CHAMBER OF MINES OF SOUTH AFRICA
Putting South Africa First

SYLLABUS FOR THE ELEMENTARY MINE SURVEYING CERTIFICATE

Version 1/06 (Legislation Amended April 2013)

Examination conditions

The candidates **must** have already passed the Basic Mine Surveying Certificate (or an acceptable equivalent)

The examination consists of **Part A** and **Part B**.

Part A (Theory):

- **A three-hour elementary mine surveying theory paper (closed book).**

To pass **Part A** the candidate must obtain a minimum of 60%. A pass mark will be retained on record for 18 months.

Only hand held non-programmable electronic calculators will be permitted for the **Part A** examination paper.

Part B (Practical):

For the purposes of this syllabus **the portfolio means:-**
documented evidence of the candidate's practical surveying skills as proof of practical competence in the prescribed or required skills as listed under **"Syllabus (Practical)"** on pg.5 below.

The candidate may undertake **Part B** at any time prior to **Part A** (the written theory examination) provided that a pass mark has been obtained for the Basic Mine Surveying examination.

Should **Part A** be undertaken first t**he portfolio** must be completed and submitted to COM Mine Surveying Examination Committee for assessment within 18 months of successful completion of **Part A**.

The candidate **may** be required to present **the portfolio** to a panel of mine surveying practitioners appointed by the COM Mine Surveying Examination Committee.

To successfully complete the Elementary Mine Surveying Certificate the candidate must have obtained to pass mark for both **Part A** and **Part B**.

Syllabus Part A (Theory)

The syllabus shall consist of the Basic Mine Surveying Certificate syllabus as well as the following:

1. Demonstrate an understanding of the theory and principles of surveying, and in particular mine surveying, with reference, but not limited to definition, objectives, types, methods, scales, maps/plans, units of measure.

2. Demonstrate an understanding of the theory and principles associated with co-ordinates and co-ordinate systems, with emphasis on the Lo and WGS84 systems.

3. Demonstrate an understanding of the use, principles of operation, adjustments and care of:

    - A level;
    - A theodolite;
    - A planimeter.

4. Demonstrate an understanding of terms commonly used in mine surveying. The terms include, but are not limited to:

    - levelling
    - datum (datum plane)
    - reduced level (elevation)
    - line of sight and line of collimation
    - backsight, intermediate sight, foresight
    - survey peg, survey point
    - grading, gradient,
    - grade peg
    - traverse
    - planes/surfaces and angles (horizontal, vertical, inclined)
    - strike and dip

5. Solve triangles. The methods to solve triangles include, but are not limited to the Theorem of Pythagoras, trigonometrical ratios for right-angled triangles, sine-rule, cosine-rule, tangent-rule and the co-tangent equation method.

6. Demonstrate an understanding of the theory and principles associated with and perform calculations related to:

- Levelling (including cut and fill, volumes).
- Grades (gradients) in flat and inclined development ends (including inclined shafts).
- Survey traverses (underground and/or surface traverses).
- Tape surveying (including tape corrections).
- Plotting and projection of underground survey pegs.
- Obtaining areas of irregular figures using a planimeter.
- Triangulation.
- Trilateration.

It is recommended that candidates obtain the following study material:

Surveying for Mine Surveyors (The Institute of Mine Surveyors)
Problems and Solutions for Mine Surveyors (The Institute of Mine Surveyors)
Survey Handbook (Survey Services Department, Durban Corporation)

7. Demonstrate and understanding of relevant mining legislation.

(Candidates must ensure that up-to-date legislation is obtained)

Sufficient knowledge of the relevant subject matter listed below is required.

RELEVANT REGULATIONS OF THE MINE HEALTH AND SAFETY ACT

CHAPTER 10. MISCELLANEOUS AND GENERAL PROVISIONS

Regulation: 10.1

Definitions:

Explosion protected apparatus; hazardous location; Light-metal.

Regulations: 10.1 (1), 10.1(2)(a), 10.1(2)(b),10.1(2)(c), 10.1(2)(e), 10.1(2)(f), 10.1(2)(g), 10.1(2)(h), 10.1(2)(j), 10.1(2)(o)(aa), 10.1(2)(o)(bb), 10.1(2)(o)(cc),

CHAPTER 14 PROTECTION OF THE SURFACE AND THE WORKINGS

Regulations: 14(4), 14(5), 14(6), & 14(7)

CHAPTER 17(As amended) SURVEYING, MAPPING AND MINE PLANS

Regulation: 17(1),

Definitions: (all)

Regulations: 17(4)(a), 17(4)(b), 17(4)(c), 17(4)(f), 17(4)(g), 17(11)(a), 17(11)(b), 17(12), 17(13), 17(14)(a), 17(14)(b), 17(14)(b)(i), 17(14)(b)(ii), 17(14)(b)(iii), 17(14)(b)(iv), 17(14)(b)(v), 17(14)(d)(i) to 17(14)(d)(x), 17(14)(e), 17(14)(f), 17(14)(h), 17(14)(j), 17(29)(a), 17(29)(b).

It is recommended that candidates obtain up-to-date copies the following study material:

The Mine Health and Safety Act (as amended) and Regulations
The Minerals and Petroleum Resources Development Act (as amended)
The Regulations of the Minerals and Petroleum Resources Development Act.

Syllabus (Practical)

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ELEMENTARY MINE SURVEY

PRACTICAL TEST CHECKLIST **SUBJECT: DEVELOPMENT SURVEYING**

Pass Mark: 75% Marks Obtained: _____

Full Names of Candidate: _____

Mine: _____ Date: _____

Examined By: _____ Designation: Section Surveyor

	TASK	STANDARD	SET	MARKS ACHIEVED
1	Plan and organise development survey	1. Study development request list 2. Select and study development layout 3. Record required information 4. Notify production personnel 5. Organise labour and equipment – L. Hand (a) Correct level (b) Equipment	2 2 2 2 2 2	
2	Apply loss control	1. Control of gang a) All present? b) Gang to follow supervisor whilst travelling and leading hand to walk behind c) Communication with gang 2. Maintenance, care and control of equipment a) All necessary equipment to be present b) In good condition 3. First aid and safety equipment a) All necessary equipment to be present b) In good condition 4. Permission to enter working place If no miner, then shift boss or team leader	 2 2 4 2 2 1 1 2	

	TASK	STANDARD	SET	MARKS ACHIEVED
2.	Apply loss control	5. Travelling ways and barricades a) Take notice of barricades and danger Signs b) Use indicated travelling ways 6. Hazard reporting Report any unsafe conditions 7. Malpractice a) No short cuts b) No dangerous practices 8. Integrity Adhere to standards	 2 2 2 1 1 2	
3	Install survey peg	1. Select position Check hanging wall 2. Drill hole a) 5cm b) Use safe goggles c) Used swab 3. Secure peg 4. Tie plumb bobs Non-slip knots	 2 2 2 2 2 2	
4	Set up theodolite	1. Set up tripod and theodolite (a) Under correct station peg (b) Secure tripod (c) Tripod head level 2. Levelling and centre theodolite According to standard	 1 2 2 2	
5	Record field work	1. Headings 2. Record correct peg numbers 3. Record angular observations (a) Base plate to be changed after each arc (b) Two arcs to be taken (c) Check levelling and centring 4. Record slope distances (a) Support tape (b) Correct pull applied 5. Record bob heights 6. Record instrument height 7. Calculation of direction foresight to station	2 2 2 2 2 2 2 1 1 2	
6	Set up theodolite new peg	1. Set up tripod (a) Under correct station peg (b) Secure tripod (c) Tripod head level 2. Level and centre theodolite According to standard	 1 1 1 2	

	TASK	STANDARD	SET	MARKS ACHIEVED
7	Install line peg	1. Select position Check hanging wall 2. Drill hole According to standard 3. Insert block and pin 4. Tie plumb bobs Non-slip knots	 1 1 1 1	
8	Record field work of line peg	1. Headings 2. Record peg number 3. Record angular observations (a) Base plate to be changed after each complete arc (b) Two arcs to be taken (c) Double foresight (d) Additional check 4. Record slope distances (a) Support tape (b) Correct pull applied 5. Record bob heights 6. Record instrument and check height	1 1 1 2 2 1 1 1 1 1	
9	✸✸ Install side grades	1. Calculate side grades (a) Calculate collimation (b) Calculate required elevation of side grades (c) Establish collimation marks on sidewalls (d) Establish position of side grades (e) Install side grades (f) Check side grades	 1 2 2 2 1 2	
10	Offset development end	1. Horizontal ends a) Distance peg to face b) Installation of 60 m tape c) Offsets - left and right d) Average height e) Offset extras 2. Inclined ends a) Distance peg to face b) Installation of 60 m tape c) Measure and record bob heights d) Offsets - left, right up and down. e) Offset extras f)	 1 1 1 1 1 1 1 1 1 1	

11	Calculation of survey peg	1. <u>Forward distance and elevation</u> (a) Name of surveyor, date, field book number and page (b) Entering base, vertical angle, slope distance, instrument and bob heights (c) Cross reference (d) Calculation of vertical differences, elevation and horizontal distance (e) Check 2. <u>Check back distance and elevation</u> (a) Name of surveyor, date, field book number and page (b) Entering base, vertical angle, slope distance, instrument and bob heights (c) Calculation of vertical difference, elevation and horizontal distance (d) Check (e) Highlighting mean horizontal distance 3. <u>Directions</u> (a) Forward direction (b) Backward direction (c) Back direction plus 45° 4. <u>Co-ordinates</u> (a) Forward co-ordinate differences and co-ordinates (b) Check	 1 1 1 3 1 1 1 3 1 1 1 1 1 2 2	
12	Calculation of chain at new peg	1. Grade elevation and chain length 2. Check	1 1	
13	Calculation of elevation and plotting point of line peg	1. <u>Distance and elevation</u> (a) Name of surveyor, date, field book number and page (b) Cross reference (c) (TOP) vertical angle, slope distance, instrument and bob height (d) (BOTTOM) vertical angle, slope distance, instrument and bob height (e) (TOP) vertical difference, elevation and horizontal distance (f) Check (g) (BOTTOM) vertical difference, elevation and horizontal distance (h) Check (i) Highlighting means horizontal distance peg to line peg 2. <u>Direction peg to line peg</u> (a) Forward direction (b) Backward direction (c) Back direction plus 45°	 1 1 1 1 3 1 3 1 1 1 1 1	

	TASK	STANDARD	SET	MARKS ACHIEVED
13	Calculation of elevation and plotting point of line peg	3. Co-ordinates of plotting point (a) Forward co-ordinates differences and co-ordinates (b) Check	 2 2	
14	Calculation of chain at line peg	1. Grade elevation and chain length 2. Check	1 1	
15	✸✸computer terminal input	1. Peg (a) Select peg calculation programme (b) Enter field work (c) Check printout 2. Line peg (a) Select peg calculation programme (b) Enter field work (c) Check printout	 2 2 2 2 2 2	
16	✸✸Computer peg calculation source documents	1. Peg (a) Enter field work (b) Check entries 2. Line peg (a) Enter field work (b) Check entries	 2 2 2 2	
17	Plotting	1. Plotting of peg (a) Plot from co-ordinates (b) Check HD from station peg (c) Ink in 2. Plotting of line peg and plot in point (a) Plotting point from co-ordinates (b) Check HD from peg (c) Plot line peg (d) Ink in 3. Plot offsets (a) Plot offsets (b) Plot extras (c) Ink in (d) Average height and width if applicable	 2 2 2 2 2 1 2 2 2 2 1	

	TASK	STANDARD	SET	MARKS ACHIEVED
18	Grade chains	1. Cut chains 2. Check chains	1 1	
19	Survey note	1. Prepare survey notes 2. Send survey note and grade chains to shaft	2 1	
		TOTAL	206	