



# education

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Department:  
Education  
**REPUBLIC OF SOUTH AFRICA**

## **ENGINEERING GRAPHICS AND DESIGN**

### **EXAMINATION GUIDELINES**

### **GRADE 12**

### **2009**

**This guideline consists of 11 pages.**

## ENGINEERING GRAPHICS AND DESIGN (**EGD**)

### **CONTENT and CONCEPTS for NOVEMBER 2009 and MARCH 2010** **GRADE 12 'NSC' EXAMINATIONS and PRACTICAL ASSESSMENT TASK (PAT)**

#### **INTRODUCTION TO AND PURPOSE OF EGD**

**NB: The content of LO 1 can be integrated as parts of questions in both examination papers.**

- **Integrate discussion** on the scope, educational and career opportunities of EGD as well as human rights, gender, inclusivity and HIV/AIDS issues.
- Emphasis should be placed on the **values** as described in **LO 1**.

**Apply the following to all the relevant content and concepts!**

#### **ANALYTICAL AND VISUALIZATION EXERCISES**

- **Analyze** drawings and answer questions based on single, multi-view and pictorial drawings within the civil, electrical, and mechanical context.
- Visualization of cognitive and perception exercises.

#### **BASIC DRAWING PRINCIPLES**

**NB: These principals are relevant to all types of drawing**

##### **Line Types**

- The use and implementation of the line types as covered in grade 10.

SUGGESTED SIMPLIFICATION FOR PENCILS:

- A -type – Border & Title block / Name block, Outlines of Drawing, Answers (loci), Projection Symbol, Tables
- B -type – All writing and Numbering, Dimensions, Projection planes, Auxiliary views, Cross hatching, Screw tread, Folding lines
- C -type – Constructions, Planning, Projections, Guide lines (for writing)
- Chain – Centre points of circles, Centre lines (Centre axis), Section planes, To indicate assemblies
- Broken – Hidden detail

**Lettering and Dimensioning**

- The use and implementation of the general lettering techniques as covered in grade 10.
- The use and implementation of the general dimensioning techniques as covered in grade 10.

**Setting up of a Drawing Sheet**

- **Set up** a drawing sheet showing all information relevant for **grade 12**, e.g. name and title blocks, projection symbols etc.

**FREE-HAND DRAWING**

The use of the four basic hand movements needed to reproduce proportional single, multi view and pictorial drawings using grid sheets and plain paper.

**INSTRUMENT DRAWING**

- **All grade 10 geometrical constructions remain applicable within other drawings.**
- **The use** of different scales for all types of drawings.

## ORTHOGRAPHIC PROJECTIONS

**Discuss and incorporate** the concepts of and **produce 1<sup>st</sup> angle** and **3<sup>rd</sup> angle** orthographic projection drawings using the rule of similarity and 45° projections.

The emphasis of **Paper 1 (civil)** is **1<sup>st</sup> angle** and the emphasis of **Paper 2 (mechanical)** is **3<sup>rd</sup> angle**.

### Descriptive Geometry

**All the grade 10 and 11 concepts remain applicable for application in primarily a civil content and for developments.**

- Draw in **1<sup>st</sup> angle** views of points and line segments that are perpendicular, inclined or oblique.
- Determine the **true length** of a line segment and the **true inclination** of a line segment to the HP and VP using the projection and the construction methods.
- Determine the **true shapes** of surfaces from given views.

### Solid Geometry

Draw in **3<sup>rd</sup> angle non-sectional** and **sectional** views of the following geometrical solids:

- **Combinations** of the geometrical solids as covered in grade 10. The axis of the solids must still be either perpendicular, parallel or inclined to one principal plane only.
- Determine the **true shape** of the sectioned surfaces.

### Mechanical Drawings

#### DRAW IN 3<sup>RD</sup> ANGLE ORTHOGRAPHIC PROJECTION

Using the *SANS 0111* as a guideline, draw:

- Non-sectional, sectional, half sectional and part sectional views of **complex assemblies**.
- Include the following: Hexagonal bolts and nuts and lock nuts, keys and keyways, washers/spacers, dimensioning techniques, title, scale, cutting planes, hatching, notes and symbol of projection.
- **Include welding, machining and surface treatment symbols and show tolerances to dimensions relevant to steel work and mechanical drawings.**

**Civil Drawings****EMPHASIZE 1<sup>ST</sup> ANGLE ORTHOGRAPHIC PROJECTION*****NB: All applications for *single story* dwellings only.***Using the *SANS 0143* as a guideline, draw:

- Floor plans and elevations.
- Sectional elevations showing detail and labeling **from the foundation to the roof**.
- Include annotation, dimensioning, scales and the following features on all relevant views: **electrical detail and detail of gabled and lean roofs** as well as all the other Gr 10 and Gr 11 features.
- Calculations of perimeters and floor areas.
- Apply hatching techniques to new additions.
- **Show site plan and schedule of specifications. Include plumbing and drainage detail.**

**ELECTRICAL DRAWINGS**Draw **wiring diagrams** on **floor plans** of **civil drawings**.

## PICTORIAL DRAWINGS

### Isometric Drawings

Draw **complex** Isometric drawings **with** or **without hidden detail**.

- Include **auxiliary views** and **circles**.
- **Include sections**.

### Perspective Drawings

Produce **2-point** Perspective drawings of **complex** castings and dwellings.

- **Include circles**.
- The positioning of the **HL**, **PP** and **SP** can be **varied**.

## INTERPENETRATIONS AND DEVELOPMENTS

### Interpenetrations

Determine the curve of interpenetration when the axes of two **complex** objects or solids penetrate or are joined at 30°, 45°, 60° or 90°.

- The focus should be on industrial applications.

### Developments

Determine the surface development of **complex interpenetrations, transition pieces, hoppers** and **containers**.

- The focus should be on industrial applications. (Seam allowances could be included where relevant.)

**LOCI****Helix**

- Apply the principles of the **helix** in a **civil or mechanical** context in **complex** applications for example: spiral chutes, handrail for a spiral staircase, coil springs, worms, threads etc.
- **Emphasis must be placed on the direction.**

**Cams**

- Apply the principles of the **cam** in **complex mechanical** contexts for example: cams to produce specific movements e.g. activating switch/lock mechanisms, control inputs/outputs and the change of direction of movement.
- **The motion could be uniform motion, uniform acceleration and retardation or simple harmonic motion.**
- **Emphasis must be placed on the direction.**
- **The follower can be roller ended or wedge ended.**

**Mechanisms**

- Apply the principles of the **locus of a point(s)** on relevant **moving components** of **mechanisms**.

The following **CONTENT** and **CONCEPTS WILL NOT** be assessed during the **NOVEMBER 2009** and **MARCH 2010 GRADE 12 'NSC' EXAMINATIONS.**

## ORTHOGRAPHIC PROJECTIONS

### Civil Drawings

- Components of **steel structures**.

## LOCI

### Rolling Circles

- Apply the principles of the **locus of a point** on the **circumference** of a **circle** in order to produce **cycloids, epi-cycloids** and **hypo-cycloids**.



The following **CONTENT** and **CONCEPTS** will be formally assessed within the **PRACTICAL ASSESSMENT TASK (PAT) ONLY.**

## THE DESIGN PROCESS

### Applicable to all Practical Assessment Tasks:

- **Complex** problem **identification** and formulating a **design brief**.
- Conducting **research** and **generate ideas/concepts** analytically and graphically (**freehand drawings**).
- **Selecting** best solution within context of specifications/constraints.
- Presenting final solution with **working/layout drawings**.
- Presenting final solution, or parts thereof, with a **3D pictorial drawing(s)**, and optionally, making a model where possible.
- **Evaluation** of the whole process.

## COMPUTER AIDED DESIGN (**CAD**) DRAWINGS

- **Application and management of CAD software**
- **Required Presentation Drawings (Part 2 of PAT)**

**ENGINEERING GRAPHICS AND DESIGN (EG&D)****GRADE 12 EXAMINATION FORMAT AND COMPOSITION**

<p style="text-align: center;"><b>PAPER 1</b> <b>-CIVIL-</b> <i>(3 hours)</i></p> <p style="text-align: center;">Emphasis on <b>1<sup>st</sup> angle</b> orthographic projection.</p>	<p style="text-align: center;"><b>PAPER 2</b> <b>-MECHANICAL-</b> <i>(3 hours)</i></p> <p style="text-align: center;">Emphasis on <b>3<sup>rd</sup> angle</b> orthographic projection.</p>
<ul style="list-style-type: none"> <li>• <b>Civil Drawings</b> (including electrical content)</li> <li>• <b>Interpenetrations</b></li> <li>• <b>Developments</b></li> <li>• <b>Perspective Drawings</b></li> </ul> <p>The paper will include <b>analytical</b> type questions. Relevant scenarios/case studies relating to LO1 may be incorporated into the paper.</p>	<ul style="list-style-type: none"> <li>• <b>Mechanical Drawings</b></li> <li>• <b>All Loci</b></li> <li>• <b>Solid geometry</b></li> <li>• <b>Isometric Drawing</b></li> </ul> <p>The paper will include <b>analytical</b> type questions. Relevant scenarios/case studies relating to LO1 may be incorporated into the paper.</p>
<p style="text-align: right;"><b>Mark allocation: 200</b></p> <p style="text-align: right;">Conversion: <math>\div 2</math></p> <p style="text-align: right;"><b>TOTAL: 100</b></p>	<p style="text-align: right;"><b>Mark allocation: 200</b></p> <p style="text-align: right;">Conversion: <math>\div 2</math></p> <p style="text-align: right;"><b>TOTAL: 100</b></p>

**ENGINEERING GRAPHICS AND DESIGN (EG&D)****Structure of internal and external assessment**

GRADE 12 ASSESSMENT ITEMS					
INTERNAL ASSESSMENT 25% (Internally set and assessed)		EXTERNAL ASSESSMENT - 75%			
		PRACTICAL ASSESSMENT TASK 25% (Externally set and internally assessed)		EXTERNAL EXAMINATIONS 50% (Externally set and assessed)	
CASS PORTFOLIO		PAT PORTFOLIO		NOVEMBER EXAMINATION	
Tests: Combined marks recorded during the first and third terms.	30	PAT Part 1 The Design Process	50	Paper One: 3 hrs (200 marks ÷ 2 = 100)	100
Assignments: 14 Course Drawings as Application Exercises to cover the all 'ASs'. • NB: Where and if possible, incorporate LO 1 and LO 2.	30				
June examination & September examination	40	PAT Part 2 CAD/Presentation Drawings of Part 1	50	Paper Two: 3 hrs (200 marks ÷ 2 = 100)	100
Total	100	Total	100	Total	200

**NB: Each of the November examination papers will be set out of 200 marks which will then be converted to a mark out of 100.**

The assessment at grade 12 level is separated into internal assessment and external assessment. Together they count 400 marks. The internal assessment is made up of 30 marks for tests, which is 7,5% of the assessment, 30 marks for tasks (which includes 2 assignments), which is 7,5% of the assessment, and 40 marks for the mid year and preparatory examinations which makes up 10% of the assessment. The external assessment is made up of a practical assessment task, which is made up of 50 marks for the design process, which is 12, 5 % of the assessment, and 50 marks for the CAD/presentation drawings, which is 12, 5% of the assessment, and an external examination, which counts for 200 marks for the year-end examination, which is 50% of the assessment.

**NB: All tasks and assignments should, where possible, integrate LOs 1, 2, 3 & 4.**