basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

ENGINEERING GRAPHICS AND DESIGN

EXAMINATION GUIDELINES

GRADE 12

2021

These guidelines consist of 10 pages.

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1. INTRODUCTION

The *Curriculum and Assessment Policy Statement (CAPS)* for Engineering Graphics and Design outlines the nature and purpose of the subject Engineering Graphics and Design. This guides the philosophy underlying the teaching and assessment of the subject in Grade 12.

The purpose of these Examination Guidelines is to:

- Provide clarity on the depth and scope of the content to be assessed in the Grade 12 National Senior Certificate (NSC) Examination in Engineering Graphics and Design.
- Assist teachers to adequately prepare learners for the NSC examinations.

This document deals with the final Grade 12 external examinations. It does not deal in any depth with the School-based Assessment (SBA), Performance Assessment Tasks (PATs) or final external practical examinations as these are clarified in a separate PAT document which is updated annually.

These Examination Guidelines should be read in conjunction with:

- *The National Curriculum Statement (NCS) Curriculum and Assessment Policy Statement (CAPS):* Engineering Graphics and Design
- The National Protocol of Assessment: *An addendum to the policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), regarding the National Protocol for Assessment (Grades R–12)*
- The national policy pertaining to the programme and promotion requirements of the National Curriculum Statement, Grades R–12

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2. ASSESSMENT IN GRADE 12

2.1 Format and composition of the Grade 12 EGD NSC question papers

PAPER 1: CIVIL (3 hours) In **first-angle** orthographic projection			**PAPER 2: MECHANICAL** (3 hours) In **third-angle** orthographic projection		
Q1	Civil analytical	±15%	Q1	Mechanical analytical	±15%
Q2	Solid geometry **AND/OR** Interpenetration and development	±20%	Q2	Loci of a cam **AND/OR** Loci of a point(s) of a mechanism	±20%
Q3	2-point perspective drawing	±20%	Q3	Isometric drawing	±20%
Q4	Civil working drawing including electrical features	±45%	Q4	Mechanical assembly	±45%
Total mark allocation		200	Total mark allocation		200
Total NSC contribution		**100**	**Total NSC contribution**		**100**

2.2 General instructions of both Grade 12 EGD NSC question papers

- The question paper consists of FOUR questions.
- Answer ALL the questions.
- ALL drawings are in first-angle orthographic projection for PAPER 1 and third-angle orthographic projection for PAPER 2, unless otherwise stated.
- ALL drawings must be prepared using pencil and instruments, unless otherwise stated.
- ALL answers must be drawn accurately and neatly.
- ALL the questions must be answered on the QUESTION PAPER, as instructed.
- ALL the pages, irrespective of whether the question was attempted or not, must be re-stapled in numerical sequence in the TOP LEFT-HAND CORNER ONLY.
- Time management is essential in order to complete all the questions.
- Print your examination number in the block provided on every page.
- Any details or dimensions not given must be assumed in good proportion.

NOTE:
Although not included as a general instruction, additional **layout planning is essential** for drawings where a reference/starting point or position is not given, e.g. solid geometry, interpenetration and development and mechanical assembly.

2.3 Weighting of the cognitive levels for the individual and combined totals of both papers.

Application of Bloom's Taxonomy	
Cognitive level	**Weighting**
Lower order (Understanding and remembering)	**±30%**
Middle order (Analysing and applying)	**±40%**
Higher order (Creating and evaluating)	**±30%**

3. DETAIL OF THE EGD EXAMINABLE CONTENT FOR GRADE 12

To improve the quality of passes, teachers are advised to pay particular attention to the notes at the end of each section of the prescribed content.

- **As prescribed on pages 12 and 13 of the EGD *CAPS* document, the contents of the following topics remains applicable to ALL Grade 12 topics:**

Applicable to **ALL questions** in **both papers**	
TOPIC	**PRESCRIBED CONTENT**
General drawing principles relevant to all types of drawings	• Relevant **line types**, as contained in the *SANS (SABS) 10111 and 10143 Guidelines* EGD GUIDELINES for PENCIL LINE-WORK: **NOTE:** *A **0.3/0.5 clutch pencil** with either a **2H, 3H or 4H** lead should be used*. ➢ **A-type line** (darkest line): Border and title/name block/ panel; outlines and visible parts; answers of, e.g. loci; projection symbol; tables ➢ **B-type line** (medium line): All writing and numbering; dimensions; projection planes; auxiliary views; hatching; screw threads; folding lines, break lines; solid geometry cutting planes ➢ **C-type line** (lightest line): Constructions; planning; projections; guidelines (for writing) ➢ **Medium chain-line** (B-type): Centre points of circles and arcs; centre lines (centre axis); mechanical drawing cutting/section planes; assembly diagrams; building lines/boundaries (servitudes) ➢ **Dark chain-line** (A-type): Plumbing; water pipes; drainage; services, irrigation systems ➢ **Short broken-line** (B-type): Hidden detail; items to be removed on civil drawings ➢ **Medium double-dash chain-line** (B-type): Outlines of adjacent components/objects; alternative and extreme positions of movable components/parts • General **lettering** (writing) and **annotation** requirements, as contained in the *SANS (SABS) 10111 and 10143 Guidelines* • General **dimensioning** requirements, as contained in the *SANS (SABS) 10111 and 10143 Guidelines.*
Freehand drawings	The basic hand movements needed to draw proportional single, multi-view and pictorial drawings on plain and/or grid/graph paper
Scales	• **Practise and apply different scales**, e.g. 1 : 1, 5 : 1, 2 : 1, 1 : 2, 1 : 25, 1 : 50, 1 : 75, 1 : 100 **etc.** • The application of **any scale** to all types of drawings
Geometrical construction	• **Practise and apply** the following **constructions**: bisecting lines and angles, perpendicular lines, angles, dividing a line, circle divisions, fillets, etc. • **Construct** regular **polygons** with **3, 4, 5, 6 and 8** sides • **Construction** of an **ellipse**
Descriptive geometry	• **Orthographic views** of **points**, **line segments** and **plane figures** that are perpendicular, inclined or oblique to the projection planes • The **true length** of line segments

- **PAPER 1 topics and prescribed content:**

<table>
<tr><td colspan="2">QUESTION 1: ±15% (±30 marks)
AND
QUESTION 4: ±45% (±90 marks)</td></tr>
<tr><th>TOPIC</th><th>PRESCRIBED CONTENT</th></tr>
<tr><td>Civil drawing</td><td>Limited to single-storey dwellings, first-angle orthographic working drawings with detailed floor plans, complete detailed elevations and sectional elevations showing the detail of the foundation to the roof.
Include the following:
• Annotation (notes), labels, dimensioning, scales
• Relevant abbreviations, drawing symbols, graphical symbols and representations
• On ALL relevant views/elevations: detail of pitched and flat roofs (trusses, battens/purlins, covering, fascia board, barge board, wall plate, ceiling, etc.), gutters, rain-water downpipes and gullies, plumbing and drainage detail, electrical fittings (installations) and wiring diagrams, as well as all the other features and fixtures covered in Grades 10 and 11
• Hatching detail and the application of colours
• Format and content of working drawing title panels
• Detailed site plans showing all the relevant features and dimensions, including electrical, plumbing and drainage services detail, as well as natural features, etc.
• Calculation of perimeters and areas
• The north point on all relevant drawings
NOTE:
• ALL aspects of all drawings must comply with the guidelines, drawing symbols, graphical symbols and representations contained in the SANS 10143.
ALL features must therefore, where applicable, be drawn as symbols and, when dimensions are given or where relevant, to scale using instruments. Features may only be drawn in neat freehand when instructed to do so.
• ALL, and only, substructure hatching may be drawn in neat freehand.</td></tr>
<tr><td colspan="2">NOTE:
• QUESTION 1 could include other content of civil drawings that are not related to the drawing for the specific question.
• Although the primary focus of QUESTION 1 will be on the prescribed content of civil drawings, aspects from other Paper 1 topics could also be included.
• QUESTION 4 could be either ONE multi-view question or it could be subdivided into more than ONE question.</td></tr>
</table>

Continuation of **PAPER 1**

QUESTION 2: ±20% (±40 marks)	
TOPIC	**PRESCRIBED CONTENT**
Solid geometry **AND/OR**	**First-angle orthographic views** of **solids** or a **combination of solids**, which includes **solids with holes**. The solids and shape of the holes may be either right-regular **prisms** or **pyramids** with 3, 4, 5, 6 and 8 sides only, as well as right-regular **cylinders** or **cones**. The axes of the solids may be perpendicular, parallel or inclined to one principal projection plane only. Include the following: • Sectional views • The true shapes of the cut surfaces • **ALL hidden detail** on non-sectioned and sectioned views
Interpenetrations and development	**First-angle orthographic** views showing the **curve of interpenetration** formed between two solids, tubes or pipes joined at 30°, 45°, 60° or 90°. • The solids, tubes or pipes must be **only right-regular prisms,** with 3, 4, 5, 6 and 8 sides, **and/or cylinders only**. • The **axes** of the two solids, tubes or pipes must **meet in a common plane**, i.e. **in-line only**, but the **curve of interpenetration** could be **non-symmetrical**. • **ALL hidden detail must be shown**, unless otherwise stated. **Include** the **surface developments** of the **parts of the interpenetrating** solids, tubes or pipes.
NOTE: • Tubes refer to prismatic shapes that are hollow with walls (sides) of insignificant thickness. • Layout planning is essential. • ALL construction, calculations (if required), projections and folding lines must be shown. • Mechanical drawing hatching, and the rules thereof, must be applied to the cut surfaces of the sectioned Solids, as well as the true shapes of the cut surfaces. • Only the curves of irregular arcs may be drawn in neat freehand. However, inaccurate and/or untidy curves will be penalised.	

QUESTION 3: ±20% (±40 marks)	
TOPIC	**PRESCRIBED CONTENT**
Perspective drawings	**2-point** perspective drawings of **complex** castings, dwellings and civil structures with **overhangs**, **depth detail**, **circles** and **arcs**. • The HL, PP and SP may be varied to provide any desired view. **NOTE:** • ALL construction and projections must be shown. • Depth at doors, windows and openings must be shown, unless otherwise stated. • Interior detail must only be shown if required. • Hidden detail must only be shown if required. • Only the curves of circles and arcs on the perspective answer/drawing itself may be drawn in neat freehand. However, inaccurate and/or untidy curves will be penalised.

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- **PAPER 2 topics and prescribed content**

QUESTION 1: ±15% (±30 marks)
AND
QUESTION 4: ±45% (±90 marks)

TOPIC	PRESCRIBED CONTENT
Mechanical drawings	**Third-angle orthographic** working drawings with **non-sectional, sectional, half-sectional and part-sectional** views of **complex mechanical assemblies**. Include the following: • Title, scale, layout planning, centre lines, hidden detail, cutting planes, hatching detail, dimensioning, notes and symbol of projection • Hexagonal bolts, nuts and lock nuts, washers, spacers, keys and keyways as well as relevant labels • Different types of section, e.g. aligned section, revolved section, removed section, etc. • Conventional presentation of common features • Format and content of working drawing title blocks • **Detailed drawings** of individual components • **Basic welding, machining and surface treatment symbols** • **Tolerances** **NOTE:** • ALL aspects of all drawings must comply with the **guidelines** and **conventional representations** contained in the ***SANS 10111***. • ALL construction must be shown where required. • Hidden detail must only be shown if required.

NOTE:
- QUESTION 1 could include other content of mechanical drawings that are not related to the drawing for the specific question.
- Although the primary focus of QUESTION 1 will on the prescribed content of mechanical drawings, aspects from other Paper 2 topics could also be included.
- QUESTION 4 could be either **ONE multi-view question or** it could be subdivided into **more than ONE question**.

Continuation of **PAPER 2**

QUESTION 2: ±20% (±40 marks)	
TOPIC	**PRESCRIBED CONTENT**
Loci of a cam **AND/OR**	• The principles of the **cam** in **complex** applications in which the following has to be shown: o The **camshaft** and **follower detail** o The **complete displacement graph** o The **complete cam profile** • The **motion** may be **uniform** and/or **simple harmonic** and/or **uniform acceleration and retardation**. • The **direction** has to be emphasised. • The follower may be **placed at any angle**, provided that it reciprocates on a centre line which passes through the centre of the camshaft. • The follower may be either **wedge-shaped** or a **roller**.
Loci of a point(s) of a mechanism	The principles of the **loci of a point(s)** on **schematic drawings** of the **moving components** of **mechanisms** • Maximum THREE points
NOTE: • ALL construction must be shown. • Only irregular curves, e.g. the profile of the loci, may be drawn in neat freehand. However, inaccurate and/or untidy curves/profiles will be penalised.	

QUESTION 3: ± 20% (± 40 marks)	
TOPIC	**PRESCRIBED CONTENT**
Isometric drawing	**Complex** isometric drawings with isometric and non-isometric lines as well as **auxiliary views**, **circles** and **sections**. **NOTE:** • ALL required auxiliary views and construction, including for circles, must be shown. • Hidden detail must only be shown if required.

The following is applicable to both PAPER 1 and PAPER 2:

- As **accuracy** is a fundamental and essential component of EGD drawings, **a deviation of only 1 mm or 1° is permissible** on the accuracy of ALL aspects of ALL drawings. However, the principles of 'mark with the mistake' and 'the learner should be given the benefit of the doubt' must also be applied when the required level of evidence of knowledge has been displayed.
- Except for the concessions referred to in the tables above, or when instructed to do so, all other **drawings or aspects of drawings prepared in freehand will not be assessed**.

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4. CONCLUSION

This Examination Guidelines document is meant to articulate the assessment aspirations espoused in the CAPS document. It is therefore not a substitute for the CAPS document which teachers should teach to.

Qualitative curriculum coverage as enunciated in the CAPS cannot be over-emphasised.

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