



**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**FACULTY OF INDUSTRIAL TECHNOLOGY**

**DEPARTMENT OF CIVIL AND WATER ENGINEERING**

**ENGINEERING SURVEY 1**

**TCW 2102**

**Examination Paper**

**DECEMBER 2015**

This examination paper consists of 7 pages

**Time Allowed: 3 hours**

**Total Marks: 100**

**Special Requirements: None**

**Examiner's Name: P. Kamwemba**

**INSTRUCTIONS**

1. Answer any four (4) questions
2. Each question carries 25 marks
3. Use of calculators is permissible

**MARK ALLOCATION**

<b>QUESTION</b>	<b>MARKS</b>
1.	25
2.	25
3.	25
4.	25
5.	25
<b>TOTAL</b>	<b>100</b>

### **QUESTION 1**

- ( a ) Define engineering survey and list four purposes it serves. **( 5 marks)**
- ( b ) List five points on care and maintenance of tapes that you learnt. **( 5 marks)**
- ( c ) Describe any two methods of establishing a horizontal control point in survey. **(6 marks)**
- ( d ) Explain any three techniques of measuring a horizontal distance using a tape in survey. **( 9 marks)**

### **QUESTION 2**

- ( a ) Draw a sketch of a mechanical planimeter and label all the parts . **( 5 marks)**
- ( b ) A planimeter was used to trace a circle of radius 8 cm and the mean planimeter reading of 6,324 revolutions was obtained . Using the same setting , the planimeter was used to measure an area on a plan drawn to scale of 1 : 200 and gave a reading of 8,713 revolutions . Calculate this area in square metres . **( 5 marks)**
- ( c ) A planimeter is set to square centimeters reads 20,00 revolutions whe traced around an area on a plan . this area is known to represent 50 000 m<sup>2</sup> . What is the scale of the plan ? **( 5 marks)**
- (d) A planimeter which is set to 10cm<sup>2</sup> , is traced over an area known to be 156 hectares . The scale of the plan being 1 : 2 500 . What is the planimeter reading ? **( 5 marks)**
- ( e ) List five precautions that you would take when using a mechanical planimeter to determine the area of a figure . **(5 marks)**

### **QUESTION 3**

Fig. 3 shows a plan of a farm A , B , C , D , E and F. CD is an irregular boundary marked by the centre of the river . Given the following information :

### **Question 3 continued**

Point	Coordinates ( m)	
A	+ 1 047,250	- 219,360
B	- 715,320	- 705,190
E	- 1 052,470	+ 819,790
F	+ 1 346,790	+ 451,020

The horizontal distance BE = 1561,804 m . The area of the irregular figure is to be calculated from the following evenly spaced offsets ( in metres) along BE : 10.5 , 7.9 , 8.4 , 11.5 , 12.4 , 15.7 , 21.9 , 25.3 , 23.4 , 18.7 and 14.4 . Calculate the area of the farm in square metres using any two methods for the irregular area . **( 25 marks)**

### **QUESTION 4**

**(a)** The ground slopes at 1 in 20 at right angles to the centre line of a proposed embankment which is 12 m wide at formation height of 3,030 m above the ground . If the sides slope at 1 in 2 , calculate the cross- sectional area of the embankment . **( 7 marks)**

**(b)** A level section of a proposed road is to be constructed on ground having transverse slope at right angles to the proposed centerline of 1 in 8 . The side slopes are to be 1 in 2 in cut and 1 in 4 in fill and the formation width is 15,0 m. The volumes of cut and fill along the section are to balance . Calculate the required depth of cut at the proposed centerline. **( 15 marks)**

( c ) Explain the following survey terms ; ( i ) formation width , ( ii ) transverse slope and (iii) formation height . **( 3 marks)**

### **QUESTION 5**

The following levels were taken along the route on which a trench 1,380 m wide with vertical sides is to be cut and in which a concrete pipe 1 020 mm internal diameter is to be laid at a down grade of – 1: 250 from A to G . The bottom of the pipe is to be 1,820 metres vertically below A .

Station	Horizontal distance from A (m)	B.S.	I.S.	F.S.
A	0	2,602		
B	18		1,908	
C	30		2,438	
D	56	1,902		2,188
E	72		1,872	
F	95	1,704		3,042
G	110			2,180

Calculate the volume of earth to be excavated , taking the reduced level of A as zero .

**( 25marks)**

**QUESTION 6**

Two tunnels A and B are approaching each other and it is required to elevate the railway track at the face of each tunnel in order that a holding gradient can be calculated between the two . From the data given below , find the grade from the track at Peg 154 to track at Peg 151 .

**( 25 marks)**

Tunnel A

Station	B.S.	I.S.	F.S.	R.L.
Peg	<u>1,550</u>			512,517
Track		1,500		
Peg 149	<u>1,960</u>		<u>1,660</u>	
Track		0,870		
Track at 154		0,690		
Peg			<u>2,760</u>	

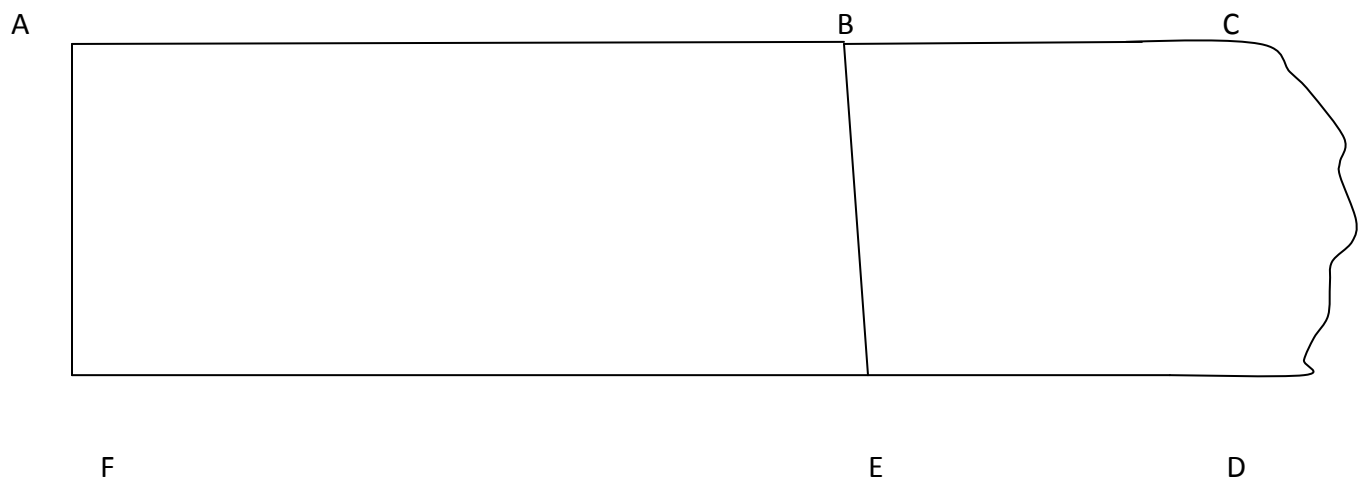
Tunnel B

Station	B.S.	I.S.	F.S.	R.L.
Peg 148	<u>1,300</u>			513,687
Track	1,520		1,840	
Track at 151		1,610		
Peg 151			<u>1,890</u>	

Horizontal distance Peg 154 to 151 = 64,000m

DIAGRAM

Fig.3



List of formulae

**List of formulae**

$$A = \frac{X \cdot Y^2 \cdot Z}{100^2}$$

$$A = \frac{(b + sh)^2}{2(s - m)}$$

$$A = \frac{(b - sh)^2}{2(s - n)}$$

$$W_g = \frac{s(b + nh)}{s - n}$$

$$W_1 = \frac{s(b + nh)}{S + n}$$

$$A = 1/2 [ h + b/n ] ( W_1 + W_g ) - b^2/n$$

$$W_1 = \frac{s b + nh}{S - n}$$

$$W_2 = \frac{s b - mh}{s - m}$$

$$A_1 = \frac{(b + sh)^2}{2(s - n)}$$

$$A_2 = \frac{(b - sh)^2}{2(s - m)}$$

$$A = d/2 [ o_1 + o_N + 2( o_2 + o_3 + \dots o_{(N-1)} ) ]$$

$$A = d/3 ( X + 2O + 4E )$$