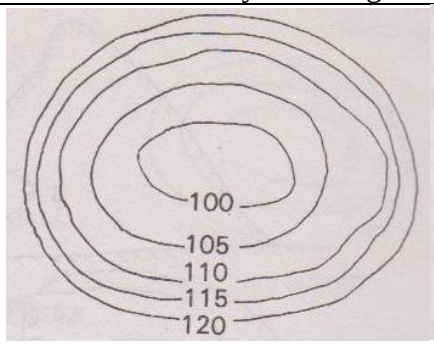
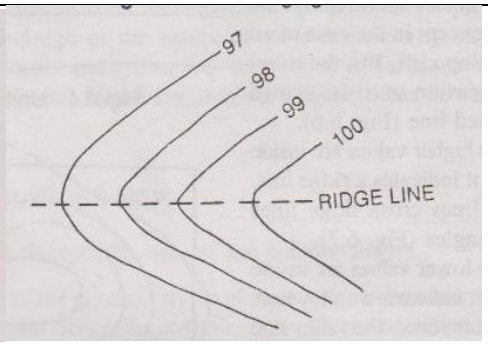
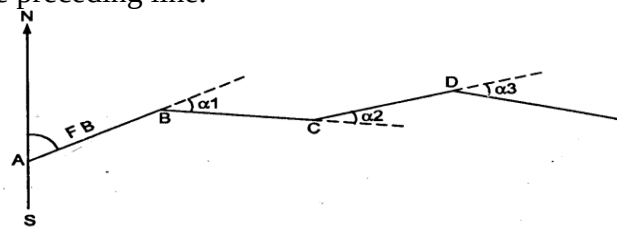
MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
(Autonomous)
(ISO/IEC-270001 – 2005 certified)

SUMMER-14 EXAMINATION

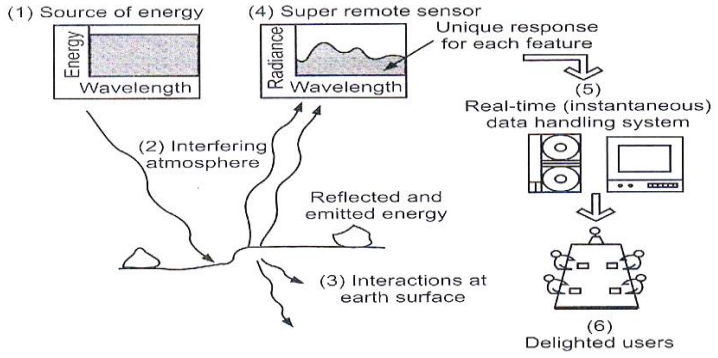
Important Instructions to examiners:

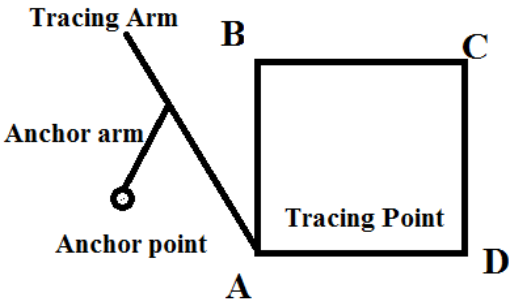
1) The answer should be examined by keywords and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language error such as grammatical, spelling errors should not be given more importance.(Not applicable for subject English and communication skill).
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figure drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In the some cases, the assumed constants values may vary and there may be some difference in the candidates answer and model answer.
6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidates understanding.

Q1) a) Attempt any SIX of the following	**12**
i)Define Contour Interval and Horizontal Equivalent	
Contour Interval: - The vertical difference between any two consecutive contours is called contour interval. **Horizontal Equivalent:-** The Horizontal distance between any two points on two consecutive contours is called Horizontal Equivalent.	1 1
ii) Draw Contours of Valley and Ridge line	
 Valley  Ridge Line	01 mark each Fig.
iii) List any four component of Polar Planimeter.	
The following are the component parts of polar Planimeter 1. Tracing points, 2.Tracing arm, 3.Anchor arm, 4.Hinge, 5.Anchor points & Weight, 6**. Integrating unit** (Wheel, Counting disc, index mark, Vernier), 7.Clamp, 8. Slow motion screw. ***(Note- ½ mark each any four)***	*
iv) Define consecutive co-ordinates.	
Consecutive Co-ordinates:- The Latitude and Departure of any point with reference to the previous point are called consecutive co-ordinates.	2

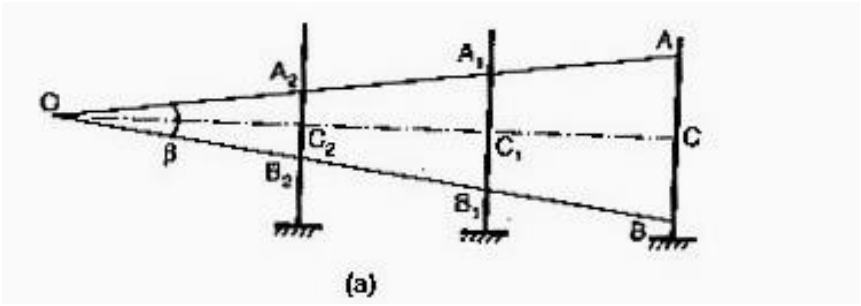
v) What is Anallatic lens?	
Anallatic Lens: - Anallatic lens is a special convex lens fitted between the object glass and eye piece at a fixed distance from the object glass inside the telescope of a tachometer. An Anallatic lens is generally provided in external focusing telescopes.	2
vi) List any four modern surveying instruments.	
The Following are the modern surveying instrument. 1) Total Station 2) One Second Micro Optic Theodolite 3) Electronic Digital Theodolite 4) Digital level 5) Remote Sensing 6) GPS 7) Aerial camera ***(Note- ½ mark each any four)***	*
vii) Define Degree of Curve.	
Degree of Curve :- It is defined as the central angle subtended by an arc of 30m or 20m length **OR** It is defined as the central angle subtended by an Chord of 30m or 20m length	2
viii) Define Passive and active Sensors.	
Passive Sensors: - The instrument used to measure the electromagnetic radiation leaving the surface under study sensors that sense natural radiations either reflected or emitted from the earth are called Passive Sensors. **Active Sensors: -** that electromagnetic radiation of a specific wavelength or band of wavelength to illuminate the earth's surface are called active sensors.	1 1
b) Attempt any two of the following	**8**
i) State the Methods of Locating contours with merits and demerits of each.	
1) Direct Method 2) Indirect Method i) By cross section ii) By Squares(Block Contouring) iii) Tachometric Method **Merits of Direct method :-** 1) It gives accurate contour lines. 2) This method can be controlled from single Station. **Demerits of Direct method :-** 1) This Method is Very Slow and tedious. 2) This method is applicable for small areas only. **Merits of Indirect method :-** 1) This method is quicker and less tedious. 2) This method is applicable for large areas. **Demerits of Indirect method :-** 1) It gives accurate contour lines.	1 1 1 1
i) Explain with sketch measurement of deflection angle by using theodolite.	
A deflection angle is the angle which a survey line makes with the prolongation of the preceding line.  Fig.	1

In the above fig. α1, α2, α3, are deflection angles. Survey line BC makes an angle with the prolongation of preceding survey line AB, similarly α2, α3 etc. Are deflection angles. Deflection angle=180- included angle. i.e. α1 = 1800x Angle ABC or α2 = 1800x Angle BCD and so on. The deflection angle may vary from 00 to 1800 but never greater than1800 .Deflection angle measured clockwise from the prolonged survey line is known as right, deflection angle and that measure anticlockwise from the prolonged survey line is known as left deflection angle. Thus, in figure the deflection angle at B is α1 R and that at C is α2 L. To Measure the deflection angle the following procedure are followed 1) Set up the theodolite at B and level it accurately. 2) With both plates clamped, the vernier A reading 3600, Take back sight on A. 3) Plunge the telescope to direct the line of sight AB produced. 4) Loosen the upper [plate and turn the telescope clockwise to take foresight on C. Read both Vernier the mean of two Vernier readings gives the approximate value of deflection angle at B (α1) 5) Loosen the lower clamp turn the telescope horizontally to back sight on A. the Vernier will read same reading as in step in 4 6) Plunge the telescop.unclamp the plate and again bisect C read both Vernier. 7) Find the mean of final Vernier readings. Thus the deflection angle ios double and hence , ½ of this average value gives the accurate value of deflection angle at B.	1 2
iii) Give The classification of EDM instrument.	
A) Classification based on the type of carrier wave used • Instrument using visible light waves • Instrument using invisible infra-red waves • Instrument using micro waves • Instrument using long ratio waves **B)** Classification based on range of the instrument. • Short range Instrument • Medium range Instrument • long range Instrument **C)** Classification based on the Appearance of the instrument **D)** Classification based upon reflected or transmitted wave.	1 1 1 1
Q2) Attempt any FOUR of the following	**16**
a) Points P & Q Are two ground points at a distance of 20 M With their reduced levels are 75.380 &78.260 M Respectively interpolate the contours of 76,77 &78	
Difference between P and Q = 78.260 - 75.380 = 2.88 m Difference of level between point P and 76 m contour = 76 - 75.380 = 0.62 m Distance of 76 m contour from P = (0.62/2.88) x 20 =4.30 m Difference of level between point P and 77 m contour = 77 - 75.380 = 1.62 m Distance of 76 m contour from P = (1.62/2.88) x 20 = 11.25 m Difference of level between point P and 78 m contour = 78 - 75.380 = 2.62 m Distance of 76 m contour from P = (2.62/2.88) x 20 = 18.19 m	1 1 1 1
b) An irregular area was measured with planimeter keeping anchor point inside the figure.The IR was 8.495 & FR was 4.325. The zero Crosses fixed index marked twice in clockwise direction find area of fig using M = 100 & C = 22.	
A=M(FR - IR ± 10N + C) A=100(4.325-8.495+ (10 x 2) + 22)	2 1

$A=3783m^2$	1
c) Define Transiting, Swinging, Face left, telescope inverted in case of Theodolite	
Transiting:- Transiting is the process of turning the telescope in vertical plane through 180^0 about the trunnion or horizontal axis. **Swinging:-** Swinging is the process of turning the telescope in horizontal plane . **Face left:-** if the face of the vertical circle is to the left of the observer the observation of angle is called as face left observation **Telescope inverted:-** A telescope is said to inverted when the vertical circle is to the right and bubble down.	1 1 1 1
d) State any four uses of Contour Maps.	
The following are the uses of contour maps 1) From the contour map we find the nature of ground , slope 2) It is used for location of highway , railway , canals , pipelines 3) For location of structures such as building, bridges etc. 4) For determination of most economical site for dams and reservoirs , maximum flood line 5) For determining the inter visibility of two points 6) For determining the storage capacity of reservoir ***(Note- 1 mark each any four)***	*
e) State any four uses of Total Station	
The following are the uses of Total Station 1) Measurement with distance stake out 2) Levelling function 3) Remote distance Measurement 4) Measurement of co-ordinates 5) Offset point measurement 6) Lot staking 7) Traverse measurement 8) Horizontal angle by method of repetition 9) 3-D cross section measurement 10) Remote elevation measurement function 11) Rear section measurement 12) Offset station measurement 13) Co-ordinate area measurement 14) Scaling measurement function ***(Note- 1 mark each any four)***	*
f) State with Sketch principle of remote sensing.	
The Principle states that remote sensing techniques are based on the observation of the reflectance of incident radiation and the emittance of radiation of the object. The Spectral emission from the object depends on the surface characteristics as well as molecular structure.  	02 02

Q3) Attempt any Four of the following	**16**
a) State with sketch procedure for computing constants of Planimeter.	
 **Known PlanArea say 100 cm2** 1) To determine the value of M, Take a plan of known area. 2) Measure the area of the plan by keeping the needle point outside the plan. 3) The measurement given the value of (R_F- R_1 ± 10N),say it equal to n, 4) Then A = Mn Therefore M = $\frac{A}{n}$ 5) To determine C, the area of zero circles is determined by the following method. A = M(R_F – R_1 ± 10N) = Mn_1 n_1 = R_F – R_1 ± 10N 6) Keep the needle point inside the plan and determine the area A of the plan again. Thus A = M(n_2 + C), Where, n_2 = R_F – R_1 ± 10N for needle point inside the plan. From above equation we can get Mn_1 = M(n_2 + C) Therefore, C = n_1 – n_2 The area of the zero circle is equal to A_o = MC = M(n_1 – n_2) ***OR*** ***(Note:- Consider the procedure attempted other than above also)***	01 03
b) Which errors are eliminated by method of repetition?	
1.) The errors due to the eccentricity of the centers and of the verniers are eliminated by reading both verniers and averaging the reading. 2.) The errors due to the imperfect adjustment of the line of collimation and the horizontal axis of the telescope are eliminated by face left and face right observation. 3.) The error of graduation is minimized by measuring the angle on different parts of the circle. 4.) The errors in the pointing tends to compensate each other and the remaining error is minimized error is minimized by the divisions.	1 1 1 1
c) The interior angles of closed traverse ABCDE are as follows: < A = $78^0$40’15” < B = $104^0$45’20” < C = $85^0$35’40” < D = $150^0$40’30” < E = $120^0$18’15” The bearing of line AB is 220^0 25’ 30” calculate bearings of remaining sides.	
Ans. The FB of AB = 220^0 25’ 30” Add < B = $104^0$45’20” $325^0$10’50” Deduct $180^0$0’00”	

The FB of BC = 145^0 10' 50" Add $< C = 85^0 35' 40"$ $230^0 46' 30"$ Deduct $180^0 0' 00"$ The FB of CD = 50^0 46'30" Add $< D = 150^0 40' 30"$ $201^0 27' 00"$ Deduct $180^0 0' 00"$ The FB of DE = 21^0 27'00" Add $< E = 120^0 18' 15"$ Bearing Of EA = $141^0 45' 15"$ **Check,** Add $< A = 78^0 40' 15"$ **FB of AB = 220^0 25' 30"**	1 1 1 1
d) State any four features of digital level.	
1) Electronic image processing for determining heights and distances 2) With the automatic recording of data for later transfer to the computer. 3) When used in electronic mode with the rod face graduate in bar code. 4) It can work in night mode also. 5) Direct display of results on digital display. ***(Note- 1 mark each any four)***	*
e) State any four uses of digital level.	
1) Digital level can be used to draw maps using interface with computer 2) It is also used for day night work of survey. 3) It can be used for determined the quantity of earth work with interfacing of software. 4) It is used to prepare a layout map for water supply sanitary or drainage scheme. 5) To prepare a L section and cross section of a project (Roads, Irrigation canal etc.) in order to determine the volume of earth work. 6) To determine altitude of different important points. 7) To prepare a counter map for fixing sights for a different structure. ***(Note- 1 mark each any four)***	*
f) Two straights meet at chainage 1800 m with deflection angle 600. The radius of curve is 100 m find i)Tangent length, ii) Long chord, iii) Length of curve, iv) Chainage of T	
Ans. i) Tangent length = R tan θ /2 = 100 tan $60^0/2$ = 57.74 m. ii) Length of long Chord = 2 R sin θ /2 = 2 sin $60^0/2$ = 100 m. iii) Length of curve = (R X θ X Л) /180 = (100 X 60 X Л)/180 =104.72m. iv) Chainage of T_1 = Chainage of PI - Tangent length = 1800 – 57.74 = 1742.26 m. Chainage of T_2 = Chainage of T_1 + Length of curve 1742.26 + 104.72 = 1846.98 m.	1 1 1 1

Q4) Attempt any Four of the following	**16**
a) Explain with example, establishing grade counter.	
Ans.: In Establishing grade counter it is necessary to measure the distance from the starting point or the lost point fixed to the next point to be fixed the required staff reading is the calculated from i) the Distance ii) Given gradient iii) The RL of plane of collimation of the level (HI). **Example**: Suppose a down gradient of 1 in 25 is to be traced on the ground. Let RL of the starting point = 750.00 m .,The distance = 30m, the height of instrument = 75.75 then R.L. of the next point = 750.00 – 30/25 = 750.00 – 1.2 = 748.80 m H.I. = 750.75 m. There for the staff reading required at the next point = 750.75 – 748.80 = 1.95 m.	02 02
b) Write any four desirable characteristics of good theodolite	
i) Telescope of theodolite must give erect image of staff ii) Theodolite must satisfy the characteristics of tachometer iii)It is desirable that it should be provided with good quality compass iv)Bubble of bubble tube must be sensitive v) Magnifying power of telescope must be more. vi)Graduations on lower plate and upper plate must be easily readable and free from errors and fitted with grater magnifying power of eye pieces ***(Note- 1 mark each any four)***	*
c) State principal of tacheometer with sketch.	
The principle of tachometry is based on the property of isosceles triangles and is that 'The ratio of the distance of the base from the apex and the length of the base is always constant. OR Stadia interval is directly proportional to staff intercepts.  (a) In the above fig. let two rays OA and OB be equally inclined to the center ray OC. Let A2-B2,A1 B1 and AB be the staff intercepts, than $(OC_2/A_2B_2) = (OC_1/AB_1) = (OC/AB) = \text{Constant } k.$	02 02

d) State how data is retrieved trough total station	
Following are the steps for data retrieval from Total Station. 1) Connect total station to pc by use of a serial port(RS 232 c) or serial cable adopter or serial USB adopter. 2) Remove other serial ports from devices like modem, printer, Scanner etc. PC 3) Set the data (files and folders) to transfer on PC from Total station in transport mode and operating system of PC. 4) Use communication set up in the Total Station and in the termination application i.e. P C. 5) Make the P.C. Application reading for receiving data and save the log input. 6) Send command to the total station for data transportation. 7) The received character string will be scrolled in the log window of P.C 8) When scrolling Stop save the log as a text file. 9) The received data will be like a text file. 10) Using MS- Excel point ID numbers, the measured parameters and the coordinates are to be separate out. 11) After getting parameters and doing simple calculation we are able to carry out slope distance, horizontal angle, vertical angle needed etc.	1 1 1 1
e) Calculate ordinates at 8 m interval for a circular curve with length of long chord 96 m. and radius 150 m.	
Given- X= 8 m L=96 m ,R = 150 m Central ordinate Oo = EF = $O_0 = R - \sqrt{R^2 - (l/2)^2}$ $= 150 - \sqrt{150^2 - (96/2)^2}$ $= 150 - 142.113$ = 7.887 m The ordinates at a distance x from the midpoint may be calculated from the formula, $O_x = \sqrt{R^2 - x^2} - (R - O_0)$ $O_8 = \sqrt{150^2 - 8^2} - (150 - 7.887)$ $O_8 =$ 7.673 m $O_{16} = \sqrt{150^2 - 16^2} - 142.113$ $O_{16} =$ 7.031m $O_{24} = \sqrt{150^2 - 8^2} - 142.113$ $O_{24} =$ 5.954 m $O_{32} = \sqrt{150^2 - 32^2} - 142.113$ $O_{32} =$ 4.43 m $O_{40} = \sqrt{150^2 - 40^2} - 142.113$	01 *

O_{40}= 2.455 m

$O_{48}=\sqrt{150^2-48^2}$ - 142.113

O_{48}= 0 m.

(Note- ½ mark each for ordinates at 8 m interval)

f) Following are the length and bearing of traverse

Line	Length	Bearing
AB	260m	30^0
BC	325m	140^0
CD	185m	210^0

Find length and bearing of DA.

Line	Length	Bearing (W.C.B.)	R.B.	Latitude Lcos Ø	Departure Lsin Ø
AB	260m	30^0	30^0 NE	+225.166	+130.000
BC	325m	140^0	40^0 SE	-248.96	+208.905
CD	185m	210^0	30^0SW	-160.214	-92.500
DA	L	Ø	Ø	Lcos Ø	Lsin Ø
				ΣL =-184.000	ΣD = + 246.400

Length of DA = L = $\sqrt{\Sigma L^2+\Sigma D^2}$

Length of DA = L = $\sqrt{184.00^2+246.400^2}$ 02

= **307.52 m**.

Bearing of DA = Ø = $\tan^{-1}(\Sigma D/\Sigma L)$

= $\tan^{-1}$ (246.4/184)

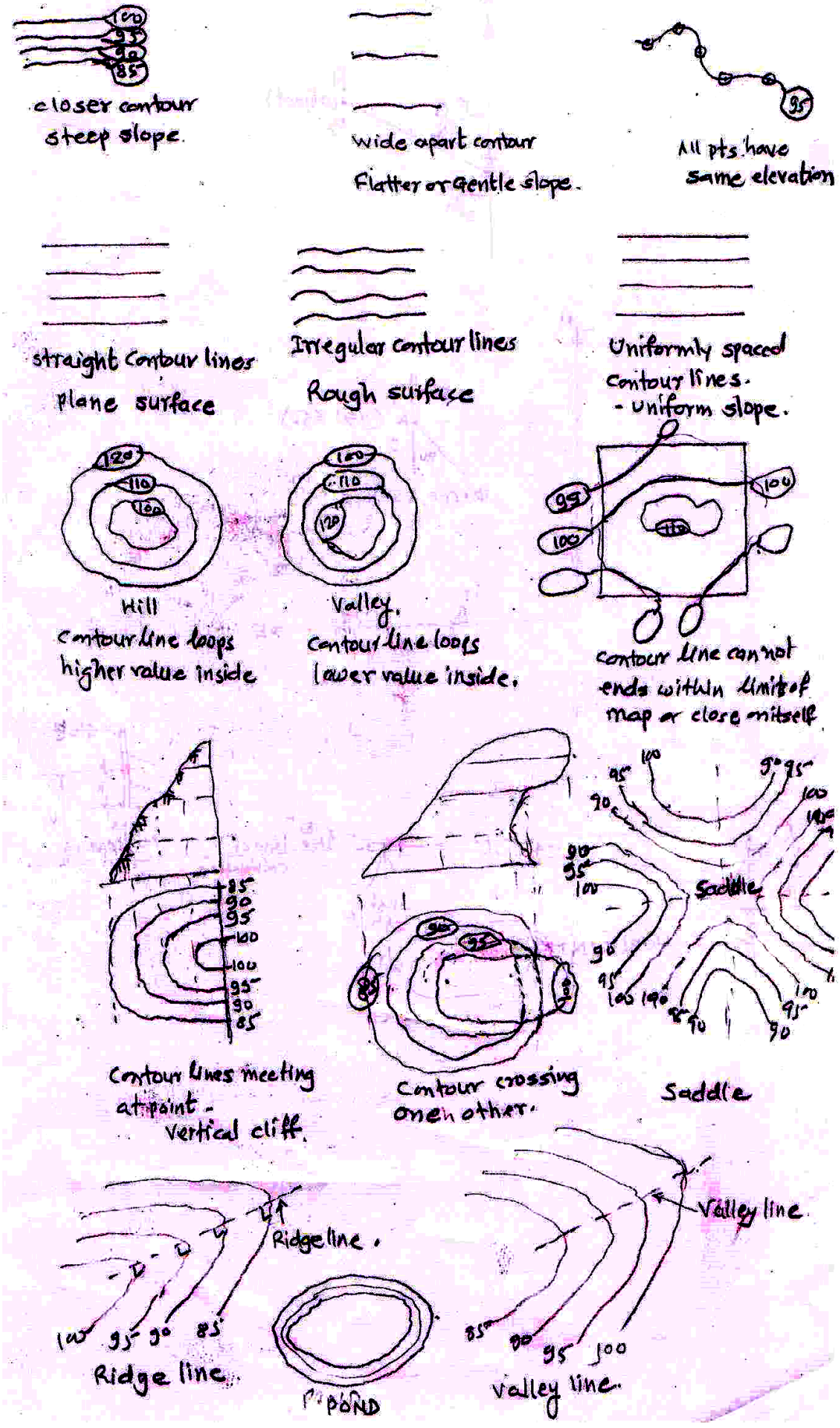
= **$53^0$14'59" SE** 02

Q.5.Attempt any FOUR of the following: **16**

a) Explain with sketch characteristics of contour line

Characteristics of contour lines are : *

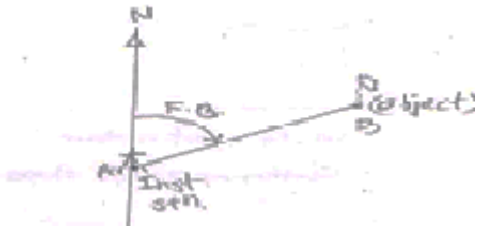
1. Closer counter line together indicates steep slope.
2. Wide or far apart counter lines indicate flatter slope or gentle slope.
3. All the points on the same counter line have same elevation.
4. Equally or uniformly spaced counter lines indicates uniform slope.
5. Straight, parallel, uniformly spaced counter lines indicates plane surface.
6. Irregular contour lines indicates rough surface.
7. A series of closed counter lines with one or more higher values inside indicates a hill or summit.
8. A series of closed counter lines with one or more lower values inside indicates a depression or valley.
9. Contour lines cannot ends within the limits of the map or ultimately close on it.
10. Contour lines meeting at a point indicates a vertical cliff.
11. Depression between summits are called saddle.
12. Contour lines cannot cross one another expect in the case of an overhanging cliff and over lapping portion shown by dotted line.
13. Contour lines cross the valley line ridge line at right angles.
14. Contour lines always form a closed circuit but these lines may be within or outside the limits of the map.
15. Contour lines closer near the bank and wide apart towards the center indicates a steep slope near the bank and flatter slope at the center and it indicates pond.



**(one marks each any four with fig.)*

b) State the procedure of measuring bearing with a theodolite.

Let the magnetic bearing of line AB is to be measured.



01

Step 1) Set up the theodolite at A .Carry at all temporary adjustment centering and leveling properly.

2) Set the vernier A at $0^0$0’00” and vernier $180^0$0'00” using lower plate clamp, upper plate clamp and upper plate tangent screws.

3) Fix the tabular circular or trough compass at its position on the theodolite (A standard of frame or on circular plate between the standards) and release the needle of the compass.

4) Loosen the lower clamp, the telescope until its points to the north(i.e. magnetic needle coincides with the 0’-0’ mark) which shows correct orientation of telescope along magnetic meridian.

5) Fix the lower clamp and loosen the upper clamp, turn the telescope clockwise and bisect the ranging rod at B roughly .Fix the upper clamp; bisect the ranging rod at B correctly using upper tangent screw.

6) Read both the vernier,the mean of these two vernier readings is the magnetic bearing of AB.

7) Change the face of the instrument repeat the above the procedure and measure the magnetic bearing of AB more precise.

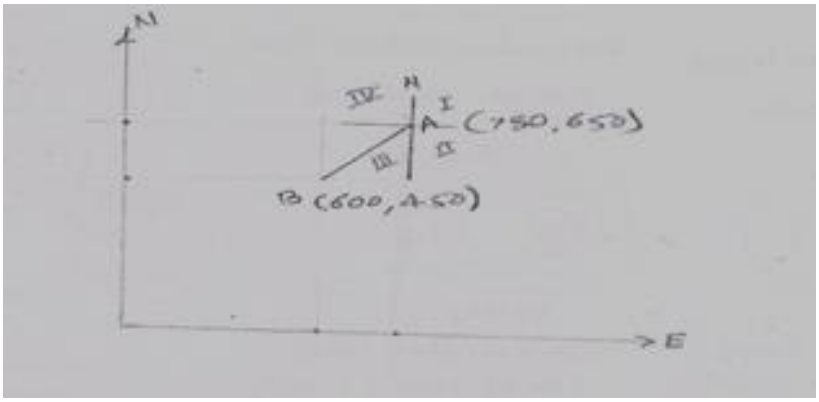
03

c) Following is the co-ordinates of point A and B.

Station	Northing	Easting
A	780	650
B	600	450

Find length and bearing of line AB.

Solution:



To find length and bearing of line AB.

Let. l= length of line AB

θ = Reduced bearing of line AB.

The difference between latitudes (North coordinates) of A and B = 600-780 = -180 m (180 towards south)

The difference between departure (East coordinates) of A and B = 450-650 = -200 m (200 towards West)
Since the latitude of B from A= -180 = 180 toward south
And departure of B from A = -200 = 200 toward west
The line AB lies in the third (SW) quadrant.

i)**To find reduced ;bearing** = θ = tan θ = $\frac{\sum D}{\sum L} = \frac{200}{180}$ =

$\therefore$ $\theta = \tan^{-1}(\frac{200}{180}) = 48^0\ 0'46.04"$

$\therefore$ Reduced bearing of line AB = S 48^0 0'46.04" W

W.C.B. of line AB = 228^0 0' 46.04" 02

ii) to find length of line AB

$l = \sqrt{\sum D^2 + \sum L^2} = \sqrt{200^2 + 180^2} = 269.0725$m

or $l = \frac{\sum L}{Cos\Theta} = \frac{180}{Cos\ 480\ 0'46.04"} = 269.0725$ m

or $l = \frac{\sum D}{Sin\Theta} = \frac{200}{Sin\ 480\ 0'46.04"} = 269.0725$ m

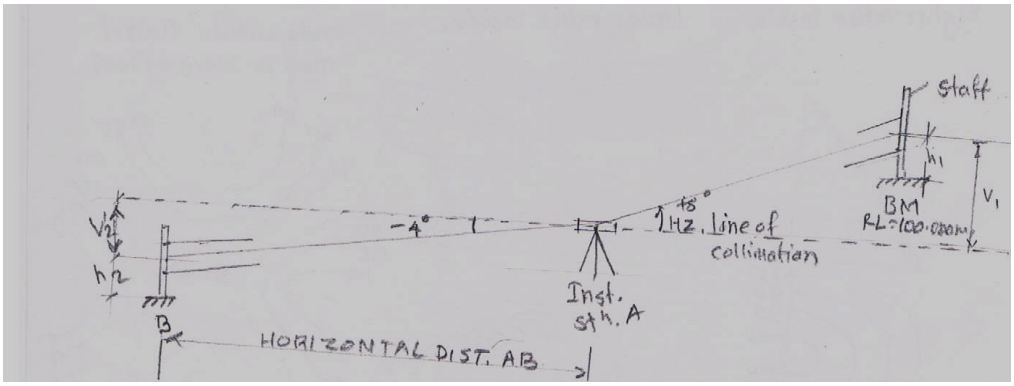
$\therefore$**Length of line AB = 269. 0725m** 02

d) A tacheometer fitted with Anallatic lens was set up at station A and the following readings were obtained on vertically held staff.

Inst. Station	Staff Station	Vertical Angle	Staff Readings
A	BM	+ 8	0.800,1.120,1.480
A	B	- 4	1.140,1.235,1.330

The constants (f/i) is 100, find distance AB and RL of station B as RL of BM is 100.000m

Solution:



Given: Anallatic lens, (f+c) = 0, f/i = 100, B.M. RL. = 100.000m

Part I Distance AB , $\theta = -4^0$ (4^0 depression), S = staff intercept = 1.33 – 1.14 = 0.19

Horizontal distance AB = f/i (S) $\cos^2\theta$ + (f+c) $\cos\theta$

= 100 (0.19) $\cos^2 4$ + 0 = **18.9075m** 02

Part II) RL of station B V_1= Vertical distance between horizontal collimation and axial reading at BM $V_1 = \frac{f/i\ (S)\ Sin2\theta}{2} + (f+c)sin\theta$, $\theta = +8^0$ (Elevation) = 100 (0.680) Sin (2 x 8)/ 2 + 0 (S = 1.480- 0.800 = 0.680) = 18.7433m /2 = 9.3716 m V_2 = Vertical distance between horizontal collimation and axial reading at B $V_2 = \frac{f/i\ (S)\ Sin2\theta}{2} + (f+c)sin\theta$ ($\theta = +4^0$) = 100 (0.190) Sin (2 x 4) / 2 + 0 (S = 1.330- 1.140 = 0.190m) = 1.3321m RL of station B = RL of BM – V_1 + h_1 – V_2 –h_2 = 100.000 – 9.371 + 1.120 – 1.332 – 1.235 **RL of station B = 89.182 m**	02
e) State any four features of total station.	
Features of total station are : 1. Easy access to any desired programme and mode of selection. 2. Try axis compensation. 3. Easy to read arrangement. 4. Atomatic atmospheric correction. 5. Guide message arrangement. 6. Higher distance resolution. 7. Two speed tangent movement. 8.Detachable tribrach facility 9. Eighteen different programmes (modes of measurements) ***(one marks each any four)***	*
f) Give classification of curves.	
Classifications of curves are : **I) Horizontal curves :** i) Simple curve ii) Compound curve iii) Reverse curve iv) Transition curve **II) Vertical curve :** i) Summit curve ii) Valley curve	02 02
Q.6.Attempt any FOUR of the following:	
a) State any four situations where tachometry is essential.	
Situations where tachometry is essentials are :- 1. Where field area or Terrain changing operation is very difficult, slow and inaccurate such as broker and uneven country hilly area with stretches of water, swamps etc. 2. In rough terrain (or field area) where it is difficult and time consuming to obtain horizontal and vertical measurement by other method. 3. Field area or terrain where many measurements are required to be taken with relatively low degree of precision such as locating contours filing in details in topographic survey. 4. For collect speedy economical and reasonable acceptable best results for investigation work. 5. In rough and difficult terrain where direct leveling is very tedious or not possible. 6.Locate survey for roads, railways (to locate alignments) ***(one marks each any four)***	*

b) A tachometer was set up on station A and following observations are taken on vertical staff.

Inst.satation	Observed station	Distance	Stadia Readings
O	A	150	1.255,1.750
	B	200	1.000,1.900
	C	250	0.75,1.200

Find constants of this taceometer.

Solution:

Note Assume $\theta = 0^0$

$D = (f/i)(S)\cos^2\theta + (f+c)\cos\theta$

$D = (f/i)(S) + (f+c)$ $\quad \cos 0 = 1$, S = Staff intercept)

$150 = (f/i)(0.495) + (f+c)$ …… Eq^n 1 (S = 1.255- 0.495 =0.495)

$200 = (f/i)(0.900) + (f+c)$ ……Eq^n 2(S= 1.900- 1.000=0.900)

$250 = (f/i)(0.450) + (f+c)$ ……Eq^n 3 (S = 1.200 – 0.750 = 0.45)

Solving equation 1 and 2 simultaneously,

Subtracting eqn 1 from 2

$200 = (f/i)(0.900) + (f+c)$

$-150 = (f/i)(0.495) + (f+c)$

$50 = 0.405\,(f/i)$

$\therefore (f/i) = 123.45$ — 03

Putting the value of (f/i) in eq^n 1, (f+c) = 88.895 — 01

OR

Note:-For solving eq^n 1 & 3 or 2&3 consider full marks

Q.6 c) Explain construction of one second micro optic theodolite.

Construction of one second micro optic theodolite :-

Micro optic theodolite is also called as optical theodolite. In this theodolite vertical and horizontal angular readings are taken with the help of a micrometer and direct angle reading microscope :- In consists of the following component

i) The tribrach with three foot screws, used to set standing axis of the instrument vertical.

ii) The base plate has central thrreaded arrangement to clamp the tripod. — 1

iii) It has swivel locking knob on the tribrach used to m the theodolite from tribrach.

iv) An optical plummet in the tribrach for centering of the instrument over ground point.

v) The circular level in the tribrach-for appropriate leveling.

vi) The conical lower part of the theodolite contains cylindrical standing axis system and the horizontal circle.

vii) The axis sleeve is rigidly connected to the center flange and studs, which fits into the tribrach. — 1

viii) The telescope is screwed to the axis stem and rotates inside the sleeve.

ix) Circle drive knob on horizontal circle plate to set the circle by rotating the horizontal circle around the axis sleeve.

x) Cover to protect the unintentional use of circle drive knob.

xi) A mirrors on horizontal and vertical circle plate to illuminate the circles to read it.

xii) Plate level for setting the standing axis vertical.

xiii) Horizontal and vertical clamps to clamp the instrument that telescope points in required direction. — 1

xiv) Horizontal and vertical drive (tangents) used for positioning the telescope to a target.

xv) Micrometer knob on standards to set the images of the diametrically opposed circle graduation in coincidence.

xvi) Sketch knob on selecting horizontal or vertical circle measurement.
xvii) Microscope- to read the circles.
xviii) Microscope eye piece – For distinct vision of microscope reading. 1
xix) Sleeve – to focus to telescope to view distinct image of object.
xx) Index level setting screw- to set the index level.

d) Two straight lines AB and BC intersect at chainage 2415m deflection angle being 10^0Calculate all data necessary for setting out 4^0 simple curves by deflection angle. The pet interval 30 m. Give table of deflection angle.

Solution :

To find

i)radius of curve from degree of curve and assuming standard chord length =30m 1

Using , $D = \frac{1718.9}{R}$, $4 = \frac{1718.9}{R}$ ∴ R = 429.725m

ii) Length of curve = lc = $\frac{\pi R \emptyset}{180} = \frac{\pi\, 429.725 x 10}{180} =$ 75.00 m 1

iii) Deflection / Tangential angles for unit chords and sub chord

for peg = interval = 30m, then unit chord =2 and sub chord = 01 of 15m 1

δ =($\frac{1718.9}{R}\, c$) minutes (R = radius of curve, C= length of chord)

$\delta 1 = \left(\frac{1718.9}{429.725} 30\right)/60 = 2^0$ Similarly $\delta 2 = 2^0$

And $\delta 3 = \left(\frac{1718.9}{429.725} 15\right)/60 = 1^0$

Deflection angle table 1

Sr. No	Chord length (m)	Deflection Angle (δ)	Total deflection angle(Δ)	Actual angle on 20" thedolite
	30	$\mathbf{2^0}$	$\mathbf{2^0}$	$\mathbf{2^0}$
	30	$\mathbf{2^0}$	$\mathbf{4^0}$	$\mathbf{4^0}$
	15	$\mathbf{1^0}$	$\mathbf{5^0}$	$\mathbf{5^0}$

iv) Length of tangent = R tan(Φ/2) = 429.725 x tan(10/2) = 37.596m

e) State any four application of remote sensing.

Applications of remote sensing are :-

i) Environmental application: - INSAT series of satellite used for weather forecast i.e. cyclone, cloud, wind velocity, sea states, pollution, global warming, and ozone layer depletion.

ii) Mineral exploration:- Detailed exploration of non –renewable resources like minerals and fossil fuels, geological data, location of minerals, mapping of mineral zones. *

iii) Land use and land cover Analysis: - Land use for Urban purpose agricultural sea forest etc.perticular cropping pattern, spread area.

iv)Natural hazards :- To analyze geological information of the area and identify the risk prone areas to provide specific warning of certain natural hazards i.e.floods,volcanic eruptions, rain storms cyclones etc.to asses the damages caused by these hazards to help in rescue operation management.i.e.in earthquake,flood,Tsunami,cyclone,landslide,volcanic eruption.

v) Archaeology:-To recognize archaeological patterns of prehistoric land use, buried

archaeologically important sites. vi) Revision of top sheets:-Rapid revision and updating of existing top sheets (maps) with help of aerial photography and satellite imagery survey of India department undertake such work. vii) Alignment of (new) highways and rail-lines: - By using aerial photographs and satellite imagery location of most economical alternative sites of such works may be carried out easily. viii) Location of gravity dam sites :- Geological investigation of dam site can be carried at using aerial photographs & satellite imagery (Geological features such as folds,faults,dykes, fractures, rock type) ix) Tunneling: - Geological information (i.e. Faults & fractures) along alignment of tunnel is furnished by aerial photographs & satellite imagery to ensure safety during construction & maintenance of funnel. x) Sitting of storage reservoir, harbors etc. :- satellite imagery gives idea about silting of reservoir (reduces reservoir capacity) qualitatively and quantitatively and silting of harbor (reduces navigational depth) xi) Location of percolation tanks: To locate exact location of percolation tank from geological investigation of permeable foundation to increase ground water table by using satellite imagery. xii) Seepage losses in canal: By careful study of aerial photograph and satellite imagery, soil moisture in and around the canal system can be monitor and identify the seepage through the canal xiii) Location of bridge site: Careful study of aerial photograph and satellite imagery used to analyze existing foundation conditions along the proposed bridge construction site, to find economic and safe alignment of bridge. xiv) Study of catchment and command area of dam site.; Aerial photographs and satellite imagery used to ascertain the catchment area and command area of dam site. ***(one marks each any four)***	
f) Determine area of figure with Planimeter having IR = 9.0,FR = 4.50.C = 21.50, and M = 100 m^2, zero mark of the disc passed once in clockwise direction with anchor point inside the figure.	
Solution: Formula to find irregular area A = M(FR -IR ± 10 N +C) Where M = 100 cm^2 , IR = 9.00, FR = 4.50, C= 21.50 anchor point inside, N = +1(clockwise) = 100(4.50 – 9.00 + 10 (1) +21.50) A = 2700 cm^2 Ans.	02 02