

ENGINEERING, GRAPHICS AND DESIGN (Updated December 2013)

A. MEANS OF ASSESSMENT

| | | |
|---------------------------------|---------|-------|
| Paper 1 | 3 hours | [100] |
| Paper 2 | 3 hours | [100] |
| Practical Assessment Task (PAT) | | [100] |
| School Based Assessment (SBA) | | [100] |

400 marks

B. REQUIREMENTS

Format and composition of the final EGD examination papers are as follows

| PAPER 1 - CIVIL- <i>(3 hours)- 200 Marks</i> | | | PAPER 2 -MECHANICAL- <i>(3 hours) – 200 Marks</i> | | |
|--|---|--------------|---|---|--------------|
| In first-angle orthographic projection | | | In third-angle orthographic projection | | |
| | | Marks | | | Marks |
| Q1 | Civil analytical | ± 25 | Q 1 | Mechanical analytical | ± 25 |
| Q2.1 | Interpenetration and/or interpenetration and development and/or development of a transition piece | ± 35 | Q2.1 | Loci of a helix and/or loci of a cam and/or loci of a point(s) of a mechanism | ± 35 |
| OR Q2.2 | | | OR Q2.2 | | |
| Q3 | 2-point perspective drawing | ± 40 | Q 3 | Isometric drawing | ± 40 |
| Q4 | Civil assembly | ± 100 | Q 4 | Mechanical assembly | ± 100 |
| Total | | 200 | Total | | 200 |

| GRADE 12 PROGRESSION/PROMOTION MARK | | |
|--|---|-------------|
| | Assessment Tasks | Promotion |
| SBA | 2 Controlled Tests | 7.5% |
| | 10 Course Drawings OR 2 Practical Assignments | 7.5% |
| | Prelim/preparatory examinations: Paper 1 and Paper 2 | 10% |
| | Practical Assessment Task (PAT) | 25% |
| | NSC Examination | 50% |
| TOTAL | | 100% |

Practical Assessment Task (PAT)

The PAT is essentially the third examination paper of EGD. ALL the presentation requirements of the PAT have to be completed at school, under the supervision of the EGD teacher. Each learner has to complete one PAT for every year of the FET phase.

The primary purpose of the PAT is to assess four subjective content and concept topics which are not assessed in the examination papers. These are:

- the Design Process
- the application of drawing knowledge and drawing skills to the design process
- CAD management and drawings **is compulsory**
- the quality and neatness of free-hand, instrument and CAD drawings.

| Elements | Gr.12 |
|--|-------|
| Part A : The Design Process | 40% |
| Part B: Correctness and quality of the presentation drawings | 60% |

School Based Assessment (SBA)

SBA comprises 25% of the total assessment for the National Senior certificate. The requirements for the school-based component of the senior certificate assessment are outlined in the table below.

| Assessment Tasks | % of final mark |
|--|-----------------|
| 2 Controlled Tests | 7.5 |
| Preliminary Examination | 10 |
| 2 Practical Assignments : <ul style="list-style-type: none"> • Case studies/ • Investigations/ • Application of drawing skills OR 10 Course Drawings | 7.5 |
| Total | 25 |

1. These Subject Assessment Guidelines must be read in conjunction with the IEB Manual for the Moderation of School Based Assessment (SBA) 2011.
2. All schools must make available the SBA evidence of learners should it be required by the IEB or Umalusi.

Tests

The tests in Engineering Graphics and Design must be substantive in terms of time and marks. For example, a test should last at least 60 minutes and count a minimum of 50 marks. Tests should include theory on graphical communication and presentation, codes of practice, computer hardware and the impact of EGD on resources and values along with the formulation and application of design briefs.

Practical Assignments

In Engineering Graphics and Design, an assignment comprises a series of practical activities and could involve case studies, design questions, application exercises, CAD; an investigation on an EGD related issue from the Topics in the Curriculum. In essence an assignment is shorter than a project and is focused on a particular Topic or a small cluster of Topics. An assignment requires learners to apply their knowledge to carry out a given task in a given situation.

Course Drawings (CDs)

The purpose of the course drawings is to provide evidence that ALL the topics have been adequately covered and that all the learners have been assessed and given sufficient feedback on their acquired knowledge and skills in common tasks on the prescribed content of each topic. Engineering Graphics & Design is both a knowledge and application/skill-based subject. Drawing and analytical tasks should be done on a regular (daily) basis. From this normal yet essential developmental process of regular (daily) tasks, at least one common task has to be selected from the prescribed content of each topic. The selected common task has to be formally assessed and recorded as part of the compulsory Programme of Formal Assessment.

Requirements for Course Drawings (CDs):

- CDs should come from the normal teaching and learning process of EGD and should therefore be one or more of the regular (daily) tasks;
- The teacher has to ensure that each CD is each learner's own work;
- All learners have to be afforded extended opportunities, within realistic time frames, to attempt to complete, correctly or incorrectly, each of the CDs;
- Each CD should address all, or most, of the grade-specific content of the topic and of an appropriate higher order of complexity for the specific grade. More than one task may be used to obtain the recorded CD mark;
- To ensure that all CDs comply with test and examination requirements and standards, all CDs, with the exception of the analytical exercises and the perspective drawing(s), have to be tasks that are completely redrawn;
- The questions and model answers of all CDs will be in the teacher's EGD file and all the assessed and recorded CDs of each learner will be in his/her EGD file;
- Simplified rubrics may be used to assess all CDs
 - (for a suggested example see Appendix G);
- course drawing is required from each of the sections listed below:
 - Development
 - Interpenetration
 - Transition Piece
 - Perspective Drawing
 - Civil Assembly
 - Helix
 - Cam Profile
 - Mechanism
 - Isometric Projection
 - Mechanical Assembly

Preliminary Examination

The Preliminary Examination for Grade 12 consists of two papers counting 100 marks each. The duration of Paper 1 and Paper 2 is 3 hours. Questions 1, 3 & 4 are compulsory. Question 2 consists of two questions of which only **one** must be answered. The questions should be set in such a way that they assess the knowledge and skills covered in all the EGD Examinable Curriculum.

Grades 10 & 11

Although SBA in grade 10 and 11 will not be monitored by the IEB, it is proposed that SBA in grade 10 and 11 follow a similar format as that for grade 12.

C. INTERPRETATION OF REQUIREMENTS

TAXONOMY OF COGNITIVE LEVELS FOR DESIGNING ASSESSMENT TASKS FOR ENGINEERING GRAPHICS AND DESIGN

| CATEGORIES OF COMPLEXITY | DESCRIPTION OF CATEGORIES | SOME EXAMPLES | WEIGHTING |
|-------------------------------|---|---|-----------|
| Basic cognitive skills | Recall of basic knowledge | give labels; list; name; state or identify functions; recognise; use given data, information or symbols; etc. | ± 10% |
| Comprehension | More than recall of facts; includes understanding and insight into routine and familiar content or situations | describe or explain concepts; classify; choose from given data, information, conventions or symbols; make direct decisions or deductions from data given; do calculations; etc. | ± 30% |
| Application | Application of components and systems to familiar and unfamiliar situations | interpret data; decide on the appropriate symbols, scales, conventions, processes and time management; draw flow charts or mind maps; produce graphics using mechanical or CAD skills; draw tables and graphs to organise and present data; draw sketches to communicate ideas and possible solutions; etc. | ± 40% |
| Higher intellectual abilities | Application of design principles, analysis, synthesis and evaluation of data. | solve the problem; formulate a hypothesis; design a solution; analyse data; predict; argue; evaluate; etc. | ±20% |

D. ADMINISTRATIVE AND SUPPORT DOCUMENTATION

- Appendix A: SBA Control Sheet
Appendix B: Sample Moderation Grade 12
Appendix C: Declaration : School
Appendix D: Declaration : Learner / Candidate
Appendix E: A simplified RUBRIC for assessing course drawings (CDs) and daily exercises
Appendix F: Rubric To Assess The Design Process
Appendix G: Examination Format and Composition

IEB COPYRIGHT

Appendix A

SCHOOL BASED ASSESSMENT CONTROL SHEET ENGINEERING GRAPHICS & DESIGN

| Centre Number: | <input style="width: 95%;" type="text"/> | Candidate Examination No: | <input style="width: 95%;" type="text"/> | | | |
|--|---|---------------------------|--|----------------|-------------------|--|
| Date of Submission | Description of task | Assignment | Tests | Exam | | |
| | Course Drawing 1 (Development) | | | | | |
| | Course Drawing 2 (Interpenetration) | | | | | |
| | Course Drawing 3 (Transition Piece) | | | | | |
| | Course Drawing 4 (Perspective Drawing) | | | | | |
| | Course Drawing 5 (Civil Assembly) | | | | | |
| | Course Drawing 6 (Helix) | | | | | |
| | Course Drawing 7 (Cam Profile) | | | | | |
| | Course Drawing 8 (Mechanism) | | | | | |
| | Course Drawing 9 (Isometric Projection) | | | | | |
| | Course Drawing 10 (Mechanical Assembly) | | | | | |
| | Assignment 1 | | | | | |
| | Assignment 2 | | | | | |
| | Test 1 | | | | | |
| | Test 2 | | | | | |
| | Examination Paper I | | | | | |
| | Examination Paper II | | | | | |
| Summary of Marks: | | | | | | |
| | Total Possible | Marks | | | Final Mark | |
| Assignments | 30 | | | | | |
| Tests | 30 | | | | | |
| Examinations | 40 | | | | | |
| | | SBA TOTAL: | | | | |
| SBA Minimum Requirement: | | 2 tests | 2 Assignments/10 Course Drawings | | 1 Exam | |
| PRACTICAL ASSESSMENT TASK (PAT) | | | | | | |
| Date of Submission | Description of task (Please see note below for choice) | | | Total Possible | Candidate Mark | |
| | Option 1 | Civil - | | | 100 | |
| | Option 2 | Mechanical - | | | 100 | |
| | | | | | | |

Appendix B (Part A)



**SAMPLE MODERATION OF SBA GRADE 12
ENGINEERING GRAPHICS AND DESIGN
To be completed and returned to the school**

Examination Centre Number: _____

Date: _____

Teacher File Records

- Is the Teacher File Available?
- Mark schedule of entire Centre's learners' performance
- Appropriate aggregation of marks
- All tasks with marking memoranda are available
- Appropriate allocation of marks on memoranda
- Appropriate allocation of Topics
- Evidence of school based moderation (Appendix C plus any other ...)
- File is bound, indexed and sections separated with interleaves

| Response and comment | |
|----------------------|--|
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| | |

Learner File Records

- Learner Files supplied according to list from IEB
- Statement of authenticity (Appendix D) available
- Summary of assessment available – SBA Control Sheet
- Appropriate aggregation of marks
- Marking in accordance with memoranda
- Files are bound, indexed and sections separated with interleaves

| Response and comment | |
|----------------------|--|
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Tasks completed and marked according to requirements

- 2 controlled tests – enter number available and comment
- Practical Assignment – CAD
- Practical Assignment – Other
- 1 examination (paper 1 & paper 2 from the same examination session)
- Course Drawings (10 – and one from each topic)

| Response and comment | |
|----------------------|--|
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| Level of difficulty of set tasks | CORRECT LEVEL OF DIFFICULTY | | |
|----------------------------------|-----------------------------|-------------|-------|
| | Tests | Assignments | Exams |
| | | | |
| | | | |
| | | | |
| | | | |

Additional Comments (including description of any tasks or questions of particular merit):

MODERATOR'S SIGNATURE: _____ **DATE:** _____

Appendix B (Part b)



SAMPLE MODERATION PART B
To be completed and retained by the
IEB

Examination Centre Number: _____ Date: _____

The candidates required to submit Learner Files for moderation (names supplied by IEB)

| Examination number | School SBA Mark | Moderated SBA Mark (%) | PAT Mark (%) | Moderated PAT Mark |
|--------------------|-----------------|------------------------|--------------|--------------------|
| | | | | |
| | | | | |
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| | | | | |
| | | | | |
| | | | | |

Comments: _____

| | | |
|---|-----|----|
| SBA MARKS SHOULD BE ACCEPTED WITHOUT ALTERATION | Yes | No |
| PAT MARKS SHOULD BE ACCEPTED WITHOUT ALTERATION | Yes | No |

Change recommended by moderator: _____

Change to be implemented: _____

MODERATOR'S SIGNATURE: _____ **DATE:** _____

Appendix C



SCHOOL ADDRESS

The IEB
 P O Box 875
 Highlands North
 2037

Dear IEB Marking Administrator

RE: SCHOOL BASED ASSESSMENT AND MODERATION OF SBA IN GRADE 12

SUBJECT: ENGINEERING GRAPHICS & DESIGN

We certify that

| teachers of the same subject have ensured that | Circle your | |
|--|-------------|----|
| they have met regularly to reflect on and discuss issues of | YES | NO |
| the assessment tasks they have set learners are of the required standard | YES | NO |
| the memoranda they have used for marking are accurate and functional | YES | NO |
| the tasks learners have completed meet the criteria described in the IEB Subject Assessment Guidelines | YES | NO |
| marking is complete and of the appropriate standard | YES | NO |
| all administrative procedures have been correctly completed | YES | NO |
| all information on the 1st page of the portfolio (Appendix A) in each Learner's File is complete and correct | YES | NO |

 TEACHER

 PRINCIPAL

 DATE

 DATE

Appendix D



This declaration must be completed and filed immediately after Appendix A in the Learner's File.

Centre Number

Candidate's Examination number

DECLARATION BY THE CANDIDATE:

I, _____ (print full names)

declare that all external sources used in my SBA have been properly referenced and that the remaining work contained in this Learner File is my own original work. I understand that if this is found to be untrue, I am liable for disqualification from the National Senior Certificate Examination.

Date:

DECLARATION BY THE CANDIDATE'S TEACHER:

I _____ (print name and title of teacher) at

_____ (print name of school) declare that the work provided by this candidate has been monitored and checked for plagiarism.

Signed: _____ Date: _____

Teacher

APPENDIX E



A simplified RUBRIC for assessing course drawings (CDs) and daily exercises – taken from the *Curriculum And Assessment Policy Statement (CAPS): Engineering Graphics And Design* – Department of Basic Education.

NOTE: If the task is a course drawing, the complete model answer of the drawing has to be used as a guideline for obtaining the mark.

| *RUBRIC FOR THE CORRECTNESS OF THE DRAWING | | | |
|---|---|---|-------------|
| DESCRIPTION for MARK | GENERAL INDICATORS | ± PERCENTAGE | MARK |
| OUTSTANDING | <i>Error free</i> | 100% | 7 |
| MERITORIOUS (VERY GOOD) | <i>Few errors</i> | ± 85% A distinction drawing | 6 |
| SUBSTANTIAL (GOOD) | | ± 70% A good 'C' to 'B' drawing | 5 |
| ADEQUATE (SATISFACTORY) | <i>Some errors</i> (± ½ right and ½ wrong) | ± 55% MORE than a 50% | 4 |
| MODERATE (ACCEPTABLE) | | ± 40% LESS than a 50% | 3 |
| ELEMENTARY (UNACCEPTABLE) | <i>Many errors</i> | ± 33% Only a few correct features | 2 |
| NOT ACHIEVED (VERY BAD) | <i>Completely wrong</i> | ± 25% & LESS 'Something' drawn very wrongly | 1 |
| <i>NON-COMPLIANCE</i> | <i>No work handed in</i> | <i>Nothing to mark</i> | <i>NC</i> |

| RUBRIC FOR THE QUALITY AND NEATNESS OF THE DRAWING | | | |
|---|--|------------------------|-------------|
| Assess the consistency and quality of line work , printing/writing , dimensioning techniques and general neatness of the drawing. | | | |
| DESCRIPTION for MARK | GENERAL INDICATORS | ± PERCENTAGE | MARK |
| OUTSTANDING (VERY GOOD) | <i>Very easy to 'read'</i> | 80% + | 3 |
| ADEQUATE (SATISFACTORY) | <i>'Readable', but could be better</i> | 60% + | 2 |
| NOT ACHIEVED (UNACCEPTABLE) | <i>Difficult to 'read'</i> | 50% & LESS | 1 |
| <i>NON-COMPLIANCE</i> | <i>No work handed in</i> | <i>Nothing to mark</i> | <i>NC</i> |

| | |
|--------------|-----------|
| TOTAL | |
| | 10 |

Appendix F



| Rubric To Assess The Design Process | | | | | | | |
|--|---|--|---|--|--|--|---|
| SCALE | 7 Outstanding 80% – 100% | 6 Meritorious 70% – 79% | 5 Substantial 60% – 69% | 4 Satisfactory 50% – 59% | 3 Adequate 40% – 49% | 2 Partial 30% – 39% | 1 Inadequate 0% – 29% |
| Formulate a given design brief | Shows an in-depth and comprehensive understanding of the given design brief. | Shows a thorough understanding of the given design brief. | Shows a substantial understanding of the given design brief. | Shows a satisfactory understanding of the given design brief. | Shows adequate understanding of the given design brief. | Shows a partial understanding of the given design brief. | Shows poor to no understanding of the given design brief. |
| Research possible solutions | Evidence of in-depth research with a wide range of possible solutions, which are clearly, logically and comprehensively recorded. | Evidence of thorough research with a number of possible solutions, which are clearly and comprehensively recorded. | Evidence of substantial research with a number of possible solutions, which are clearly and comprehensively recorded. | Evidence of adequate research with a number of possible solutions, which are clearly recorded. | Evidence of adequate research with limited possible solutions, which are recorded. | Evidence of limited research with a possible solution, which is not fully recorded | Little to no evidence of any research or research is irrelevant to the solution. |
| Select, analyse and synthesise information and select a final solution | A high level of independent / creative thought in analysing, synthesising and selecting a final solution. | Thorough evidence of analysing, synthesising and selecting a final solution. | Substantial evidence of analysing, synthesising and selecting a final solution. | Satisfactory evidence of analysing, synthesising and selecting a final solution. | Adequate evidence of analysing, synthesising and selecting a final solution. | Limited evidence of analysing, synthesising and selecting a final solution. | Little to no evidence of any analysis or synthesis in selecting a final solution. |
| The final solution | The final solution is outstanding/exceptional. | The final solution is of a very high standard. | The final solution is of a high standard. | The final solution is satisfactorily completed. | The final solution is adequate | The final solution is partially complete. | The final solution is incomplete and disjointed. |
| Evaluation | Evidence of comprehensive evaluation at all stages of the design process. | Evidence of thorough evaluation at all stages of the design process. | Evidence of substantial evaluation at all stages of the design process. | Evidence of satisfactory evaluation of most stages of the design process. | Evidence of adequate evaluation at some stages of the design process. | Evidence of limited evaluation at some stages of the design process. | Little or no evidence of any evaluation. |

**ENGINEERING GRAPHICS AND DESIGN
EXAMINATION FORMAT AND COMPOSITION**

GRADE 12

| PAPER 1 – CIVIL – (3 hours) Emphasis on 1 st angle orthographic projection. | PAPER 2 – MECHANICAL – (3 hours) Emphasis on 3 rd angle orthographic projection. |
|---|--|
| <ul style="list-style-type: none"> • <u>Civil Drawings</u> The application of civil drawings showing the foundation to the roof with a restriction to single story dwellings. <ul style="list-style-type: none"> ○ Site plans ○ floor plans elevations ○ sectional elevations ○ window, door and roof detail ○ waste water/sewer lines ○ electrical wiring ○ plumbing components ○ areas and perimeters ○ dimensioning annotations and notes ○ scale ○ SANS 0143 • <u>Perspective Drawings</u> <ul style="list-style-type: none"> ○ Single or Two point Perspective ○ Dwellings and civil structures ○ Depth detail regarding windows and doors ○ Overhanging roof detail ○ Circular features • <u>Interpenetrations</u> The view showing the curve of interpenetration formed between two solid/ hollow pipes, including the following: <ul style="list-style-type: none"> ○ Regular geometric prisms or cylinders ○ Axes can be in line or off-set ○ Branch piece axis may be perpendicular or inclined to one principle plane ○ Focus on industrial examples • <u>Developments</u> The surface developments of: <ul style="list-style-type: none"> ○ Interpenetrating solid/ hollow pipes ○ Hoppers ○ Sectioned pyramids and cones ○ Complex transition pieces ○ Focus on industrial examples ○ Seam allowances can be included • <u>Civil Analytical</u> <ul style="list-style-type: none"> ○ dimensioning annotations and notes ○ component and feature identification ○ civil abbreviations ○ types of civil drawings ○ comprehension of civil drawings ○ rodding and inspection eyes ○ electrical components ○ plumbing components ○ area and perimeter ○ scale ○ conventions ○ the application of colours ○ SANS 0143 | <ul style="list-style-type: none"> • <u>Mechanical Assembly</u> Complex assembly drawing incorporating temporary and permanent fasteners and mechanical features <ul style="list-style-type: none"> ○ dimensioning annotations and notes ○ SANS 0111 ○ Scale ○ Sectioning: <ul style="list-style-type: none"> – Full Sectional views – Half Sectional views – Non-Sectional views • <u>Isometric Projection</u> <ul style="list-style-type: none"> ○ Isometric and non-isometric lines and surfaces ○ Sectioned isometric ○ Isometric circle ○ Isometric polygons ○ Isometric angles ○ The use of auxiliary views ○ Centre lines • <u>Loci</u> <ul style="list-style-type: none"> ▪ Cam <ul style="list-style-type: none"> ○ Uniform or Simple Harmonic Motion\ ○ Wedge and Roller Follower ○ Direction ○ Graph of Displacement ○ Calculations: <ul style="list-style-type: none"> – Travel – Displacement – Angular movement ▪ Helix <ul style="list-style-type: none"> ○ Augers ○ Spiral Chutes ○ Coil Springs ○ Square Threads ○ Single Start ○ Right or Left hand ○ Direction ▪ Mechanism <ul style="list-style-type: none"> ○ Up to 3 moving points ○ Schematic Drawings • <u>Mechanical Analytical</u> <ul style="list-style-type: none"> ○ dimensioning ○ machining symbols ○ welding symbols ○ tolerances ○ annotations and notes ○ comprehension of mechanical drawings ○ scale ○ mechanical abbreviations ○ component and feature identification ○ conventions ○ SANS 0111 |
| Mark allocation: 200 <u>Conversion: ÷ 2</u> TOTAL: 100 | Mark allocation: 200 <u>Conversion: ÷ 2</u> TOTAL: 100 |