

**PROGRAM** : NATIONAL DIPLOMA  
*MINERAL SURVEYING*

**SUBJECT** : **MINERAL SURVEY 111**

**CODE** : **MSY 3111**

**DATE** : YEAR-END EXAMINATION  
02 NOVEMBER 2015

**DURATION** : (X & Y PAPER) 08:00 - 15:30

**WEIGHT** : 40:60

**FULL MARKS** : 100

**TOTAL MARKS** : 100

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**EXAMINER** : MR D.N.WILSON

**MODERATOR** : MR D. RAE

**NUMBER OF PAGES** : 5 PAGES

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**INSTRUCTIONS** : ANY CALCULATORS ARE PERMITTED (STUDENTS  
ARE ALLOWED MORE THAN ONE CALCULATOR).  
: STUDENTS ARE ALLOWED ANY REFERENCE  
MATERIAL (THIS IS AN OPEN BOOK EXAM).  
: STUDENTS MAY USE THE COMPUTERS PROVIDED  
: ALL ANSWERS MUST BE WRITTEN IN THE  
EXAMINATION SCRIPT – STEPS SHOULD BE SHOWN  
WHERE NECESSARY (WITH SKETCHES)

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**REQUIREMENTS** : SUFFICIENT SPACE FOR REFERENCE MATERIAL

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**INSTRUCTIONS TO STUDENTS:**

1. ANSWER ALL THE QUESTIONS.

**QUESTION 1**

The following leveling traverses were carried out to determine the final elevations of three new leveling benchmarks (P), (Q) and (R).

Given :

Line	Level traverse Number	Vertical Difference	Number of set-ups
[A] to [Q]	1	- 7,693 2m	14
[A] to [P]	2	- 4,463 2 m	7
[P] to [Q]	3	- 3,224 8 m	4
[B] to [P]	4	+ 4,992 5m	24
[B] to [Q]	5	+ 1,767 4 m	9
[R] to [Q]	6	+ 5,965 9 m	17
[C] to [Q]	7	+ 8,810 1 m	32
[B] to [R]	8	- 4,196 1 m	12
[C] to [R]	9	+ 2,843 4 m	19
[D] to [R]	10	- 2,531 4 m	21
[D] to [P]	11	+ 6,659 7 m	24

Benchmark Number	Final Elevation
[A]	+ 1 682,497 8 m
[B]	+ 1 673,038 2 m
[C]	+ 1 665,997 5 m
[D]	+ 1 671,368 2 m

Calculate :

- 1.1 the final elevations of points (P), (Q) and (R) by using a suitable least square adjustment method. Do a “logical” check to confirm your answers.

[20]

QUESTION 2

The following co-ordinates are known on two systems of co-ordinates.

The following **readings** (observations – un-orientated) were taken at an unknown point [P] in order to determine the Final co-ordinates of the unknown point [P].

Set-up @ point [P] (before any adjustments)				
	Direct	Transit	Direct	Transit
R/O [D]	290°09'53"	110°09'51"	290°09'49"	110°09'46"
[B]	319°25'24"	139°25'20"	319°25'22"	139°25'26"
[F]	343°54'13"	163°53'54"	343°54'12"	163°53'59"
[E]	199°11'48"	19°11'52"	199°11'55"	19°11'57"
[C]	204°44'12"	24°43'56"	204°44'06"	24°43'54"
R/O [D]	290°10'03"	110°09'54"	290°10'09"	110°09'52"

Given :

Goldfields			L.O. 29 ° E	
Y (m)	X (m)	Point	Y (m)	X (m)
+ 20 000,012	- 9 999,976	[B]	+ 84 513,489	+ 2 881 312,708
+ 18 347,529	- 11 505,934	[C]	+ 82 995,618	+ 2 882 953,865
+ 19 229,989	- 10 581,598	[D]	+ 83 926,287	+ 2 882 078,403
+ 18 901,302	- 11 546,298	[E]		
		[F]	+ 85 287,905	+ 2 879 376,834

Calculate:

- 2.1 The provisional co-ordinates for point [P] by using the known points [C], [D] and [F] –  
These provisional co-ordinates must be calculated on L.O. 29° East.
- 2.2 The final co-ordinates of point [P] on L.O. 29° East by using a suitable least square adjustment method. **ALL the observed points** must be used in the calculation.
- 2.3 **The co-ordinates for point [F] on the Goldfields System** by using only the **three points** which are common to both systems.

**All the necessary corrections must be applied to obtain any marks for this question.**

[50]

QUESTION 3

In order to determine the co-ordinates of a new point [Z], the distances were measured from point [Z] to the known points [P], [Q], [R] and [S].

The E.D.M. used to measure the distances was first calibrated to determine any zero or constant error for the instrument. The table below shows seven (7) horizontal distances that were measured after correctly applying atmospheric pressure and temperature corrections. The measured horizontal distances are listed with the actual correct known distance in the table.

QUESTION 3 (cont)

Line	Correct (known distance)	Measured horizontal distance
1 – 2	148,276 m	148,313 m
2 – 4	500,424 m	500,432 m
1 – 5	850,618 m	850,638 m
6 – 7	364,402 m	364,468 m
1 – 3	601,809 m	601,869 m
3 – 4	440,384 m	440,397 m
5 - 6	550,767 m	550,821 m

Point	Co-ordinates		
	Y	X	Elevation A.M.S.L.
[P]	- 108 662,320 m	+ 2 787 593,110 m	+ 1 179,160 m
[Q]	- 113 378,490 m	+ 2 787 637,460 m	+ 1 298,370 m
[R]	- 112 417,530 m	+ 2 788 870,580 m	+ 1 235,650 m
[S]	- 109 915,570 m	+ 2 790 985,880 m	+ 1 498,320 m

The elevation of point [Z] was determined by leveling and calculated to be + 1 218,311 m above mean sea level.

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**QUESTION 3 (cont)**

The following slope (incline) distances were measured with the same E.D.M. and prisms as was used during the calibration exercise.

Slope distance Z – P = 3 362,653 m

Slope distance Z – Q = 1 427,540 m

Slope distance Z – R = 965,659 m

Slope distance Z – S = 3 651,972 m

The instrument height (above) at the unknown point [Z] = 1,680 m

The target height (above) at the known points [P], [Q], [R] and [S] = 0,360 m

Calculate:

- 3.1 the provisional co-ordinates of point [Z] by using the **final corrected distances** from the two points [P] and [S].
- 3.2 the final co-ordinates of point [Z] by using a suitable least square adjustment method.

**All the necessary corrections must be applied to obtain any marks for this question.**

[30]

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**TOTAL : 100**