
- 1.5 Enlargement** **Linear** enlargement and reduction of figures having straight and curved lines. Different methods to be used: radial, pole, proportional, etc.
- 1.6 Areas** **Conversion** of areas. Polygon to quadrilateral, triangle, rectangle, square. Rectangle to rectangle. Rectangle to square etc.

1.7 Areas

Determination of areas of regular or irregular figures bound by straight and curved lines. Both methods - squares and parts of - and mid-ordinate, methods are to be used.

2 SOLID GEOMETRY

2.1 Conic sections

The ellipse, the parabola and the hyperbola as conic sections and using **radial and sections** method. Developments - radial method. Projection of elevations from given developments.

2.2 Inclined

See Form 3 Year 1: 5.5

3 ORTHOGRAPHIC PROJECTION

3.1 Assembly

Orthographic projection of assembled components from: in line exploded pictorial projection. From orthographic views and combination of.

3.2 Sectioning

Whole, half, part, staggered, removed, revolved.

3.3 Conventions

Simple B.S. drawing conventions to represent components in engineering drawing. Dimensioning included. Refer to PD7308.

3.4 Free-hand

Free-hand sketching of orthographic views with straight and curved lines in good proportion.

4 PICTORIAL PROJECTION

- 4.1 Planometric** Introduction to planometric projection. Horizontal axis of the object to be 45° / 45° or 60° / 30° . In the case of 45° / 45° the height may be reduced, depending on height of object. Including straight and curved lines.
- 4.2 Perspective** Introduction to perspective projection. **Estimated** only. Single point and two points perspective. Shading.
- 4.3 Free hand** Free-hand sketching of pictorial views with straight and curved lines in good proportion and either shaded or unshaded.

5 GRAPHICS

- 5.1 Ideograms** Introduction and examples of.
- 5.2 Logos** Introduction and examples of.
- 5.3 Maps** Introduction and examples of.
- 5.4 Electricity** Introduction to electrical circuits and examples of.
- 5.5 Graphs** Line, block , pie, pictograms, etc.
- 5.5 Flow Charts** Simple Flow Charts of practical nature. Symbols used - terminals, process, input / output, decisions and connectors.

5.6 Design

Design in relation to graphical presentation. To find and draw a solution to a given simple problem in design. See specimen paper SEC 2002 -2004 syllabus.

THE SYLLABUS FOR FORM 5 REMAINS THE SAME.

APPENDIX 2

TECHNICAL DESIGN - Taken as a 4th year option in Secondary Schools (5 lessons per week)

FORM 4 Year 1

1 THE EQUIPMENT

- 1.1 Pencils** Types of pencils: common and clutch. Codes used on pencils (6H----H HB B---6B). Pencils used in the subject. Sharpening of pencils. Pencil point should always be sharp for accuracy, neatness and presentation.
- 1.2 Erasers** Types of. Synthetic and natural rubber. Soft, hard.
- 1.3 Rulers** Common types: wooden, plastic (metal should not be used). Attention when measuring to avoid errors.
- 1.4 Paper** Types of. Grading by weight and surface finish. Common metric sizes: A sizes.
- 1.5 Drawing boards** Types of boards: wooden or plastic used by students and drafting machines used in drawing offices. Sizes.
- 1.6 Board clips** Their use and alternatives. Drafting tape or sellotape, pins, other fasteners.
- 1.7 Tee-square** Wooden or plastic. Fixed or adjustable. Sizes.

- 1.8 Set squares** Types of. Material, sizes, names (30 / 60 and 45). Safe use. Students should be taught how to handle and use the set squares. How to draw angles with one or two set squares (30° and $45^{\circ} = 75^{\circ}$).
- 1.9 The protractor** Proper use of. Inside and outside reading. Right- and left-handed reading. Reading of angles on perpendicular, vertical and inclined bases.
- 1.10 Compasses** Types: spring, small, wheel operated, etc. Emphasis on having good quality instruments. Two compasses, with one for small circles, should be encouraged. Safe use of these instruments.
- 1.11 Dividers** Use of. Safe and proper handling of.
- 1.12 Other equipment** Drawing aids: French curves, flexi curve, radius curves, templates, others. These should not be encouraged at this stage. Should be mentioned for general knowledge and can be used later on after acquiring drafting skills.

2 DRAWING TECHNIQUES

- 2.1 Lines** Types of. **Outlines** - bold and dark - H pencil or an HB. **Construction / projection / dimension lines** - thin and faint (feint) 2H pencil. Emphasis on difference. The other types of lines will be dealt with as they come along.

- 2.2 Borders** Borderlines and title block / panel. All necessary information to be included when appropriate. Name, class date, drawing number, scale and projection.
- 2.3 Lettering** Simple block lettering. Freehand and between guidelines for uniformity (3mm to 5mm is ideal height). Lettering should be checked regularly. Do not encourage stencils or dry transfers.
- 2.4 Measuring out** Proper method of measuring out with the use of the dividers and ruler. Discourage direct transfer of measurement from the ruler to the drawing.

3 GEOMETRICAL CONSTRUCTION

- 3.1 Bisection** Bisection of horizontal, vertical and inclined lines using the compasses. Multiple bisections - 4, 8 etc. Attention should be drawn to the fact that a perpendicular (90°) is produced.
- 3.2 Perpendiculars** Erection from a central point on a line. Erection from a point near the edge of a line. Dropping a perpendicular from a point above the line. Erection of a perpendicular to one end of the line. The line can be in a vertical, horizontal or inclined position.
- 3.3 Division of lines** Divide a line into a number of equal parts. Use of set squares, compasses and dividers. Practicing parallel lines with the use of set squares. Division of straight lines to a given ratio. Its application.
- 3.4 Angles** Right angle, acute, obtuse and reflex. Construction of angles with the use of set squares ($30^{\circ} + 45^{\circ} =$

75°) protractor and/or compasses. Bisection of angles by means of set squares and compasses.

3.5 Triangles

Types of triangles: right-angled, obtuse-angled, acute angled, equilateral, isosceles, scalene. Technical names: vertex, base, altitude. Properties of triangles: triangles in a semicircle, triangles between parallels. Construction of triangles from given data.

3.6 Quadrilaterals

Types of Square, rectangle, parallelogram, rhombus, trapezium, kite, etc. Their properties. Their construction.

3.7 Polygons

Pentagon, hexagon, heptagon and octagon. Regular and irregular. Properties of regular polygons. Their construction by protractor angles.

3.8 The Hexagon

Construction by means of: Set squares and tee square. Inscribed in a circle using the compasses. Inscribed in a circle using the 60° set square. Circumscribed around a circle using the set squares.

3.9 The Octagon

Its construction in a circle and in a square.

3.10 The Pentagon

Construction of the pentagon and heptagon by means of the protractor. .

3.11 Polygons

Construction of regular polygons in a given circle. Construction of regular polygons on a given line (one side given).

3.12 The circle

Parts of the circle: circumference, radius, sector, quadrant, diameter, centre, segment, chord, arc, semi-circle, etc. Problems related to the circle: Finding the centre of a circle. Circles inscribed in triangles, squares and polygons. Circumscribed circles. Escribed circles.

Tangents - to a point on the circumference. From a point outside the circle. Tangents to **equal and unequal circles** (external and internal tangents).

Circles touching - two and three circles touching internal and external - tangential arcs.

3.13 The Ellipse

Construction of the ellipse. Five methods: Auxiliary circles or Concentric circles, Trammel, Intersecting lines or Rectangle, Intersecting arcs or Foci or Radial interceptors and Compasses or Approximate. Construction of circles and lines tangential to the ellipse.

3.14 Scales

Simple or plain scale. Its application.

3.15 Application

Application of the above geometrical constructions to practical examples.

4 ORTHOGRAPHIC PROJECTION

4.1 Orth. Proj.

Introduction to orthographic projection. **1st angle and 3rd angle** orthographic projection. Both projections should be used regularly. Projection with straight lines and including vertical, horizontal and

inclined lines. End elevation to be drawn on either side of the front elevation (can also be drawn on both sides of the front).

4.2 Hidden details

Blocks with hidden edges (**dotted lines**), slots and square/rectangular holes.

4.3 Curved lines

Introducing curved lines, holes and **centrelines**.

4.4 Sectioning

Introducing simple whole sectioning. Section lines at 45° and equally spaced.

4.3 Free-hand

Free-hand sketches of elevations on squared (grid) paper. Several examples can be given where two views are given the third to be added.

5 SOLID GEOMETRY

5.1 Prisms

Square, rectangular, hexagonal, etc. truncated at different angles - and including elevations, true shape of section and development. Truncation may be sectioned.

5.2 The Cylinder

Truncated at different angles and as in 5.1

5.3 Pyramids

Square, rectangular, hexagonal, etc. truncated at different angles - and including elevations, true shape of section and development. Introducing true lengths.

5.4 The Cone

Truncated at different angles and as in 5.3.

5.5 Inclined

Prisms and cylinders standing inclined at an angle to one of the principal planes. To project side elevation and plan.

6 PICTORIAL PROJECTION

6.1 Isometric Projection

Introduction. Straight lines including vertical, horizontal and inclined only. To be drawn from given isometric, oblique and simple orthographic views.
Curved lines including circles, arcs and cylinders.

6.2 Oblique Projection

Introduction. Similar to 6.1. To be in **CABINET** form with the 3rd axis at 45° and half-true length. **CAVALIER** oblique to be mentioned, for general knowledge only.

FORM 5 year 2

Revision of previous year with emphasis on **time management**.

1 GEOMETRICAL CONSTRUCTIONS

- 1.1 Scales** Revision of the simple scale and introduction to diagonal scales.
- 1.2 Enlargement** Linear enlargement and reduction of figures having straight and curved lines. Different methods to be used - radial, pole, proportional.
- 1.3 Loci** Loci of simple moving parts/mechanisms. Circular and reciprocating co-planar motion. Glissette, Cranks, Cycloids, Involutives, Archimedean spiral and **Helix**.
- 1.4 Helix** To cover simple line helices with one or more revolutions. Its applications such as Springs - circular, rectangular or square. Other applications (threads not considered).
- 1.5 Areas** **Conversion** of areas. Polygon to quadrilateral, triangle, rectangle, square. Rectangle to rectangle. Rectangle to square etc.
- 1.6 Areas** **Determination** of areas of regular or irregular figures bound by straight and curved lines using squares and parts of - and mid-ordinate method.

1.5 Vectors Simple vectors. Triangle and polygon of forces. Co-planar and concurrent only.

2 SOLID GEOMETRY

2.1 Interpenetration Interpenetration of solids. Lines of intersections between prisms and cylinders equal and unequal in diameter. Interpenetrations to be restricted to solids whose axes are perpendicular. These axis may either lie in the same vertical plane or offset, but always parallel to the vertical plane. Developments.

2.2 The Cone The ellipse, parabola and hyperbola as conic sections and using the **radial and sections** method. **Developments** - radial method. **Projection** of elevations from given developments.

3 ORTHOGRAPHIC PROJECTION

3.1 Auxiliary Auxiliary views of simple objects. Auxiliary plan and auxiliary elevation. Given auxiliary elevation and plan to draw the front and side elevations.

3.2 Assembly Orthographic projection of assembled components from: in line exploded pictorial projection, from orthographic views and combination of.

3.3 Sectioning Whole, half, part, staggered, removed, revolved.

3.4 Conventions Simple B.S. drawing conventions to represent engineering components and including dimensioning. Refer to PD7308.

3.5 Free hand Free-hand sketching of orthographic views with straight and curved lines in good proportion.

3.6 Lines Lines in space. Finding their true length by rotation or by auxiliary projection. Lines to be drawn in isometric in relation to the vertical and horizontal planes.

4 PICTORIAL PROJECTION

4.1 Planometric Introduction to planometric projection. Horizontal axis of the object to be $45^{\circ} / 45^{\circ}$ or $60^{\circ} / 30^{\circ}$. In the case of $45^{\circ} / 45^{\circ}$ the height may be reduced depending on height of object. Including straight and curved lines.

4.2 Perspective Introduction to perspective projection. **Estimated** only. Single point and two points perspective. Shading.

4.3 Free hand Free-hand sketching of pictorial views with straight and curved lines in good proportion and either shaded or unshaded.

5 GRAPHICS

5.1 Ideograms Introduction and examples of. Include Prohibition, Warning, Mandatory, Safety and Information.

5.2 Maps Harder examples. Past papers.

5.3 Logos Harder examples. Past papers.

5.4 Electricity Introduction and examples of.

- 5.5 Symbols** Building symbols. Simple plans of dwellings / buildings and contents.
- 5.6 Graphs** Harder examples including interpretation of.
- 5.7 Charts** Simple Flow Charts of practical nature. Symbols used: terminals, process, input / output, decisions and connectors. **Sequence of work** (as in do-it-yourself kits)
- 5.8 Design** Design in relation to graphical presentation. To find and draw a solution to a given simple problem in design. See specimen question SEC 2002 - 4 syllabus.

Revision of work through past papers with emphasis on accuracy, presentation and time management.