MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
(Autonomous)

(ISO/IEC -270001 – 2005 Certified)

WINTER -2019 EXAMINATION **Subject code: 17419**

Model Answer

Important Instructions to the 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.

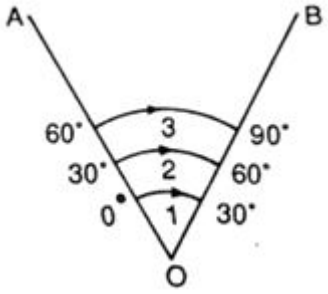
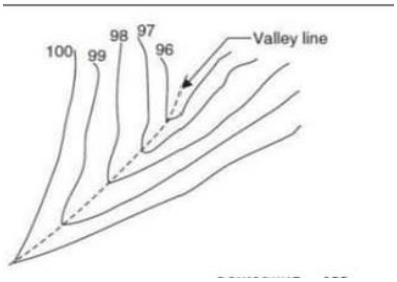
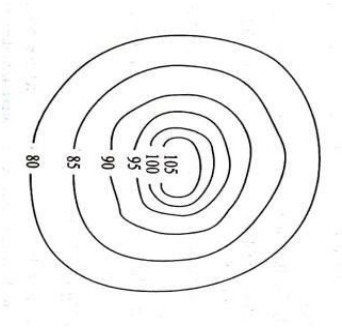
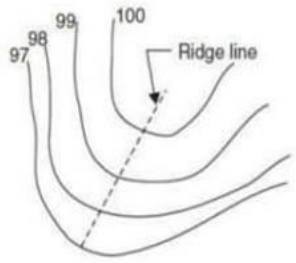
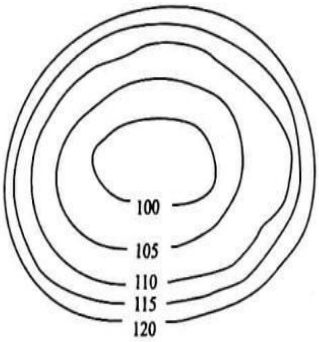
6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidates understanding

7) For programming language papers, credit may be given to any other program based on equivalent concept.

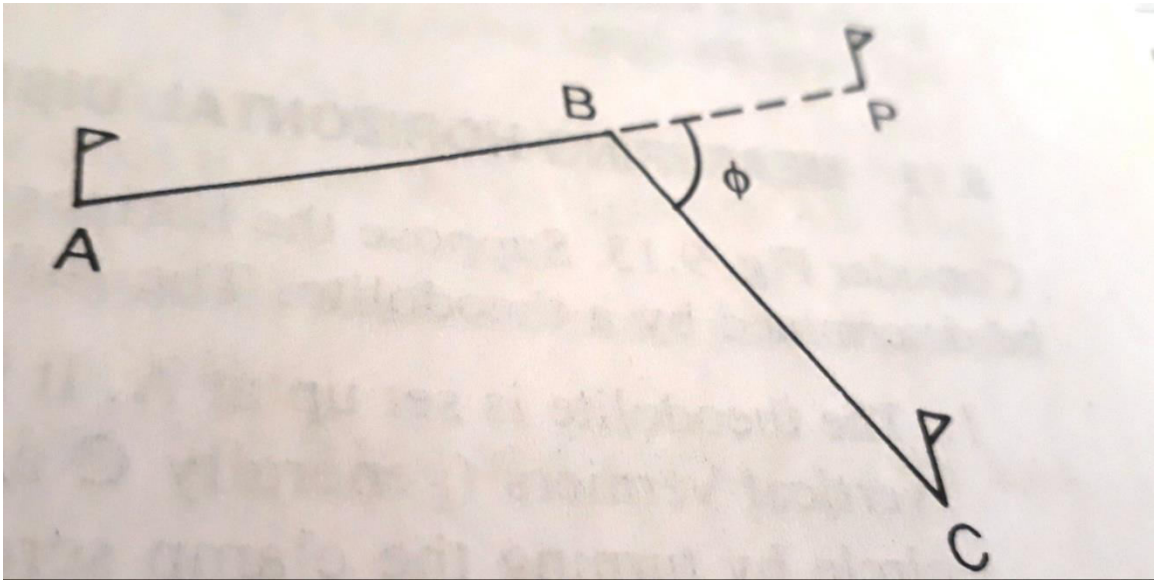
Que No	Question and Model Answers	Marks
1 a)	**Attempt any SIX of the following:**	**12**
i	Define horizontal equivalent .	
	The horizontal distance between any two successive contours is called horizontal equivalent.	**2**M
ii	State the uses of contour map.	
	Following are the uses of contour maps. 1.The nature of the ground surface or topography of a country weather hilly, undulating ,or flat can be understood. 2. For determining the most economical site for dams, reservoirs, maximum flood line, submerged area. 3. For estimating volume of water to be impounded in a reservoir. 4.For location of highways ,canals, railways, etc. 5. For determining volume of cutting and embankment in given gradient. 6.For determining intervisibility of given points.	(1) M each (Any two)
iii	State the advantages of digital planimeter..	
	1.It gives more accurate reading.	1M

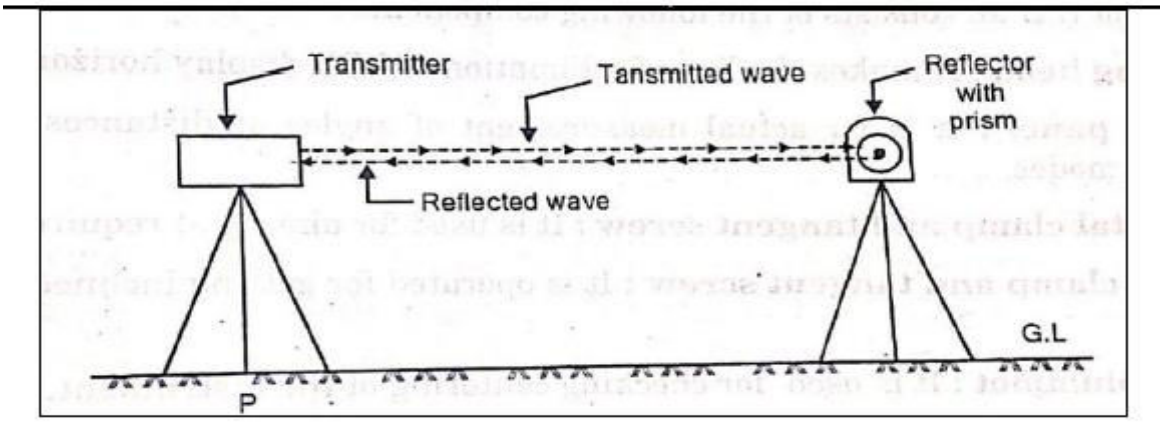
	2.No calculation are required for area. 3. Less time required for measurement of area. 4 Area can be measured in any desired unit.	each (any two)
iv	Define the terms- latitude and departure.	
	Latitude : The projection of survey line parallel to meridian is called latitude. OR Projection of survey line parallel to N-S direction is called latitude. **Departure:** The projection of survey line perpendicular to meridian is called departure. OR Projection of survey line parallel to E-W direction is called departure.	1M 1M
v	Define swing of telescope	
	It the process of turning the telescope in horizontal plane about vertical axis.	2M
vi	State four objective of tachometry.	
	1. Preparation of contour maps 2. Used in hydrographic survey 3. Location of roads, railways , reservoir. 4. To enable horizontal and vertical distances to be computed from readings upon a stadia rod in difficult terrain. .	4M
vii	Define degree of curve.	
	The angle subtended at the centre of the circle by a chord of standard length of 30m is known as degree of curve.	2M
viii	State the fundamental axes of theodolite.	
	1 Vertical axis 2 Axis of plate level 3 The line of collimation 4 Horizontal axis or Trunnion axis 5 The bubble line of the altitude level	½ M each (any four)
1 b)	**Attempt any TWO of the following**.	**8**
1	Explain the procedure of establishing grade contour on ground.	

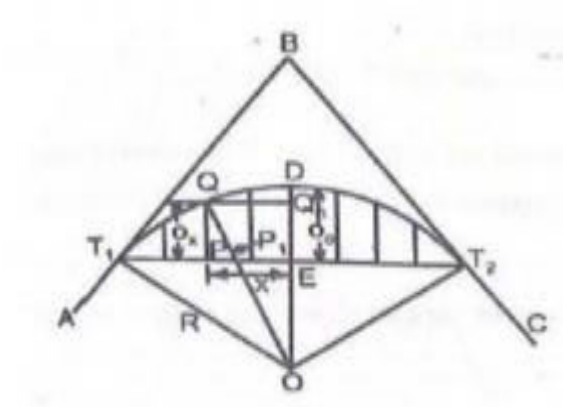
	The grade contour along hill side can be established by following procedure. Suppose a grade contour of 1 in 30 is to be established on ground at an interval of 40 m. The points of grade contour can be marked approximately using level. By setting the instrument on tripod do all temporary adjustments. Take the reading on bench mark of R.L. say 100 m as B.S. reading of say 0.400 m; so that H.I. will be 100.400 m. Here BM is considered as starting point of grade contour. Therefore R.L. of next point (40 m away in straight line) will be 100.000 – (40/30) = 98.67 m. And therefore to get this R.L. on ground, the staff reading should be 100.400 – 98.67 = 1.73 m Now, the staff is held 40 m away from bench mark and up and down movement is done to get 1.73 m reading and then point is marked on ground with peg. The above procedure is continued in the same straight line and corresponding points are marked on ground. .Finally the line joining all the marked points will give us the required grade contour of 1 in 30 accurately  	3M exp. 1M figure
ii	What is GPS. State any four uses of GPS	
	GPS is satellite navigation system used to determine the ground position of an object. **Uses of GPS:** 1.To prepare contour map 2 It is widely used in navigation. 3. To locate different points of known co-ordinates. 4. To set alignment of road, railways etc. 5. For bridges work to fix alignment , positions of piers etc. 6 It gives accrate timing to banks, mobile oprators etc.	2M 1/2M each (any four)
iii	Explain the method of repetition to measure horizontal angle using transit theodolite.	
	Procedure: 1 Suppose the angle AOB is to be measured by the repetition process. The theodolite is set over O. The instrument is centered and levelled properly.Vernier A is set at 0^0 and vernier is at 180^0 2.The lower plate is loosened.By turning the telescope the ranging rod at A is perfectly bisected with the help of lower clamp and tangent screw. Here the initial reading of vernier A is 0^0 3.The upper clamp is loosened and telescope is turned clockwise to perfectly bisect ranging rod at B by using upper clamp and tangent screw. Suppose the reading on vernier A is 30^0 4.The lower clamp is loosened and telescope turned to exactly bisect the ranging rod at A by lower plate clamp and tangent screw.Here the initial reading is 30^0 for second observation.	Proced 3 M fig 1M

	5. The upper plate is loosened and the telescope is turned to exactly bisect the ranging rod at B by using upper clamp and tangent screw..Let the reading on vernier A is 60^0 6 The procedure is repeated for one more time. 7.The face of the instrument is changed and the previous procedure is followed. 8 The mean of the two angles obtained from two faces gives the actual angle AOB.  	
2	**Attempt any FOUR of the following.**	**16**
a	Draw neat sketch of contour for the following i)Hill ii) Valley iii)Gentle Slope iv) Ridge Line  Valley  Hill  Ridge line.  Gentle slope. *Note: Students may draw different sketch for gentle slope.*	1M each
b	State Direct & indirect method of contouring.Explain tacheometric method.	
	Method of contouring are: 1.Direct method 2 Indirect methods which include a)by cross section b)by squares c) tachometric contouring method. **Tachometric contouring method.** 1.This method is most suitable when a contour map of a hill is required. In this method instruments used is tachometer or a transit theodolite equiped with stadia diaphragm.	1M method

	2.To begin with a no. of lines are set out at a given angular interval and the representative points are located in the field by observing i) the vertical angles and ii) the stadia readings 3 The horizontal distance between instrument and staff station and RLs of staff stations ares calculated by tacheometry formulae. 4 The survey is plotted and then contour lines are interpolated.	3M
c	State the procedure for computing the volume by prismodial formula.	
	Procedure: 1. The total length of plane is divided into no of strips. 2. Calculate the areas at ends (A_1&A_n) 3. Calculate area of intermediate strips A_2,A_3,A_4…… A_n So that,A_1, A_2, A_3 ….A_n are areas of cross sections and D is the distance between consecutive sections. 4 Volume of earthwork is given as $V= D/3(A_1+4A_2+2A_3+4A_4+\ldots\ldots\ldots+2A_{(n-2)}+4A_{(n-1)}+A_n)$ 5 To use this formula it requires odd number of section.	4M
d	Describe the temporary adjustment of theodolite	
	Temporary Adjustments: The temporary adjustments have to be carried out at every setup of the instrument before taking observations with the theodolite A)**Setting up:** 1) Place the instrument over the station by spreading the tripod legs well apart at a convenient height. 2) Suspend a plumb bob from the hook approximately over the station point so that the plumb bob hangs about 2 cm above station point. 3) Bring the plumb bob exactly over the station point by moving each leg radially as well as circumferentially, and then press the legs firmly into the ground. By doing this the instrument is approximately leveled also. 4) If shifting head is provided the instrument, centering can be done rapidly. On hill side to ensure greater stability, place two legs of tripod down hill and the third leg uphill. **B)Leveling up of theodolite:** 1) Turn the theodolite about its vertical axis until the plate level is parallel to any pair of leveling screws. 2) Bring the bubble to the centre of its run by turning both foot screws uniformly. By using thumb and forefingers, move the foot screws either towards each other or away from other. 3) Turn the instrument through 90^0 so that the bubble line will be at right angle to its previous position. Now, move only the third foot screw either in or out till the bubble is brought to the centre of its run. 4) Repeat the process until finally the plate bubble is exactly centered in both the positions. 5) Now rotate the theodolite about the vertical axis through 360^0. The bubble will remain central provided it is in correct adjustment. The vertical axis is thus made truly vertical. **C) Focusing the eye piece :** The object of focusing the eye piece is to make the cross hairs on diaphragm distinct and clear. To do this, direct the telescope towards the sky or hold a sheet of white paper in front of the object glass, and move the eye piece circumferentially or in or out until the cross hairs are seen sharp and black. **D) Focusing of object glass :**	. 1M 1M 1M

	The object of focusing the glass is to bring the image of the object formed by the object glass exactly in the plane of cross hairs. If not done accurately, there will be an apparent movement of the image relatively to the cross hairs when the observer moves eye up and down. This effect is known as parallax. The parallax can be removed by the sharp focusing until the image appears sharp and clear.	1M
e	Explain the procedure of measurement of deflection angle.	
	Procedure: 1. The theodolite is set up at B and centered and leveled properly . Vernier A is set at 0^0 and B at 180^0 .The lower one is loosened. By turning the telescope the ranging rod at A is perfectly bisected using lower plate clamp and tangent screw. 2. The telescope is transited. 3. The upper clamp is loosened. By turning the telescope clockwise ,the ranging rod at C is properly bisected using upper plate clamp and tangent screw.The readings on both vernier are taken. 4. The lower clamp is loosened and by turning the telescope clockwise the ranging rod at A is again bisected using the lower clamp and tangent screw. 5. The telescope is transitied .Upper clamp is loosened and by turning the telescope clockwise, the ranging rod at C is bisected using upper plate clamp and tangent screw. The readings on verniers are taken. 6. Thus the deflection angle is doubled. The average angle of two faces is calulated. One half of this angle will be the deflection angle.  	3M procd 1 M Diagram
f	What is meant by permanent adjustment of a theodolite.Enlist any two such adjustment.	
	A theodolite consist of several fundamental lines .In order reading to be accurate, certain desired relationship must exist between the fundamental lines of the instruments. But due to improper handling or excessive use, this relationship may be disturbed and hence the reading from the theodolite may lead to erroneous results. For rectifying a disturbed relationship, some procedures, termed as permanent adjustment are adopted. Following are the adjustments: 1 Adjustment of plate level 2 Adjustment of line of collimation 3 Adjustment of horizontal axix	2 M 1M each (

	4 Adjustment of level tube on the telescope 5 Adjustment of vertical index frame.	any two)
Q.3	**Attempt any <u>FOUR</u> of the following:**	**16M**
a)	**State any four advantages of total station over dumpy level and theodolite.**	
:	**Advantages of total station over dumpy level and theodolite :** 1)Total station gives digital measurements of sloping, horizontal and vertical distances aaccurately and precisely. 2) Total station gives digital measurements of vertical and horizontal angles accurately and precisely. 3) Total station consists of electronic field book to record the data and additional information. 4) Total station is used for speedy completion of any type of project work. 5) Total station provides the provision of uploading and downloading the data to computer. 6) Total station is used to prepare the map and drawings using softwares.	**1M each (Any Four)**
b)	**Enlist any four component parts of digital level. State the functions of each.**	
	Following are the component parts of Digital Level: 1. Display screen: To show the program going on. It has high resolution. 2.Key Pad- For operating the instrument. 3.Telescope- For bisecting the object at longer distance with high precision. 4.Foot screws- For leveling purpose. 5. Focusing screw- Internal focusing is provided, so to observe the object clearly, it is focused with focusing screw.	**1M each (Any Four)**
c)	**Explain the working principal of EDM with a neat sketch.**	
:	 • Let the distance between P and Q be 'D' which is to be measured. • A wave is transmitted from the transmitter at station 'P' with certain phase angle. . There is a reflector at the other end 'Q' .Reflector consist of prism. The wave strikes on reflector at Q and then gets reflected from Q. • It is received back at the transmitter end at 'P' with different phase angle. For . finding the distance, the phase difference between transmitted wave and reflected	**2M fig.** **2M for exp.**

	wave is measured and converted into distance.	
d)	**Explain the procedure for measurement of vertical angle using digital theodolite.**	
	Digital Theodolite for measurement of vertical angle. 1)Taking out digital theodolite for box and fix it on tripod over required station. 2) Accurate centering and aapproximate leveling by leg adjustment is done.. 3) Levelling the digital theodolite using foot screws by usual method i.e. plate level parallel to pair of foot screw and perpendicular position 4) Focusing of eyepiece and object glass is done using eyepiece and focusing screws. 5) Switch on the digital theodolite. 6) Direct the telescope toward the object of which angle is to be measured say A, bisect it. Clamp the instrument, accurate bisection is done by slow motion screw.one. 7) Press hold button, LCD gives required vertical angle from zenith point or horizantal plane as per setting of the instrument. *Note: Procedure may vary slightly as per make and model of instrument.*	**4M**
e)	**State any four application of digital theodolite.**	
:	**Application of digital theodolite:** 1. To measure horizontal angle very precisely up to one second. 2. To measure vertical angle accurately up to one second. 3. For long road and railway bridges, alignment and c/c distance of piers can be fixed 4. To take reduced levels of ridge and valley lines accurately. 5. Triangulation work can be completed with highest precesion 6 To set right angle with very high accuracy,say, for building layout.	**1M each (Any Four)**
f)	**Describe the method of setting out simple curve by using the method of offset from long chord with sketch.**	
Ans :	 **Given data:** Direction of two straights, chainage of point of intersection, radius of curve. **Procedure:** 1) Set theodolite over B and measure deflection angle Φ 2) Calculate tangent length by formula R x tan (ϕ/2). 3) Locate first tangent T1 point by measuring backward along BA distance equal to tangent length and second tangent point T2 by measuring forward along BC distance equal to tangent length. 4) Divide long chord into even number of equal parts.	**1M fig.**

	5) Calculate ordinates O0 by formula $O_0 = R - (R^2-(L/2)^2)^{0.5}$ and other ordinates by formula $Ox = (R^2-X^2)^{0.5} - (R- O_0)$. 6) Locate mid point of long chord (point E) 7) Chain is laid in ET_1 direction; perpendicular is erected at E, and says by optical square, point on curve is fixed by measuring distance O_0 along the erected perpendicular. 8) Other offsets are similarly set. 9) Curve being similar about mid point of long chord, calculations for right half are similar to left half.	**3M proc.**
Q.4	**Attempt any <u>FOUR</u> of the following:**	**16M**
a)	**Define zero circle. How it is found out?**	
:	Zero circle or circle of correction is defined as circle round the circumference of which if tracing point is moved, wheel will simply slide(without rotation) on the paper without any change in reading. There are three methods of finding area of zero circle. **Method-I** To find area of zero circle by using formula. Area of zero circle = $\pi(L^2 \pm 2LL_1 + R^2)$ Where, L= length of tracing arm from hinge to tracing point. L_1=distance from hinge to wheel. R= length of anchor arm from hinge to anchor point. +ve sign:- When wheel is placed beyond hinge away from tracing point -ve sign:- When wheel is placed between hinge and tracing point. **Method-II** To find area of zero circle by using planimeter. i) Measure area of figure with anchor point outside of the figure. ii) Measure area of figure with anchor point inside of the figure. iii) Equate two results to find area of zero circle. **Method-III** When constants M and C are known. Area of zero circle = M × C Where M= multiplying constant. C= additive constant.	**2M** **2M any one meth.**
b)	**Give the application of remote sensing.**	
Ans :	**Applications of remote sensing:-** Remote sensing is widely applicable in the following areas. **1) Applications of Remote sensing with respect to natural hazard.** e. g In case of flood ,earthquake ,volcano eruption and related hazards, land slides, Tsunami, cyclone, etc. **2) Environmental application**: Series of satellite used for weather forecast i.e. cyclone, cloud, wind velocity, sea states, pollution, global warming, and ozone layer depletion. **3) Land use and land cover Analysis**: Land use for urban purpose, agricultural, sea, forest etc. particular cropping pattern spread area. **4) Archaeology**:-To recognize archaeological patterns of prehistoric land use, buried archaeologically important sites. **5) Revision of topo sheets**: Rapid revision and updating of existing topo sheets (maps) with help of aerial photography and satellite imagery, survey of India department undertake such work. **6) 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. **7) Location of gravity dam sites** :- Geological investigation of dam site can be carried at using aerial photographs and satellite imagery (Geological features such as folds, faults,	**1M each**

	dykes, fractures, rock type). **8) Tunneling**: - Geological information (i.e. Faults & fractures) along alignment of tunnel is furnished by aerial photographs and satellite imagery to ensure safety during construction and maintenance of tunnel. **9) Silting 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). **10) 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. **11) Seepage losses in canal**: By careful study of aerial photograph and satellite imagery, soil moisture in and around the canal system can be monitored to identify the seepage through the canal. **12) 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. **13) 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. **14) Mineral exploration:** Detailed exploration of non –renewable resource like minerals and fossil fuels, geological data, location of minerals, mapping of mineral zones.	**(Any Four)**
c)	**Define G.I.S. Enlist the key components of G.I.S.**	
	Definition: A Geographic Information System (GIS) is a computer based tool that allows you to create, manipulate, analyze, store and display information based on its location. **Components of GIS:** **1.Hardware**- It is the computer on which GIS operates **2. Software**- It provides the functions and tools needed to store, analyse, and display geographic information. Key components are a database management system (DBMS), tools for input and manipulation of geographic information, graphical user interface (GUI) for easy access to tools. **3. Data**- Geographic data and related tabular data can be collected or brought from a commercial provider. **4. People**- GIS users range from technical specialist who design and maintain system to those who use it to help them do their everyday work. **5. Methods**- A successful GIS operates according to a well-designed plan and business rules, which are the models and **operating** practices unique to each organization.	2**M** 1/2**M each (Any** four)
d)	**How would you determine the constant of given tacheometer on field?**	
:	**Method of determining tacheometric constants in the field-** **1)** A fairly level ground is selected. The tacheometer is set up at O. Vertical angle is kept zero and pegs are fixed at A, B & C, known distances apart. **2)** The staff intercepts (stadia hair readings) are noted at each of the pegs. Let these	

intercepts be S_1, S_2 & S_3.

3) The horizontal distances of the pegs from O are actually measured. Let these distances be D_1, D_2 & D_3.

4) By substituting the values of D_1, D_2, D_3 and S_1, S_2, S_3 in general equation

$D = (f/i) S + (f+d)$

We get a number of equations, as follows

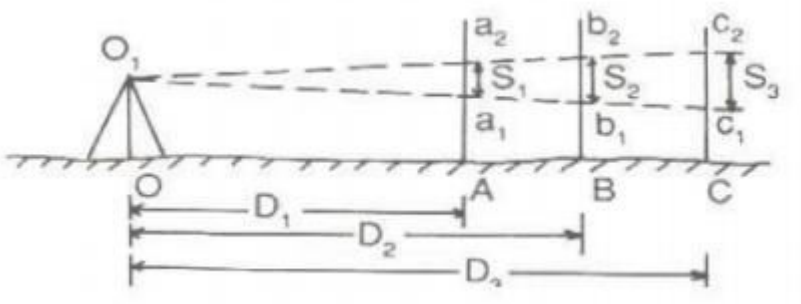
$D_1 = (f/i) S_1 + (f+d)$

$D_2 = (f/i) S_2 + (f+d)$ and so on.

3M proc.

5) By solving the equations in pairs, we get number of values tacheometric constants (f/i) and (f+d)

6) Average of (f/i) and of (f+d) as obtained above, gives values of constants.



1M Fig.

e) What is the difference between a theodolite and a tacheometer. Give any two characteristics of tacheometer.

: **Difference between theodolite and tacheometer**.

Sr.No	Theodolite	Tacheometer
1.	It is most accurate instrument use for measurement of horizontal and vertical angle.	Tacheometer is usually a transit theodolite having a stadia diaphragm.
2.	In case of theodolite,the distance is measured on the field by chain or tape.	In case of tacheometer distance is calculated by direct formula.
3.	Suitable for plane areas with less obstacles.	Suitable in case of obstruction like steep and broken ground.
4.	More station are required to take reading on field.	Less stations are required to take reading on field.

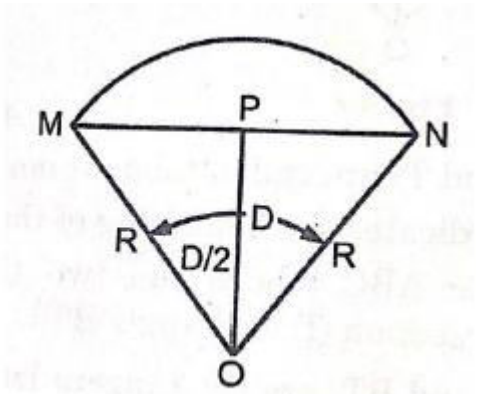
1M each (Any two.)

Characteristics of tacheometer:

1. The value of constant f/i = 100 Where, f = focal length i = length of image.
2. The telescope should be powerful, the magnification should be 20 to 30 times the Diameter.
3. The telescope should be fitted with anallatic lens to have the value of f +d = 0
4. The vision through the telescope should give a clear and bright image for a long distance.

1M each (Any two)

f) Derive the relationship between the radius and degree of curve.

:	 **Relationship between radius and degree of curve.** Referring Fig Let R = the radius of the curve in m. D = the degree of cuve.— MN = the chord 30 m long. P = Mid point of chord MN In triangle OMP, OM = R, PM = ½ MN = 15 m. Then sin D/2 = PM/OM = 15/R Or R = $\frac{15(\text{Exact})}{\text{Sin } D/2}$ When D is small, sin D/2 = D/2 radians *R = $\frac{15}{(D/2)x(\Pi/180^o)} = \frac{15x360}{\Pi D} = \frac{1718.89}{D}$ **R = $\frac{1719}{D}$** Sometimes it is taken as **R = $\frac{1720}{D}$** **If the length of chord is 20m** Then R = $\frac{10}{(D/2)x(\Pi/180^o)} = \frac{1145.45}{D}$ **R = $\frac{1145.45}{D}$** ***(Students may derive for 30 m or 20 m chord length, appropriate marks should be given for any one relationship)***	**1M Fig.** **3M** derive
5	**Attempt any TWO of the following:**	**16**
a)	**Following are the lengths and bearings of a closed traverse ABCDA.** **Determine the length and bearing of line DA.**	
	Ans : Let L = Latitude, D = Departure, l = length and θ = bearing of line DA	

Line	**AB**	**BC**	**CD**	**DA**
Length (m)	**260**	**240**	**250**	**?**
Bearing	**341°**	**295°**	**147°**	**?**

Line	Length (m)	Bearing	Reduced bearing(θ)	L=lcosθ	D= lsinθ
AB	260	341°	N 19° W	+ 245.835	- 84.648
BC	240	295°	N 65° W	+ 101.428	- 217.514
CD	250	147°	S 33° E	- 209.668	+ 136.160
DA	?	?		L	D

3M

For a closed traverse, $\sum L = 0$

$\therefore + 245.865 + 101.428 - 209.668 + L = 0$ **1M**

$\therefore$ L = - 137.595 (-)

$\sum D = 0$ **1M**

$\therefore - 84.648 - 217.514 + 136.160 + D = 0$

$\therefore$ D = + 166.002 (+) **1M**

As latitude is -ve and departure is +ve, the line lies in II quadrant.

Length of line DA = l = $\sqrt{(L)^2 + (D)^2}$ **1M**

$= \sqrt{(-137.595)^2 + (166.002)^2}$

l = 215.613 m

Bearing of line DA **1M**

$tan\theta = D/L$ = 166.002/137.595

$\boldsymbol{\theta = 50.349° = S\ 50°20'43''W}$

b **Enlist any eight components of transit theodolite and write their functions.**

Ans:

Components of transit theodolite and their functions –

Sr.No.	Component	Function
1)	Leveling head	To support the main working parts of the instrument and screws on to a tripod.
2)	Leveling base and trivet	To level the instrument.
3)	Movable Head	To center the vertical axis accurately over the station point.
4)	Lower Plate	It carries a graduated circular arc which is used for taking readings.
5)	Upper Plate	It carries an index and vernier to read fine reading on graduated horizontal circle.
6)	Standards or 'A' frame	To support the telescope, and vertical circle.
7)	Vertical circle	It is provided with circular graduated arc which is generally divided into four quadrants and is used for measurement of vertical angle.
8)	Telescope	For observation and bisection of the object.
9)	Plate bubble	For leveling the instrument.
10)	Altitude bubble	For leveling the instrument at the time of taking vertical angle.
11)	Compass	To take bearing of a line.
12)	Lower clamp and Lower Tangent screw	To fix the lower plate and slow movement of lower plate.
13)	Upper clamp and Upper Tangent screw	To fix the upper plate and slow movement of upper plate.
14)	Spindles	Inner spindle and outer spindles are coaxial.

0.5 x 8 = 4 (for components)

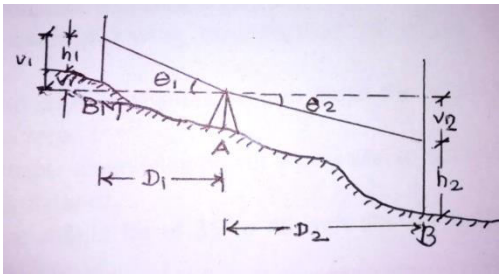
0.5 x 8 = 4 (for its functions)

C	**A tacheometer was set up at station A and following reading were obtained on a staff held vertically.** **The constant of instrument were 100 and 0.10. Find the horizontal distance AB and R.L. of B. if R.L. of B.M is 500.00m.**	

Station	Staff St^n	Vertical angle	Hair reading
A	BM	+7° 30'	0.900, 1.175, 1.530
A	B	-2° 20'	1.125, 1.330, 1.445

Ans:

Given- (f/i) = 100, (f+d) = 0.10
$\theta 1 = 7°30'$ $\theta 2 = 2°20'$
h_1 = 1.175 m, h_2 = 1.330 m
B.M. RL = 500.00 m



1M for fig.

Staff intercept at BM = S_1 = 1.530 – 0.900 = 0.630 m
Staff intercept at B = S_2 = 1.445 – 1.125 = 0.320 m

1M

V_1 at BM = (f/i)S_1 x (sin2θ1)/2 + (f+d)sin θ1
= 100 x 0.63 x sin(2x7°30')/2 + 0.10 x sin7°30'
= 8.17 m

1M

V_2 at B = (f/i)S_2 x (sin2θ2)/2 + (f+d)sin θ2
= 100 x 0.32 x sin(2x2°20')/2 + 0.10 x sin2°20'
= 1.31 m

1M

RL of instrumental axis = RL of BM + h_1 - V_1
= 500.00 + 1.175 - 8.17
= 493.005 m

1M

RL of station B = RL of instrumental axis - V_2 - h_2
= 493.005 – 1.31 – 1.330
RL of station B = 490.365 m

2M

Horizontal Distance AB = (f/i)S_2 x $\cos^2 \theta 2$+ (f+d) cos θ2
= 100 x 0.32 x $\cos^2$ 2°20'+ 0.10 x cos 2°20'
AB = 32.05 m

6.	**Attempt any <u>TWO</u> of the following:**	**16**
a)	**Enlist component parts of mechanical planimeter. Calculate area of fig form following data:** **(i) Initial reading – 1.586** **(ii) Final reading – 0.392** **(iii) Multiplying constant – 100** **(iv) Additive constant – 20** **(v) Rotation of disc – once in reverse direction**	

Ans:

Component parts of mechanical planimeter -

1) Tracing arm 2) Tracing point 3) Anchor arm 4) Weight 5) Anchor point 6)Carriage 7) Counting disc 8) Graduated drum 9) Pivot 10) Wheel 11) Vernier 12) Magnifier 13) Adjusting screw

0.5 x 8 (any eight)

Given: IR= 1.586, FR= 0.392 **1M**

M=100 sq.cm, C=20

N= -1 (as reverse direction)

Area of figure **1M**

A = M (FR – IR ± 10N + C) **1M**

= 100 (0.392 – 1.586 – 10x1 + 20) **1M**

A = 880.60 sq.cm

b) **Two tangent intersect at chainage at 2140 mt. The deflection angle being 36^o. Calculate all the data necessary for setting out curve with a radius 300 mt. by deflection angle.**

Ans:

Given: R = 300 m

$\emptyset = 36^o$

Chainage at intersection = 2140 m

Assuming peg interval as 30 m.

Data required for setting out curve:

1) Tangent length = BT1 = BT2 = $R\tan\emptyset/2$ = 300 x $\tan(36^o/2)$ **1M**

BT1 = BT2 = 97.48 m

2) Curve length = $\frac{\pi R\varphi}{180} = \frac{\pi x 300 x 36}{180}$ **1M**

= 188.50 m

3) Chainage of Tangents **1M**

Chainage of T1 = 2140 – 97.48 = 2042.52 m

Chainage of T2 = Chainage of T1 + Curve length = 2042.52 + 188.50

= 2231.02 m

4) Initial Sub chord = 2070 – 2042.52 = 27.48 m

5) No. of full chords of 30 m = (2231.02 – 2070)/30 = 5.367

= Say 5

Chainage covered = 2042.52 + (5 x 30) + 27.48 = 2220 **1M**

Length of final Sub chord = Chainage of T2 – Chainage covered

= 2231.02 – 2220

= 11.02 m

6) Deflection Angles $\delta = 90C/\pi R$

$\delta 1 = \frac{90x27.48}{\pi x300} = 2°37'27''$

$\delta 2\ to\ \delta 6 = \frac{90x30}{\pi x300} = 2°51'53''$ **2M**

$\delta 7 = \frac{90x11.02}{\pi x300} = 1°3'8''$

7) Arithmetic Check

$\Delta n = \delta 1 + 9x\delta 2 + \delta 11$

$= 2°37'27'' + (5\ x\ 2°51'53'') + 1°3'8''$

$= 18°0'0'' = \emptyset/2 Hence\ O.K.$

8) Setting Table

Point	Chainage	Chord Length (M)	δ	Δ
T1	2042.52	--	--	--
P1	2045.52	27.48	$2°37'27''$	$2°37'27''$

	P2	2065.52	30	2°51′53″	5°29′20″	**2M**
	P3	2085.52	30	2°51′53″	8°21′13′	
	P4	2105.52	30	2°51′53″	11°13′6″	
	P5	2125.52	30	2°51′53″	14°4′59″	
	P6	2145.52	30	2°51′53″″	16°56′52″	
	T2	2231.02	11.02	1°3′8″	18°0′0″	
	(*Note-As peg interval is not given student may assume 20m peg interval length, and other value of length of first sub chord, give credit accordingly.					
c)	**Describe layout of small building by using total station.**					
	Ans: **Layout of small building by using total station:** 1. On the plan supplied by an architect, number the column serially from left to right and top to bottom starting from top left corner. 2. Work out coordinates of column centre with respect to one plot corner or well defined point, assuming line parallel to any one face of building as meridian. 3. Create an excel document with 4 independent columns one for column number and rest three for N, E & H coordinates. Upload this file to total station by using transfer software provided with instrument. 4. Set the total station at site at a point with respect which the coordinates of column centre are work out. Initiate the total station by proving with the coordinates of station and by orienting the telescope along the reference meridian. 5. Now, activate the setting out programme of the total station. Open the uploaded file & bring in the coordinates of any column to be set out. 6. Hold prism pole at tentative position of that column on ground, bisect it & get measured its coordinates. 7. In next reading machine will display the discrepancies in the coordinates of the point & point to be set out. 8. Direct the reflector man accordingly to occupy the new position, bisect him again & get measured its coordinates to know the discrepancy. 9. Repeat the process till you get no discrepancy in the coordinates of point occupied & point to be set out. In this way Get marked centres of rest of the columns. 10. Check the accuracy of the process of setting out by comparing the diagonal distance between the extreme column centres to their calculated values.					**1M each (For eight points)**