

SEC SYLLABUS (2006-7)

TECHNICAL DESIGN

SEC 29

SYLLABUS

Technical Design SEC 29

(Not available in September)

Syllabus

Paper 1 (2 hrs)+Paper 2 (2hrs)

Aims.

The syllabus aims to:-

- Develop the ability to interpret, reason and communicate graphically;
- To foster an awareness of the importance of Graphic Communication as an International language;
- To stimulate an interest in, and enjoyment of, the study of graphical techniques and their application;
- To develop the ability to use a range of drafting techniques;
- To contribute to pupil's personal development and overall education;
- It is considered that this syllabus forms an appropriate introduction to relevant further studies (intermediate and advanced level etc.)

Assessment Objectives

Candidates will be expected to demonstrate:

1. Knowledge
2. Comprehension
3. Application
4. Analysis
5. Technique

Knowledge of

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

Comprehension

- a) Interpret the information given (verbally, in written form, graphically or a combination of two or more), so as to represent design concepts.
- b) Consider and represent plane and solid shapes.
- c) Understand and visualize spatial relationships.

Application

- a) Produce suitable drawings from information presented.
- b) Apply the principles of plane and solid geometry to the solution of problems.
- c) Apply the principles of orthographic and pictorial projection.

Analysis

- a) Compare and use the appropriate graphical methods of communicating information and ideas.
- b) Analyze and solve a problem graphically

Technique

- a) Accuracy in questions answered.
- b) Ability to sketch freehand and in good proportions.
- c) Present good draughtsman ship (presentation, cleanliness finishing spacing etc.)
- d) Use available aids and media to enhance the presentation where appropriate.

The subject content shall be weighed against the assessment objectives.

The Examination

The examination will consist of two papers of two hours duration each. The candidates must satisfy the examiners in both papers. Any examination question can test material from more than one topic. The questions will be set in English. Calculators are allowed.

Paper 1 will test the core syllabus and will carry 60% of total marks. Candidates will be expected to attempt all questions. This paper is compulsory to all students.

Paper 2 will consist of a single option chosen by the candidates from the following two options

Graphical Communication

Technology

Candidates are required to indicate on registration for the examination which option they wish to sit for. Each option will consist of questions related to that particular option and will carry 40% of the total marks for the subject. Candidates will be expected to attempt all questions.

There will be two versions of Paper 2: Paper 2A and Paper 2B. Questions in Paper 2A will be more difficult than those in Paper 1. Questions in Paper 2B will be easier than those in Paper 1. Candidates are required to indicate on the registration form which Paper 2 they wish to sit for. No change in the choice of paper will be allowed after the registration period.

Results

Candidates sitting for Paper 1 and Paper 2A may qualify for grades 1, 2, 3, 4 and 5. The results of candidates who do not obtain at least a grade 5 shall remain unclassified (U). Candidates sitting for Paper 1 and Paper 2B may qualify for grades 4, 5, 6 or 7. The results of candidates who do not obtain at least grade 7 shall remain unclassified (U).

GENERAL

The questions in both papers will be printed on answer sheets, which may include pre-printed partly drawn solutions. Written solutions may be required.

The format of the papers shall be A3.

Questions shall be set in SI units and reference should be made, as appropriate, to the following publications of the British Standards Institutions.

B S 308 part 1 and 2

P D 7308 Engineering drawing practice for schools and colleges.

(excluding section 14 –Toleranced dimensions)

B S 1192 Building symbols.

B S 3939 Electrical symbols

B S 4058 Flow charts.

B S 499 Part 2 Welding symbols.

Other related ISO standards.

Drawing Skills. Whilst a high degree of executive skill in drafting is desirable, if graphical representation is to be effective, it must be recognised that drafting skills is a means to a general end and not an end in itself.

Drawing skills should be developed in order to present precise and accurate information.

Layout. Good layout of drawings is required to achieve visual impact and clarity.

Although the candidates are expected to be capable of using drafting aids such as trammels, arc ends, ellipse aids, curve aids (french and flexi curves), nut templates, lettering stencils, colouring media and the like, their use would be restricted in the examination for obvious reasons.

Use of Instruments. The effective use of instruments and aids are required to achieve good drafting technique.

Lettering. Only the use of freehand techniques will be accepted unless otherwise stated. The selection and positioning of letters and figures of suitable scale is required. The criteria should be clarity, proportion and uniformity in presentation.

Symbols. The appropriate use of symbols. Where an appropriate British Standard is published, the symbols in it should be followed.

Presentation. The effective use of shading, colouring, dry transfers, and other techniques for emphasis. Selection of an appropriate method of presentation.

Candidates should be aware of the value of relative line thickness and the various techniques of shading, colouring using pencil, and crayon.

Candidates should also be able to select the most effective method of graphical illustration, example, free hand or instrument work: orthographic or pictorial projections.

Practical component. In parallel with drawing office practice the candidate will be expected to have had “hands on” practical sessions in constructing two dimensional laminae and three dimensional objects in soft materials that physically interpret drawn and designed exercises.

Paper 1: Common Core

1. Plane Geometry

Geometrical Constructions

- a) Construction, bisection and division of lines, angles and erection of perpendiculars.
- b) Division into equal or proportional parts.
- c) The construction of angles by the continuous bisection of 90° , 60° , 45° and multiples thereof, without the use of the protractor.
- d) Properties and construction of triangles, quadrilaterals and polygons regular or irregular, bounded by straight lines and/or arcs of circles.
- e) The construction of regular polygons on a given line or in a circle
- f) Regular polygons restricted to triangle, quadrilateral, pentagon, hexagon, heptagon and octagon.
- g) Linear enlargement or reduction of figures: radial and pole methods included.
- h) Determination of areas of plane figures by:
 - (i) mid-ordinate method.
 - (ii) division into squares and parts of.
- i) Construction of figures having the same area of another given polygon.

Scales

- a) Construction of simple or plain scale
- b) Diagonal scale
- c) The application of scales

Circles

- a) The parts of a circle – circumference, diameter, radius, quadrant, sector, arc, segment, and semicircle.
- b) Finding the centre of a circle. Concentric and eccentric circles.
- c) Construction of straight lines and arcs, tangential to other arcs
- d) Circles which touch or intersect
- e) Construction of circles to pass through given points, and tangential to given lines
- f) Points of tangency should be established in all the above

The Ellipse

- a) Construction of an ellipse

- b) Construction of a normal and tangent to an ellipse, to be able to draw circles and straight lines tangential to an ellipse
- c) Construction to include:
 - (i) Trammel
 - (ii) Auxiliary circles – concentric circle
 - (iii) Radial interceptors – intersecting lines – rectangle
 - (iv) Intersecting arcs – foci
 - (v) Compasses – approximate method

Loci

The loci of simple moving parts; to include circular and reciprocating coplanar motion. The use of trammel is permitted.

2. Solid Geometry

- a) Representation of right prisms, cylinders, pyramids and cones
- b) Sections and true shape of items mentioned above at set square angles to principal planes. Both section and radial methods are to be considered.
- c) Developments related to the above
- d) True lengths of lines and their true angles to the V.P. and H.P.
- e) True shape of triangular laminae

3. Orthographic Projection

- a) First and third angle projection including their symbols.
- b) Sectional views including: whole, half sections, part (scrap), revolved, removed and staggered (offset).
- c) Simple assemblies from:
 - (i) exploded views projected in line
 - (ii) assembled pictorial views
 - (iii) orthographic views
 - (iv) a combination of the above
- d) Dimensioning and conventions
- e) Scaled drawing
- f) Freehand drawings: Candidates will be expected to be able to produce drawings which are clear, well proportioned and suitably scaled in orthographic projection without the use of instruments.
- g) Tolerancing will not be required.**

4. Pictorial Projection

Isometric

Constructions of isometric views including circles and arcs by either the use of a grid, ordinates or approximate methods. Isometric scale not included.

Oblique

To be in cabinet form with the 3rd axis at 45° and half true length

Planometric

Horizontal axis of the object to be $45^\circ / 45^\circ$ or $60^\circ / 30^\circ$. In the case of the $45^\circ / 45^\circ$, the height may be reduced to $\frac{3}{4}$, $\frac{2}{3}$, $\frac{1}{2}$, depending on height of object.

Perspective

Single and 2-point perspective drawing. Estimated perspective only. Perspective grid not considered.

Freehand

Candidates will be expected to be able to produce shaded or unshaded drawings which are clear, well-proportioned and suitably scaled in all the above pictorial projection.

Paper 2 Graphical Communication Option

Paper 2 will cover the areas under common core, and will also include the following:

1. Plane Geometry

Loci

- The cycloid
- The involute
- Simple Archimedean spiral
- The helix and its application (simple). Threads will not be considered.

Vectors

Simple concurrent, coplanar, vectors: including triangle of forces, relative velocity and relative acceleration, and polygon of forces.

2. Solid Geometry

Interpenetrations

Lines of intersection between and combination of Prisms and cylinders

Interpenetration is 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 included.

3. Orthographic Projection

Auxiliary projection

First auxiliary projection of simple objects at set square angles

4. Design

Knowledge, understanding and application of design as a communication tool.

Design in relation to graphical presentation.

Ability to visualise objects and shapes in space with the realisation of drawn objects having a functional existence.

Simple analysis of required design from given data.

Design requirements to be related only to the realisation of manufactured articles to be found within familiar environments such as the school or local.

Layout of drawings and other graphical media from the viewpoint of aesthetics with clarity of presentation and maximum information content.

The following topics are to be covered:

- a) School creative subjects.
- b) Manufactured articles commonly found within the school or local environment.
- c) Logos – simple logos from given data with the possibility of exploring different ideas and then to identify and develop the final logo. The proper use of colours/shading is expected.
- d) Ideograms and symbols - simple ideograms from given data with the possibility of exploring different ideas and then to identify and realise the final ideogram. The proper use of colour /shading is expected. The following standard safety symbols are to be included: mandatory, caution, prohibition, general and safe way.
- e) Graphs and charts – Simple line, bar, column, histograms, pie, percentage bar, pictograms and other unconventional charts. Pictorial graphs/charts may be included. Pictorial pie charts to be either oblique or planometric. The candidates should include a key where appropriate.
- f) Diagrams, time charts and flow diagrams to illustrate scientific, historical, geographical and other given data. Flow charts to incorporate simple data processing of practical nature and may include the following symbols: terminals, process, input / output, decisions and connectors. BS 4058
- g) Instructions sequences – The candidates should interpret graphically written data so as to produce instructions sequences (e.g. as found on “do it yourself” kits and model making).
- h) Electrical circuits - To reduce pictorial representations of electrical circuits into circuit diagrams using given symbols according to BS 3939.
- i) Maps – maps, charts, layout of buildings and content, rooms and roads annotated with appropriate symbols. BS 1192
- j) The construction of static and working models reflecting the assimilation of knowledge of technical design.

Paper 2 Technology Option

Knowledge, understanding and application of design as a communication tool. Clarity of presentation and maximum information content is of great importance.

Paper 2 will include the areas under common core and will also include the following:

1. Plane geometry

Loci

The helix, involute, Archimidean spiral, and their applications.

2. Orthographic projection

Auxiliary views

First Auxiliary projection of simple objects at set square angles.

Freehand

Candidates will be expected to be able to produce drawings, which are clear, well proportioned and suitably scaled in orthographic and pictorial projection without the use of instruments. Its application to improve the design of existing objects in relations to ergonomics, aesthetics, and functionality. The drawing of simple tools, machinery parts and materials related to and found in the school environment.

3. Graphical instructions

Interpretations and sequential following of graphical instructions in building up or / and assembly of models and technological projects involving various trades found in schools.

4. Solid Geometry

Developments

Developments of common objects with allowances for bending and joining. Care in the economic use of material.

Interpenetrations

Lines of intersections between and combinations of Prisms and Cylinders. Interpenetration is to be restricted to solids, whose axes are perpendicular and lie in the same vertical plane. Developments included.

5. Technical Component

Engineering

- a) Hexagonal bolt and nut drawing according to accepted standards.
- b) Bolt or screw heads: countersunk, raised countersunk (instrument), round, pan, cheese, fillister, hexagonal and square.
- c) Screw head driving: cross slot, Phillips pozidrive, hexagonal head, square head, hexagonal socket (allen screw),
- d) Grub screws and studs.
- e) Screw ends: round ended, flat ended, cone pointed, cup pointed and dog ended.
- f) Self tapping screws and spire nut.
- g) Common nut, lock nut, fly or wing nut and thumb screws.
- h) Common locking devices including (i) friction and (ii) positive locking devices: (a) lock nuts, self locking or Simmonds' nut, spring and flat washers, external and internal serrated washers, (b) nut and taper pin, slotted nut and split pin, castle nut and split pin, wire locking, tab washers.
- i) Rivets- pop, pan and countersunk.
- j) Basic graphical welding symbols. BS 499

Woodwork

- a) Common woodwork joints such as: Dovetail, comb, housing, butt, lap, halving, mitre, bridle, dowel, mortise and tenon.
- b) Screws – Common and chipboard screws in round head, countersunk, pozidrive, countersunk raised, pan, coach bolts and coach screws.
- c) Nails and their use in woodwork and upholstery – panel pins, round nails, oval nails, corrugated nails, clout nails, staples, gimp pins, cut tacks, masonry nails.

Electrical

Drawing and interpreting basic elementary electrical and electronic circuits using standard symbols. B.S. 3939.

Building plans

Capability of reading of simple plans incorporating the layout of buildings, contents, rooms and roads annotated with appropriate symbols. BS1192

Book list

This list is not meant in any way to be prescriptive, but include books which may be helpful.

Graphical Communication Book 1 / 2 -----	A. Yarwood.
Graphical Communication Book 1 / 2-----	S. Bland
Technical Drawing-----	F. B. Mayock
Starting Graphics and Design-----	K. Balkham / R. Mills
Geometric and Engineering Drawing -----	K. Morling
Information Graphics-----	B. Purves
Manual of Engineering Drawing-----	C. Simmons / D. Maguire