NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF CIVIL AND WATER ENGINEERING
FACULTY OF INDUSTRIAL TECHNOLOGY
BACHELOR OF ENGINEERING (HONOURS) DEGREE
PART II FIRST SEMESTER EXAMINATIONS-MAY 2009
ENGINEERING SURVEY I TCW 2102

INSTRUCTIONS

Answer any four questions

Time : 3 hours
Total Marks : 100

QUESTION 1

A baseline PR was measured in two sections with a tape and the field data recorded are as follows :

Line	Length(m)	Slope angle	Temperature	Tension	Catenary
PQ	99,895	$+2^0$	25^0c	51N	3 equal bays
QR	31,115	$+1^0$ 50'	26^0c	50N	1 bay

Other Data

Radius of the earth	=	6361km
Coefficient of linear expansion	=	$0{,}0000112/^0$c
Elevation (height) above sea level of ground points	=	1 500m
Standard temperature	=	22^0c
Standard tension	=	50N
Cross-sectional area of tape	=	$2mm^2$
Mass of tape	=	0,17kg/m
Young's Modulus for the tape material	=	$200kN/mm^2$

Calculate the mean sea level distance PR. (25 marks)

QUESTION 2

(a) An embankment shown in fig2 a is to be constructed on a road site to the following dimensions :
Formation width AB = 16m
Height at center (h) = 4m
Side slope = 1:2
Ground slope(transverse) = 1:12

Calculate the cross-sectional area for this embankment. (10 marks)

(b) A road is to be constructed on a hillside section as shown in fig.2. Given the following road parameters :

Road width	=	20m
Existing ground slope	=	1in 5
Side slope in cut	=	1 in 1
Centre height in cut	=	1m
Side slope in fill	=	1 in 2

Calculate the cross-sectional areas of cut and fill. (10 marks)

© Given the following information:

Horizontal distance intervals(m) :	0 , 50 100 , 150 , 200
Reduced levels(m)	500 , 450 , 550 , 575 and 600

Draw a longitudinal profile. (5 marks)

(25marks)

QUESTION 3

(a) Define the following terms : bench mark , datum , change point and horizontal line. (5 marks)

(b) Fig.3b shows the longitudinal section for a straight length of a proposed road and a series of six cross-sections taken at right angles to the proposed centerline at 50m horizontal distance intervals. Calculate the total volumes of cut and fill required between the first and last cross-sections. (20 marks)

(25 marks)

QUESTION 4

(a) A building site is to be excavated on a hill sloping at 100 to the horizontal. If the horizontal base of the site is to be 40m by 40m and the sides of the excavation are to slope at 1m vertical to 1,5m horizontal as shown in fig. 4a. Calculate the volume of earth to be excavated. (20 marks)

(b) A planimeter is traced over a circle of radius 8cm and the difference in readings obtained was 6,324 revolutions . At the same setting the planimeter was used to measure an area on a plan drawn to a scale of 1 : 200 and gave a reading of 8,713 revolutions. Calculate this area. (5 marks)

(25marks)

QUESTION 5

The following sets of readings were taken to test an automatic level

Set 1
Level set up midway between two pegs A and B , 60m apart horizontally.
Reading on the staff when held vertically at A = 1,608m
Reading on the staff when held vertically at B = 1,484m

Set2
Level set up on the line AB extended , 6m from B horizontally.
Reading on the staff when held vertically at A = 1,455m
Reading on the staff when held vertically at B = 1,371m

Calculate the collimation error in the level per 60m of sight. (20 marks)

(b) Comment on the error. (5 marks)

(25 marks)

QUESTION 6

The following levels were taken over a stretch of ground where it is required to excavate a trench , 1,1 metres wide with vertical sides for carrying a pipe at a downgrade of 1 : 50 from a to F . The bottom of the pipe is to be 1,7metres vertically below A. Reduced elevation of A is 1300,000m and 1 cubic metre of water = 1 000litres.

Station	Distance from A	B.S.	I.S.	F.S.
A	-	3,094		
B	15m		2,194	
C	37m		1,524	
D	56m	0,640		0,381
E	67m		1,143	
F	76m			2,652

Reduce the levels using the rise and fall method and
Calculate
(i) the volume of the excavation in cubic metres. (20marks)

(ii) Assuming that a pipe of 0,762metres internal diameter is laid in the trench and that the depth of water in the pipe is 0,558metres with a linear velocity of 15metres per minute , calculate the flow in litres per hour . (5 marks)

(25marks)

List of Formulae

$A = \frac{X.Y^2.Z}{100^2}$ $A = \frac{(b-sh)^2}{2(s-n)}$ $A = \frac{(b+mh)^2}{2(s-m)}$

$W_1 = s\,\frac{(b-nh)}{s-n}$ $W_2\ s\,\frac{(b+mh)}{s-m}$

$V = h/3\ (A+ 2O + 4E)$, $V = h/2\ [A_1 + A_N + 2(A_2 + A_{3\ +.....}A_{(N-1)})\ ]$

$W_l = s\,\frac{(b+nh)}{s+n}$, $Wg = \frac{(b+nh)}{s-n}$, $A = ½\ (h + b/n)\ (W_1 + W_g) - b^2/n$

$C_s = L\frac{(L'-L)}{L}$, $C_t = L_m(t_f-t_s)\alpha$, $C_c = \frac{(mg)^2L^3m}{24T^2}$, $C_m = \frac{L_mh}{R+h}$

$V = 1/6\ (a+b+c).l.h$, $C_T = \frac{T_f-T_S}{AxE}$

Fig.2a

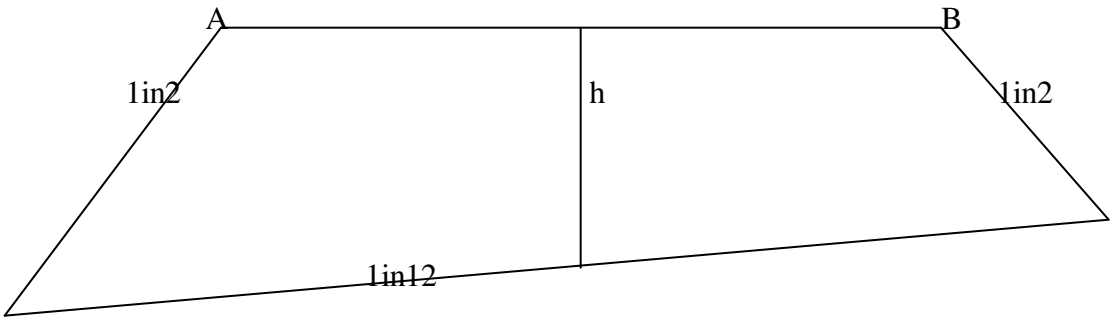


Fig.2b

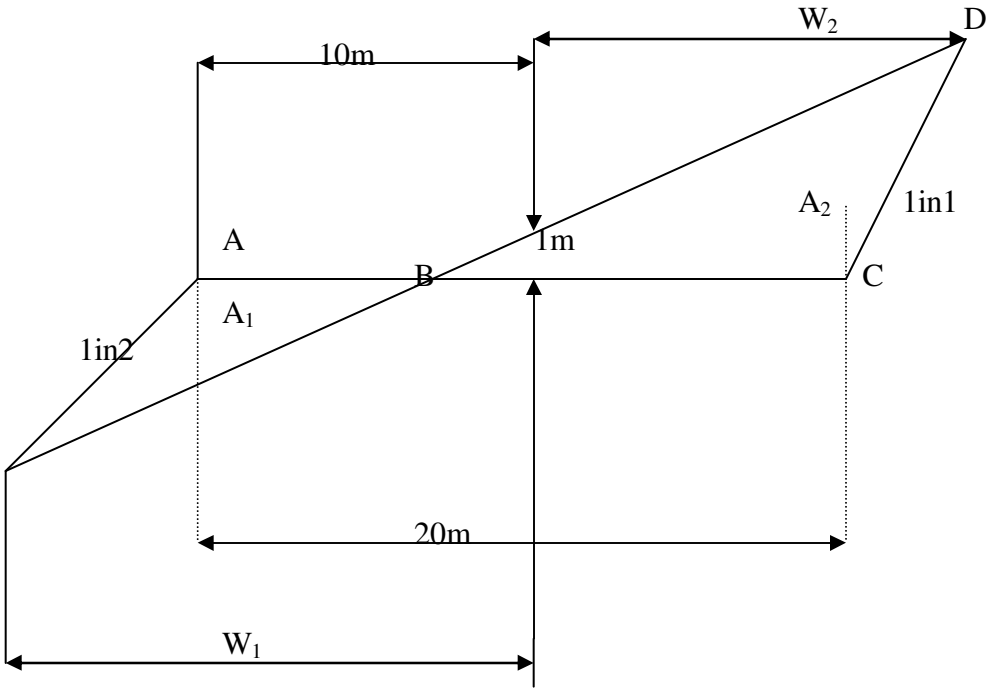
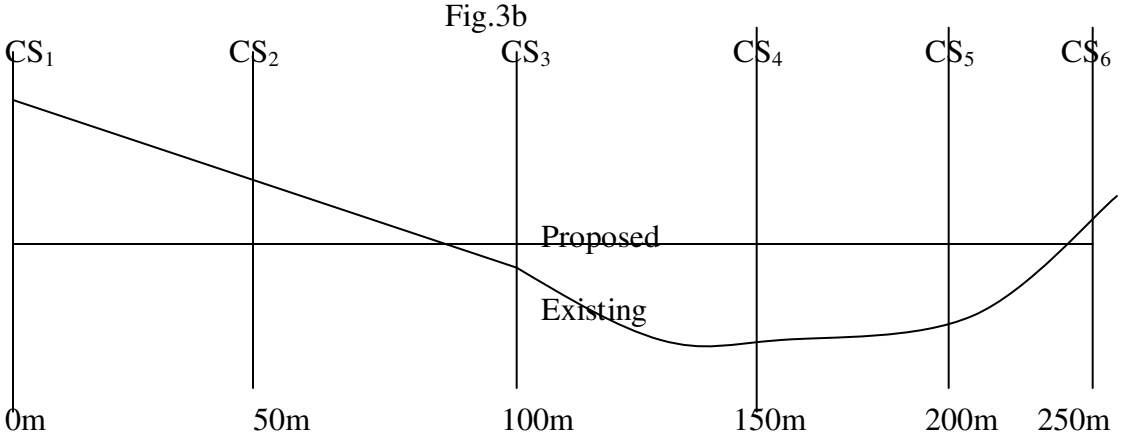
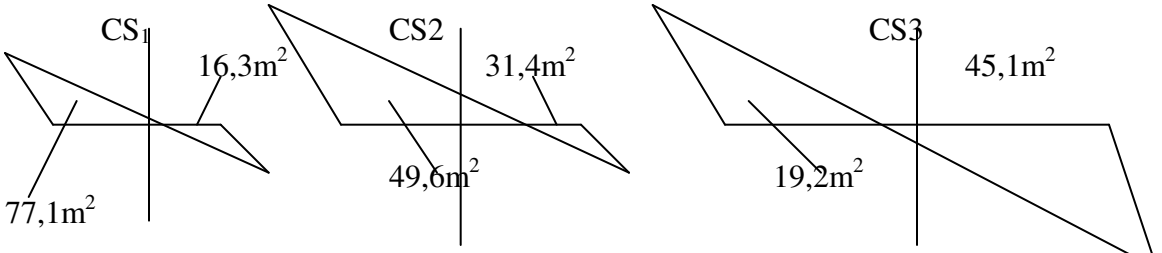


Fig.3b


CS1
CS2
CS3
CS4
CS5
CS6
Proposed
Existing
0m
50m
100m
150m
200m
250m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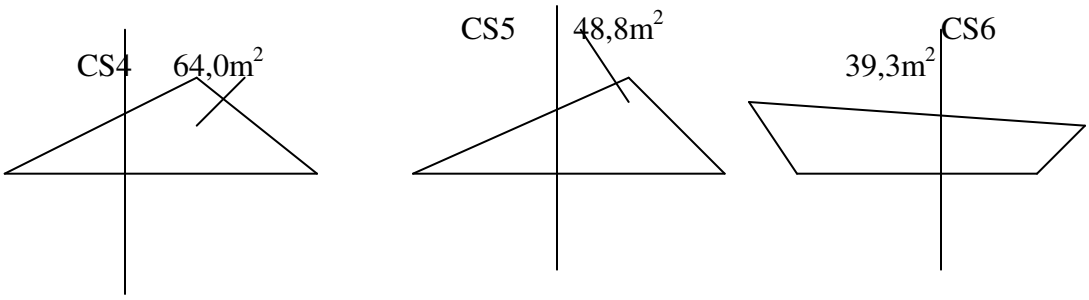
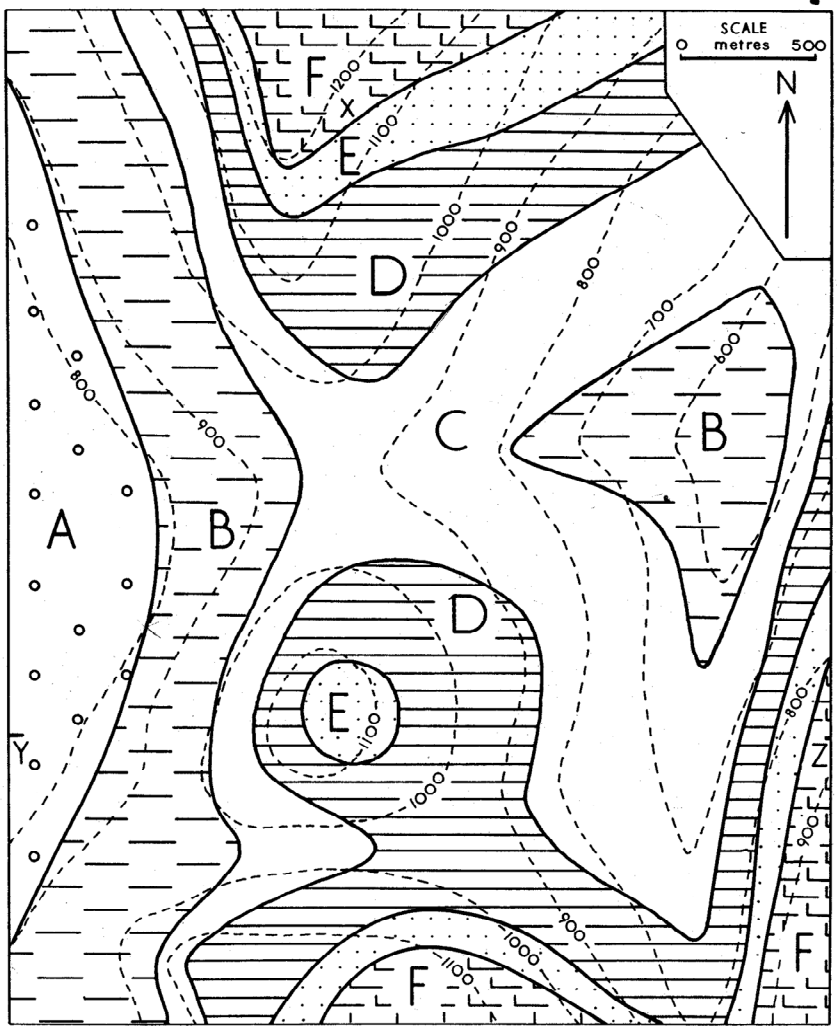
16,3m2
77,1m2
CS2
31,4m2
49,6m2
CS3
45,1m2
19,2m2


CS4
64,0m2
CS5
48,8m2
CS6
39,3m2

MAP 1


SCALE
metres 500
N
F
E
D
C
B
A
B
D
E
F
F
X
Y
Z
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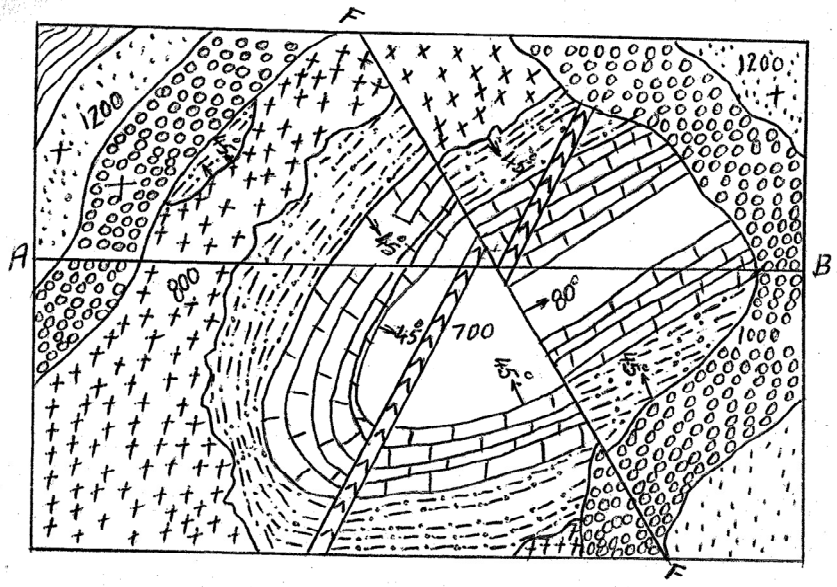
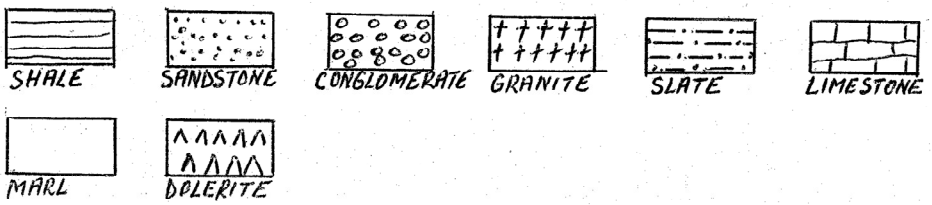
1000
900
800
700
600
800
900
1000
1100
1000
900
800
900
1000
1100

MAP 6


F
A
B
F
1200
1200
800
700
1000
45°
45°
80°
45°
45°


SHALE
SANDSTONE
CONGLOMERATE
GRANITE
SLATE
LIMESTONE
MARL
DOLERITE