MODEL QUESTION PAPER-I

ADVANCED SURVEYING

Time :3 hrs Maximum Marks: 75

PART A

I. Answer all questions in one word or one sentence.

1. Draw contour lines for uniformly sloping ground.
2. Define swinging
3. Define deflection angle
4. Latitudes and departures are collectively called as __________ co-ordinates
5. Write the equation for additive constant of a tacheometer
6. Name any one EDM instrument
7. Electronic theodolites are used for _________ measurement
8. Name one GIS software
9. Acquisition of information about an object or phenomenon without making physical contact with the object____________

PART B

II. Answer any eight questions from the following, Each question carries 3 marks.

1. List any three uses of theodolite
2. Differentiate between transit and non-transit theodolites
3. List the temporary adjustments of a theodolite
4. Explain the components of a simple curve with neat sketches
5. Explain the different sources of error in total station data
6. Explain the working principle of a total station
7. Explain prism mode and non-prism mode in total station
8. Differentiate between aerial and terrestrial photogrammetry
9. List the advantages of GPS survey over conventional surveying
10. Explain GNSS .

3*8 = 24 marks

PART C

Answer ALL questions. Each question carries 7 marks.

III. The area within contour lines of a pond are given below.Taking 150 as the bottom level of pond and 160 as the top level calculate the volume of soil to fill the pond

Contour (m)	150	152	154	156	158	160
Area(m^2)	30	100	700	1400	2700	4150

OR

IV. Explain the measurement of horizontal angle by reiteration method

V. State the fundamental lines and their relations if the theodolite is in perfect adjustment

OR

VI. Explain how you would measure the magnetic bearing of a line with a theodolite.

VII. Two straights intersect at chainage 2500m and the angle of intersection is 120˚. If the radius of the simple curve to be introduced is 600m, find the following. (i) Tangent distance (ii) Chainage of point of commencement (iii) Chainage of point of tangency (iv) Length of long chord

OR

VIII. A theodolite was set up at a distance of 200m from a tower. The angle of elevations to the top of the tower was 8˚18' while angle of depression was 2˚24'. The staff reading on the BM of RL 248.362 with the telescope horizontal was 1.286m. Find the height of the tower and RL of the top of the tower.

IX. Explain any one method of traversing using a theodolite

OR

X. The following are the lengths and bearings of the sides of a closed traverse PQRS.

Line	Length	Bearing
PQ	70.80m	140˚15'
QR	195.90m	36˚25'
RS	35,20m	338˚45'

Compute the length and bearing of the line SP.

XI. Describe steps intraversing using a total station.

OR

XII. Describe data gathering and data processing in a total station

XIII. Explain the applications of GIS in Civil Engineering

O

XIV. Explain remote sensing and list its applications.

Prepared by

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ADVANCED SURVEYING MODEL QUESTION PAPER I

ANSWER KEY

PART A

I. Answer all questions in one word or one sentence.

1. Draw contour lines for uniformly sloping ground.

2. Define swinging

   It means turning the telescope about its vertical axis in the horizontal plane.

3. Define deflection angle

   A deflection angle is the angle between the onward extension of the previous leg and the line ahead.

4. Latitudes and departures are collectively called as __________ co-ordinates

   Consecutive co-ordinates

5. Write the equation for additive constant of a tacheometer

   (f + d) =C

6. Name any one EDM instrument

   Geodimeter, Tellurimeter

7. Electronic theodolites are used for _________ measurement

   Angular

8. Name one GIS software

   ArcGis

9. Acquisition of information about an object or phenomenon without making physical contact with the object____________

   Remote sensing

   9x1mark for correct answer

PART B

II. Answer any eight questions from the following, Each question carries 3 marks.

1. List any three uses of theodolite

   Measure horizontal angle

   Measure vertical angle

   Measure bearings ***3x1***

2. Differentiate between transit and non-transit theodolites

Transitt theodolite-Line of sight can be reversed 180 degree by revolving the telescope- ***1.5mark***

Telescope cannot be reversed for non transit theodolite -***1.5 mark***

3. List the temporary adjustments of a theodolite

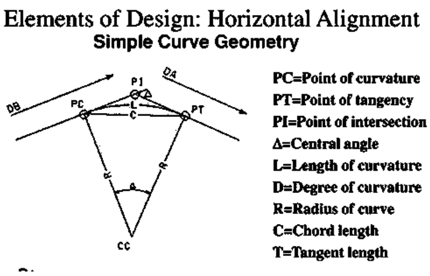
   Setting up

   Levelling up

   Elimination of parallax

   3x1mark

4. Explain the components of a simple curve with neat sketches.



   1.5 mark for figure and 1.5 mark for identifying any 3 elements

5. Explain the different sources of error in total station data

- Circle Eccentricity
- Horizontal Collimation Error in Total Station
- Height of Standards Error in Total Station.
  (or any other relevant points)
  3 x 1mark for each point

6. Explain the working principle of a total station

   Given the co-ordinate of the instrument position and bearing of a backward station the co-ordinates of any other point can be computed.(Explain briefly) ***3mark***

7. Explain prism mode and non-prism mode in total station

In prism mode reflectors are used .***1.5 mark***

In non prism mode reflector is not used***1.5 mark***

8. Differentiate between aerial and terrestrial photogrammetry

Aerial photogrammetry
Cameras fit to a machine that flies take pictures, and with the system, these pictures are used to generate measurements. ***1.5 mark***

Terrestrial photogrammetry
In this kind of photogrammetry, a camera is used in a stationary position. The camera is positioned on an elevated level. ***1.5 mark***

9. List the advantages of GPS survey over conventional surveying
    - The GPS signal is available anywhere on the globe. Hence user will not deprive of GPS facility anywhere.
    - There is no charge to utilize the GPS service as US Defence bears cost of GPS system. It is maintained and upgraded by US Department of Defence. It is cheaper compare to other navigational systems.
    - The GPS system gets calibrated by its own and hence it is easy to be used by anyone.
    - It provides user with location based information. This will be helpful in various applications such as mapping (used in cars), location (geocaching), performance analysis (used in sports), GIS etc.

    3 x 1mark for any 3 points

10. Explain GNSS.

    GNSS stands for Global Navigation Satellite System, and is the standard generic term for satellite navigation systems that provide autonomous geo-spatial positioning with global coverage. This term includes e.g. the GPS, GLONASS, Galileo, Beidou and other regional systems.

    3 mark

3*8 = 24 marks

PART C

Answer ALL questions. Each question carries 7 marks.

III. The area within contour lines of a pond are given below. Taking 150 as the bottom level of pond and 160 as the top level calculate the volume of soil to fill the pond

Contour (m)	150	152	154	156	158	160
Area(m^2)	30	100	700	1400	2700	4150

Use trapezoidal or prismoidal formula to compute volume taking contour interval as 2m.

1 mark for identifying contour interval

2 mark for writing equation

2 mark for substituting areas

2 mark for final answer

OR

IV. Explain the measurement of horizontal angle by reiteration method.

This method consists in measuring several angles successively and finally closing the horizon at the starting point. The final reading of the vernier A should be same as its initial reading. If not ,the discrepancy is equally distributed among all the measured angles.

Explain step by step procedure with figure

5mark for procedure and 2 mark for figure

V. State the fundamental lines and their relations if the theodolite is in perfect adjustment

Fundamental lines of transit theodolite

These are:

(i) The vertical axis.

(ii) The axis of the plate levels.

(iii) The axis of telescope.

(iv) The line of collimation.

(v) The horizontal axis.

(vi) The axis of the altitude bubble.

(3.5 mark)

Following are the relationships between the fundamental lines

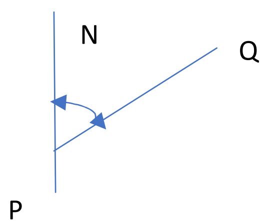
1. The axis of the plate level must lie in a plane perpendicular to the vertical angle
2. The line of collimation must be perpendicular to the horizontal axis at its intersection with the vertical axis
3. The horizontal axis must be perpendicular to the vertical axis
4. The axis of the altitude level must be parallel to the line of collimation
5. The vertical circle vernier must read zero
6. The axis of the striding level must be parallel to the horizontal angle

(3.5 mark)

OR

VI. Explain how you would measure the magnetic bearing of a line with a theodolite.

1. Set the instrument at P and level it accurately
2. Set accurately the vernier A to zero
3. Loose the lower clamp. Release the needle of the compass. Rotate the instrument about its outer axis till the magnetic needle roughly points to north. Clamp lower clamp. Using the lower tangent screw, bring the needle exactly against the mark so that it is in magnetic meridian. The line of sight will also be in the magnetic meridian.
4. Loose the upper clamp and point the telescope towards Q. Bisects Q accurately using the upper tangent screw. Read vernier A and B.
5. Change the face and repeat steps 2,3 and 4. The average of the two will give the correct bearing of the line PQ.



5 mark for procedure and 2 mark for figure

VII. Two straights intersect at chainage 2500m and the angle of intersection is 120˚. If the radius of the simple curve to be introduced is 600m, find the following. (i) Tangent distance (ii) Chainage of point of commencement (iii) Chainage of point of tangency (iv) Length of long chord

Deflection angle = $180^0 - 120^0 = 60^0 = \Delta$

(i) Tangent distance = R tan (Δ / 2)

$= 600 \tan (60^0/2)$

$= 346.41$m

The length of the curve = $\pi R\Delta/180$

$= \pi \times 600 \times 60/180$

$= 628.32$m

(ii) Chainage of the point of commencement = Chainage of point of intersection – tangent length

$= 2500 - 346.41$

$= 2153.59$m

(iii) Chainage of the point of tangency = Chainage of point of commencement + length of curve

$= 2153.59 + 628.32$

$= 2781.91$m

(iv)Length of long chord = $2R\sin(\Delta / 2)$

$= 2 \times 600 \times \sin 30^0$

$= 600$m

(i)=3mark

(ii)=1mark

(iii)=1mark

(iv)=2mark

OR

VIII. A theodolite was set up at a distance of 200m from a tower. The angle of elevations to the top of the tower was 8˚18' while angle of depression was 2˚24'to the foot. The staff reading on the BM of RL 248.362 with the telescope horizontal was 1.286m. Find the height of the tower and RL of the top of the tower.

Height of the tower above instrument axis= 200 tan8˚18'=29.177 ***(1.5mark)***

Vertical distance of the foot from instrument axis=200 tan2˚24'=8.382***(1.5mark)***

Height of tower=29.2+8.4=37.559m***(1.5mark)***

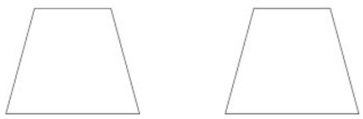
RL of the instrument axis=248.362+1.286=249.648***(1.5 mark)***

RL of the top of tower=249.648+29.177=278.825m***(1mark)***

IX. Explain any one method of traversing using a theodolite

Traversing by Included Angle

An included angle at a station is either of the two angles formed n\by two survey lines meeting there and these angles should be measured clockwise. The method consists simply in measuring each angle directly from a back sight on the preceding station. The angled may also be measured by repetition. The angles measured from the back station may be interior or exterior depending on the direction of progress.



If the direction of progress is counter-clockwise the angles measured clockwise are the interior angle. If the direction of progress is clockwise the angles measured clockwise are the exterior angle.

This or any other method 7marks

OR

X. The following are the lengths and bearings of the sides of a closed traverse PQRS.

Line	Length	Bearing
PQ	70.80m	140˚15'
QR	195.90m	36˚25'
RS	35.20m	338˚45'

Compute the length and bearing of the line SP.

RB of PQ = $180^0 0'0'' - 140^0 15'0'' = S\ 39^0 45'0''\ E$

RB of QR = $N\ 36^0 25'0''$

RB of RS = $360^0 0'0'' - 338^0 45'0'' = N\ 21^0 15'0''\ W$

Latitude of PQ = 70.80 X $\cos 39^0 45'0''$ = -54.434

Departure of PQ = 70.80 X $\sin 39^0 45'$ = +45.272

Latitude of QR = 195.90 X $\cos 36^0 25'$ = +157.6448

Departure of QR = 195.90 X $\sin 36^0 25'$ = +116.2966

Latitude of RS = 35.20 X $\cos 21^0 15'$ = +32.8066

Departure of RS = 35.20 X $\sin 21^0 15'$ = +12.7578

Lat. Of PQ + Lat.of QR + Lat.of RS + Lat. SP = 0

-54.434 + 157.6448 + 32.8066 + Lat. Of SP = 0

Lat. Of SP = -136.0174

Dep. Of PQ + Dep.of QR + Dep. RS + Dep. Of SP = 0

+45.272 + 116.2966 -12.7578 + Dep. Of SP = 0

Dep.of SP = -148.8188

$$Length\ of\ SP = \sqrt{(-136.0174)^2 + (-148.8188)^2}$$

= 201.6129m

$$tan\theta = \frac{-148.8188}{-136.0174} = \frac{Dep.of SP}{Lat.of\ SP}$$

$\theta = 47°34'$

SP lies in III quadrant

$\theta = S47°34'E$

1mark for calculating RB

2Mark for calculating departure and latitude

2 mark for calculating departure and latitude of SP

1 Mark for calculating length of SP

1 mark for calculating angle

XI. Describe steps in traversing using a total station.

1. Fix the total station over a station and level it

2. Press the power button to switch on the instrument.

3. Select MODE B -------> S function------->file management------>create(enter a name)------- >accept

4. Then press ESC to go to the starting page

5. Then set zero by double clicking on 0 set(F3)

6. Then go to S function ------> measure-----> rectangular co-ordinate---->station --- >press enter

7. Here enter the point number or name, instrument height and prism code.

9. Keep the reflecting prism on the first point and turn the total station to the prism ,focus it and bisect it exactly using a horizontal and vertical clamps.

10. Then select MEAS and the display panel will show the point specification

11. Now select edit and re-enter the point number or name point code and enter the prism height that we have set.

12. Then press MEAS/SAVE (F3) so that the measurement to the first point will automatically be saved and the display panel will show the second point.

13. Then turn the total station to second point and do the same procedure.

14. Repeat the steps to the rest of the stations and close the traverse

15. Now go to S function----> view/edit----graphical view.

16. It will show the graphical view of the traverse.

(7 marks)

OR

XII. Describe data gathering and data processing in a total station

When target is sighted, horizontal and vertical angles as well as sloping distances are measured and by pressing appropriate keys they are recorded along with point number. Heights of instrument and targets can be keyed in after measuring them with tapes. Then processor computes various information about the point and displays on screen.

This instrument is provided with an inbuilt microprocessor. The microprocessor averages multiple observations. With the help of slope distance and vertical and horizontal angles measured, when height of axis of instrument and targets are supplied, the microprocessor computes the horizontal distance and X, Y, Z coordinates.

The processor is capable of applying temperature and pressure corrections to the measurements, if atmospheric temperature and pressures are supplied.

At the end of the day the information stored is downloaded to computers.

The point data downloaded to the computer can be used for further processing.

There are software like auto civil and auto plotter clubbed with AutoCad which can be used for plotting contours at any specified interval and for plotting cross-section along any specified line.

(4mark for data gathering and 3 mark for data processing)

XIII. Explain the applications of GIS in Civil Engineering

- Structural Engineering. ...
- Transportation. ...
- Terrain Mapping and Analysis. ...
- Watershed Analysis. ...
- Environmental Engineering & Impact Studies. ...
- Wastewater and Stormwater Management. ...
- Disaster Management.

7 x 1mark

OR

XIV. Explain remote sensing and list its applications.

Remote sensing may be defined as art and science of gathering the information about objects, occurrence or area without having physical contact with it. ***(2 mark)***

There are various applications of remote sensing which may be grouped into the following:

1. Resource Exploration
2. Environmental Study
3. Land use
4. Site Investigation
5. Archaeological Investigation and
6. Natural Hazards Study(***any 5 x 1mark***)

COURSE : Advanced Surveying

MODULE	Hr/Module	Marks /Module $h_i / \sum H_i * 123 (\pm 5\%)$	Part A		Part B		Part C		Total	
			No of questions	Score	No of questions	Score	No of questions	Score	No of questions	Score

BLUE PRINT

1	15	26-36%	2	2	3	9	4	28	9	39
2	16	27-37%	3	3	1	3	4	28	8	34
3	13	22-32%	2	2	3	9	2	14	7	25
4	14	24-34%	2	2	3	9	2	14	7	25
Total			9	9	10	30	12	84	31	123

Blue Print

Cognitive Level Mark Distribution

COGNITIVE LEVEL	MARKS	PERCENTAGE
REMEMBERING	**6**	**4.88**
UNDERSTANDING	**88**	**71.54**
APPLYING	**29**	**23.58**

QUESTION WISE ANALYSIS

COURSE :Advanced Surveying

Qn No	**Module Outcome**	**Cognitive Level**	**Score**	**Time in Minutes**
I.1	1.01	Apply	1	1.46
I.2	1.02	Remembering	1	1.46
I.3	2.01	Understanding	1	1.46
I.4	2.01	Understanding	1	1.46
I.5	2.02	Understanding	1	1.46
I.6	3.01	Remembering	1	1.46
I.7	3.01	Understanding	1	1.46
I.8	4.03	Understanding	1	1.46

I.9	4.01	Remembering	1	1.46
II.1	1.04	Understanding	3	4.38
II.2	1.02	Remembering	3	4.38
II.3	1.03	Understanding	3	4.38
II.4	2.04	Understanding	3	4.38
II.5	3.03	Understanding	3	4.38
II.6	3.02	Understanding	3	4.38
II.7	3.04	Understanding	3	4.38
II.8	4.04	Understanding	3	4.38
II.9	4.02	Understanding	3	4.38
II.10	4.04	Understanding	3	4.38
III	1.01	Applying	7	10.22
IV	1.03	Understanding	7	10.22
V	1.02	Understanding	7	10.22
VI	1.04	Understanding	7	10.22
VII	2.04	Applying	7	10.22
VIII	2.03	Applying	7	10.22
IX	2.01	Understanding	7	10.22
X	2.02	Applying	7	10.22
XI	3.03	Understanding	7	10.22
XII	3.04	Understanding	7	10.22
XIII	4.03	Understanding	7	10.22
XIV	4.01	Understanding	7	10.22

MODEL QUESTION PAPER-II

ADVANCED SURVEYING

Time :3 hrs Maximum Marks: 75

PART A

I. Answer all questions in one word or one sentence.

10. Contour lines never intersect except at___________________________.
11. A _______________theodolite is the one in which line of sight can be reversed by revolving the telescope through 180^0in the vertical plane.
12. To measure the vertical angle instrument should be levelled with respect to_________________________
13. Permissible error in angular measurement is___________
14. A curve which consists of two arcs of different circles is called_______________
15. Least count of total station for distance is_______________
16. EDM instruments uses ______________waves for measuring distance
17. The fundamental principle of photogrammetry is___________.
18. Expansion of GIS is____________

PART B

II. Answer any eight questions from the following, Each question carries 3 marks.

11. List the errors eliminated by repetition method
12. Explain the terms transiting and swinging
13. Differentiate between consecutive coordinates and independent coordinates
14. Differentiate between simple curve and compound curve
15. Describe the working principle of an EDM
16. List the functions of a total station
17. Explain the control of errors in a Total station
18. List the applications of GPS
19. Explain the classification of GIS
20. Explain Drone surveying .

3*8 = 24 marks

PART C

Answer ALL questions. Each question carries 7 marks.

XV. The area within contour lines of a reservoir site are given below.Taking 350 as the bottom level of reservoir and 362 as the full reservoir level calculate the volume of water in the reservoir.

Contour (m)	350	352	354	356	358	360	362
Area(m^2)	300	10500	76000	145000	270000	415000	470000

OR

XVI. Explain the measurement of horizontal angle by repetition method

XVII. Explain how a theodolite can be used to prolong a straight line.

OR

XVIII. Explain how you would measure the deflection angle of a line with a theodolite.

XIX. Two straights intersect at chainage 1150.5m and the angle of deflection is 60˚. If the radius of thecurveis 500m, find the following. (i) Tangent distance (ii) Chainage of point of commencement (iii) Chainage of point of tangency (iv) Length of long chord

OR

XX. In order to determine the elevation of the top Q of a signal, observations were made from two instrument stations A and B which are in line with the signal. The stations A and B are 80m apart. The vertical angles of Q as observed at A and B were 30˚ 45'tand 16˚ 10'. The staff readings on the bench mark of elevation 178.450 m was 2.850m when the instrument was at A, and 3.580m when the instrument was at B. Determine the elevation of the top and foot of the signal, if the height of the signal above the base is 5m

XXI. Define balancing of the traverse. State Bowditch's rule and Transit rule.

OR

XXII. The latitude and departures of the lines of a closed traverse are given below. Calculate the area of the traverse

Line	Northing	Southing	Easting	Westing
AB		157.2	154.8	
BC	210.5		52.5	
CD	175.4			98.3
DA		228.7		109.0

XXIII. Write the steps involved in measuring the area of a plot using single stationed total station

OR

XXIV. Explain the working principles and components of a total station.

XXV. Explain the fundamental principles of photogrammetry and list its applications

OR

XXVI. Explain :

1. Remote sensing.
2. GNSS

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PART A

I. Answer all questions in one word or one sentence.

1. Contour lines never intersect except at___________________________.
   Overhanging cliffs
2. A _______________theodolite is the one in which line of sight can be reversed by revolving the telescope through 180^0in the vertical plane.
   Transit
3. To measure the vertical angle instrument should be levelled with respect to_________________________
   Altitude bubble
4. Permissible error in angular measurement is___________
   20”
5. A curve which consists of two arcs of different circles is called_______________
   Compound curve
6. Least count of total station for distance is_______________
   1mm
7. EDM instruments uses ______________waves for measuring distance
   Infrared
8. The fundamental principle of photogrammetry is___________.
   Triangulation
9. Expansion of GIS is____________
   Geographic information system
   1mark x9

PART B

II. Answer any eight questions from the following, Each question carries 3 marks.

1. List the errors eliminated by repetition method

Errors due to eccentricity of verniers and centers are eliminated by taking the both vernier readings and averaging them.

2) Errors due to in adjustments of line of collimation and trunnion axis are eliminated by taking both face left and face right readings.

3) Errors due to inaccurate graduations are eliminated by taking the readings at different parts of circle.

4) Errors due to inaccurate bisection of object may compensate each other.

5) Errors due to improper levelling can be minimized

(any 3 points)

2. Explain the terms transiting and swinging

   Swinging the Telescope : It is the process of turning the telescope about the vertical axis in a horizontal plane. ***(1.5 Marks)***

   Transiting the telescope : The operations consisting of revolving the telescope through 180° in a vertical plane about its horizontal axis.***(1.5 Marks)***

3. Differentiate between consecutive coordinates and independent coordinates

   Consecutive coordinates of a station is designated by its departure and latitude from its previous station as origin. ***(1.5 Marks)***

   The **coordinates** of any point with respect to a common origin are said to be the **independent coordinates** of that point.***(1.5 Marks)***

4. Differentiate between simple curve and compound curve

   A simple curve consists of a single arc of a circle connecting two straights. ***(1.5 Marks)***

   A compound curve consists of two or more simple curves having different radii bending in the same direction and lying on the same side of the common tangent. ***(1.5 Marks)***

5. Describe the working principle of an EDM

   Electronic distance measurement (EDM) is a method of determining the length between two points, using phase changes, that occur as electromagnetic energy waves travels from one end of the line to the other end.***(3 Marks)***

6. List the functions of a total station

   Measurement of Horizontal distance.

   Measurement of distance between any two points.

   Measurement of Elevation of objects

   Measurement of the three coordinates of the observed points.

   (List any 3 x 1)

7. Explain the control of errors in a Total station

   1. Instrumental Errors

      Some instrumental errors are eliminated by observing on two faces of the total station and averaging

      Instrumental errors are measured and corrected using electronic calibration procedures that are carried out at any time and can be applied to the instrument on site.

   2. Tilting Axis Error

      This axial errors occur when the titling axis of the total station is not perpendicular to its vertical axis. This has no effect on sightings taken when the telescope is horizontal, but introduces errors into horizontal circle readings when the telescope is tilted, especially for steep sightings. As with horizontal collimation error, this error is eliminated by two face measurements, or the tilting axis error a is measured in a calibration procedure and a correction applied for this to all horizontal circle readings

   3. Horizontal Collimation (Or Line Of Sight Error)

      This axial error is caused when the line of sight is not perpendicular to the tilting axis. It affects all horizontal circle readings and increases with steep sightings, but this is eliminated by observing on two faces.

      (Explain any two -2 x1.5)

8. List the applications of GPS

   1. As a tracking device
   2. Provides latitude longitude and altitude information
   3. Aids navigation in vehicles, aircrafts and ships

      (This or any other relevant 3 points 3x1)

9. Explain the classification of GIS

1. Management of natural disasters
2. Mapping. ...
3. Telecom and Network Services. ...
4. Accident Analysis and Hot Spot Analysis. ...
5. Urban planning. ...
6. Transportation Planning. ...

   (any 3 points 3 x 1)

10. Explain Drone surveying .

    A **drone survey** refers to the use of a **drone**, or unmanned aerial vehicle (**UAV**), to capture aerial data with downward-facing sensors, such as RGB or multispectral cameras, and LIDAR payloads. ... These maps can also be used to extract information such as highly-accurate distances or volumetric measurements.***(3 Marks)***

3*8 = 24 marks

PART C

Answer ALL questions. Each question carries 7 marks.

III. The area within contour lines of a reservoir site are given below.Taking 350 as the bottom level of reservoir and 362 as the full reservoir level calculate the volume of water in the reservoir .

Contour (m)	350	352	354	356	358	360	362
Area(m^2)	300	10500	76000	145000	270000	415000	470000

Use trapezoidal or prismoidal formula to compute volume taking contour interval as 2m.

1 mark for identifying contour interval

2 mark for writing equation

2 mark for substituting areas

2 mark for final answer

OR

IV. Explain the measurement of horizontal angle by repetition method

1. The theodolite is mounted on the tripod stand.
2. The theodolite is centered over an arbitrarily selected station P from where the given stations can be sighted without any obstruction and the instrument is levelled using the foot screws and the plate bubble is brought to the centre of the run.
3. The theodolite is set on the face right mode on the vernier A and the horizontal circle is initially set at 0°00’00” and the station A is sighted .
4. The upper clamp screw is unclamped and the theodolite is swung to the right and the station B is sighted and the central vertical cross hair is made to bisect this station and the horizontal angles on both the vernier A and B are observed.
5. The measurement of horizontal angle between the stations A and B is repeated for the desired number of repetitions and the cumulative horizontal angle observed in the last repetition is recorded.
6. The theodolite is then set on the face left mode and the vernier A on the horizontal circle is initially set at 180°00’00” and the station B is sighted.
7. The upper clamp screw is unclamped and the theodolite is swung to the left and the station A is sighted and the central vertical cross hair is made to bisect this station and the horizontal angles on both the vernier A and B are observed.
8. The measurement of horizontal angle between the station A and B is repeated for the same number of repetitions as earlier and the cumulative horizontal angle observed in the last repetition is recorded.
9. The observations are recorded in the field book.
10. The mean values of the horizontal angles on vernier A and B are computed for every sighting.
11. The actual horizontal angle between the given stations is determined by dividing the cumulative horizontal angle by number of repetitions.
12. The average of the two actual horizontal angles observed on each for the two initial settings of vernier A is determined as the result.

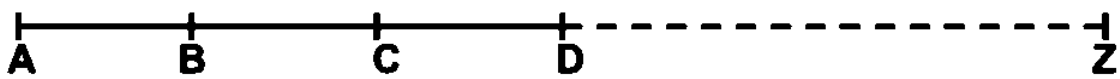
(7marks)

V. Explain how a theodolite can be used to prolong a straight line.

i)Set up the theodolite at A and level it accurately. Bisect the point b correctly. Establish a point C in the line beyond B approximately by looking over the top of the telescope and accurately by sighting through the telescope.

ii) Shift the instrument to B, take a fore sight on C and establish a point D in line beyond C.

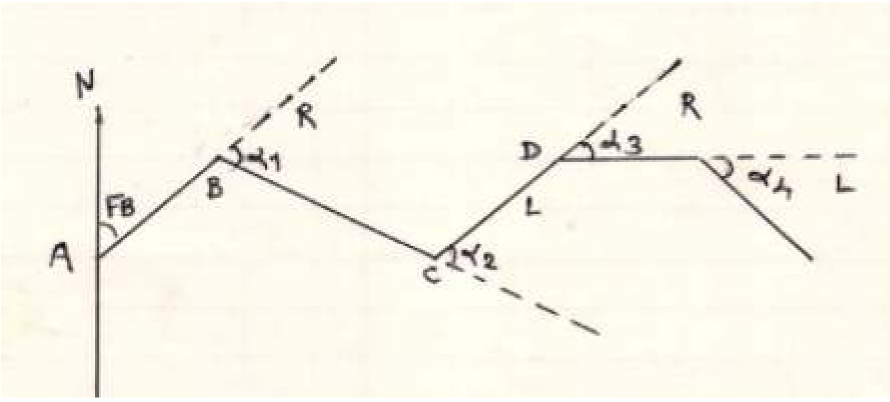
iii) Repeat the process until the last point Z is reached.



(5 Mark for procedure and 2 mark for figure)

OR

VI. Explain how you would measure the deflection angle of a line with a theodolite.



Procedure

1. The instrument was setup and level accurately at station 'O'
2. Both the plates wear clamped at 'O' level and back sight was taken on station point.
3. The upper plot was in clamped and the fore sight of the station 'O' was taken. The reading on both the verniers were recorded.
4. The lower clamp was unclamped and the instrument was shifted to station 'P' again. There was no change in the reading as recorded in step three above.
5. The process was repeated and the instruments was again sighted to 'Q'. The readings on both verneirs are recorded.
6. As the deflection angle was doubled because of taking both face reading. The average value of deflection angle was obtained by dividing the final reading by two.

(5 Mark for procedure and 2 mark for figure)

VII. Two straights intersect at chainage 1150.5m and the angle of deflection is 60˚. If the radius of the curve is 500m, find the following. (i) Tangent distance (ii) Chainage of point of commencement (iii) Chainage of point of tangency (iv) Length of long chord

Deflection angle = 60^0

i. Tangent distance=R tan(α/2)

$=500\tan 30^0$

$=288.68$m **_2mark_**

Chainage of point of commencement=chainage of point of intersection - tangent distance =1150.5-288.68=861.82m **_1mark_**

Chainage of point of tangency= length of curve+ Chainage of point of commencement

Length of curve=$\pi R\alpha/180$= 523.33

Chainage of point of tangency=523.33+861.82=1385.15m **_2mark_**

Length of long chord= 2R Sin(α/2) = $1000\sin 30^0$ =500 **_2mark_**

OR

VIII. In order to determine the elevation of the top Q of a signal, observations were made from two instrument stations A and B which are in line with the signal. The stations A and B are 80m apart. The vertical angles of Q as observed at A and B were 30˚ 45'tand 16˚ 10'. The staff readings on the bench mark of elevation 178.450 m was 2.850m when the instrument was at A, and 3.580m when the instrument was at B. Determine the elevation of the top and foot of the signal, if the height of the signal above the base is 5m

IX. Define balancing of the traverse. State Bowditch's rule and Transit rule.

A **traverse** is balanced by applying corrections to latitudes and departures. This is called **balancing** a **traverse** . In case of a closed **traverse**, the algebraic sum of latitudes and departures must be equal to zero (i.e. L=0 and D=0)**_(2marks)_**

Bowditch's method

The basis of this method is on the assumption that the errors in linear measurements are proportional to $\sqrt{l}$ and that the errors in angular measurements are inversely proportional to $\sqrt{l}$ where l is the length of a line. Bowditch's rule is mostly used to balance a traverse where linear and angular measurements are of equal precision. The total error in latitude and in the departure is distributed in proportion to the lengths of the sides.

Bowditch's rule is :

Correction to latitude (or departure) of any side = Total error in latitude (or departure) X (Length of that side / Perimeter of traverse)

Thus, if CL = correction to latitude of any side

CD = Correction to departure of any side

ΣL = Total error in latitude

ΣD = Total error in Departure

Σl = Length of the perimeter

l = Length of any side

$$C_L = \sum L.\frac{l}{\Sigma l}$$

$$C_D = \Sigma D.\frac{l}{\Sigma l}$$

(2.5 marks)

Transit Method

Transit rule may be employed where angular measurements are more precise than the linear measurements. According to this rule, the total error in latitudes and in departures is distributed in proportion to the latitudes and departures of the sides

Transit rule is :

Correction to latitude (or departure) of any side = Total error in latitude (or departure) X (Latitude (or departure) of that line / Arithmetic sum of latitude (or departures)

Thus, if L = Latitude of any line

D = Departure of any line

L_T = arithmetic sum of latitudes

D_T = arithmetic sum of departures

We have $C_L = \sum L.\frac{L}{L_T}$

$$C_L = \Sigma D.\frac{D}{D_T}$$

(2.5 marks)

OR

X. The latitude and departures of the lines of a closed traverse are given below. Calculate the area of the traverse

Line	*Northing*	*Southing*	*Easting*	*Westing*
AB		157.2	154.8	
BC	210.5		52.5	
CD	175.4			98.3
DA		228.7		109.0

Compute area from independent coordinates

2 mark for tabulation of latitudes and departures with proper signs

2 mark for arriving at independent coordinates

2 mark for equation of area using independent coordinates

1 mark for the final answer

XI. Write the steps involved in measuring the area of a plot using single stationed total station

1. Fix the total station over a station and level it

2. Press the power button to switch on the instrument. 3. Select MODE B -------> S function------->file management------>create(enter a name)------- >accept

4. Then press ESC to go to the starting page

5. Then set zero by double clicking on 0 set(F3)

6. Then go to S function ------> measure-----> rectangular co-ordinate---->station --- >press enter.

7. Here enter the point number or name, instrument height and prism code.

8. Then press accept (Fs)

9. Keep the reflecting prism on the first point and turn the total station to the prism, focus it and bisect it exactly using horizontal and vertical clamps.

10. Then select MEAS and the display panel will show the point specification

11. Now select edit and re-enter the point number or name point code and enter the prism height that we have set.

12. Then press MEAS/SAVE (F3) so that the measurement to the first point will automatically be saved and the display panel will show the second point.

13. Then turn the total station to second point and do the same procedure.

14. Repeat the steps to the rest of the stations and close the traverse

15. Now go to S function----> view/edit----graphical view.

16. It will show the graphical view of the traverse.
17. Select S function---> calculation---> 2D surface----> All------> accept
18. This will give the area of the closed traverse.

(7marks)

OR

XII. Explain the working principles and components of a total station.

Total station is a surveying equipment combination of Electromagnetic Distance Measuring Instrument and electronic theodolite. It is also integrated with microprocessor, electronic data collector and storage system. The instrument can be used to measure horizontal and vertical angles as well as sloping distance of object to the instrument.

Data collected and processed in a Total Station can be downloaded to computers for further processing. Total station is a compact instrument and weighs 50 to 55 N. A person can easily carry it to the field. ***(3.5marks)***

The components used in Total station surveying are as follows:

1. A tripod is used to hold the total station
2. An electronic notebook used to record, calculate and even manipulate the field data
3. Prism and prism pole which can measure lengths up to 2 km and up to 6-7 km can be measured with triple prism
4. Battery

(3.5 marks)

XIII. Explain the fundamental principles of photogrammetry and list its applications

Photogrammetry gathers measurements and data about an object by analysing the change in position from two different images. It uses things like perspective, advanced processing software and photo analysis. The fundamental principle used by photogrammetry is triangulation. Triangulation involves taking pictures from a minimum of two different locations. These pictures create lines of sight that lead from each camera to specific points on the object being photographed. The intersection of these lines plays into mathematical calculations that help produce 3D coordinates of the specified points.***(3 marks)***

The applications of photogrammetry are

- Land Surveying. ...
- Engineering. ...
- Real Estate. ...
- Military Intelligence. ...
- Medicine. ...
- Film and Entertainment. ...
- Forensics. ...
- Construction and Mining.

(any 4 points 4 marks)

OR

XIV. Explain :

1. Remote sensing.

   Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object, in contrast to in situ or on-site observation. The term is applied especially to acquiring information about the Earth and other planets. Remote sensing is used in numerous fields, including geography, land surveying and most Earth science disciplines (for example, hydrology, ecology, meteorology, oceanography, glaciology, geology); it also has military, intelligence, commercial, economic, planning, and humanitarian applications, among others. ***(3.5 marks)***

2. GNSS

   GNSS stands for Global Navigation Satellite System, and is the standard generic term for satellite navigation systems that provide autonomous geo-spatial positioning with global coverage. This term includes e.g. the GPS, GLONASS, Galileo, Beidou and other regional systems. GNSS is a term used worldwide The advantage to having access to multiple satellites is accuracy, redundancy and availability at all times. Though satellite systems don't often fail, if one fails GNSS receivers can pick up signals from other systems. Also if line of sight is obstructed, having access to multiple satellites is also a benefit. Common GNSS Systems are GPS, GLONASS, Galileo, Beidou and other regional systems.***(3.5 marks)***

MO	Hr/Modul	Marks/M	Part A	Part B	Part C	Total

COURSE : Advanced Surveying

BLUE PRINT

			No of questions	Score	No of questions	Score	No of questions	Score	No of questions	Score
1	15	26-36%	2	2	2	6	4	28	8	36
2	16	27-37%	3	3	2	6	4	28	9	37
3	13	22-32%	2	2	3	9	2	14	7	25
4	14	24-34%	2	2	3	9	2	14	7	25
Total			9	9	10	30	12	84	31	123

Blue Print

Cognitive Level Mark Distribution

COGNITIVE LEVEL	MARKS	PERCENTAGE
REMEMBERING	11	8.94
UNDERSTANDING	83	67.48
APPLYING	29	23.58

QUESTION WISE ANALYSIS

COURSE :Advanced Surveying

Qn No	Module Outcome	Cognitive Level	Score	Time in Minutes
I.1	1.01	Apply	1	1.46
I.2	1.02	Remembering	1	1.46
I.3	2.01	Understanding	1	1.46
I.4	2.02	Understanding	1	1.46
I.5	2.04	Understanding	1	1.46
I.6	3.02	Understanding	1	1.46
I.7	3.01	Understanding	1	1.46
I.8	4.04	Understanding	1	1.46
I.9	4.03	Understanding	1	1.46
II.1	1.03	Understanding	3	4.38
II.2	1.02	Remembering	3	4.38
II.3	2.01	Understanding	3	4.38
II.4	2.04	Understanding	3	4.38
II.5	3.01	Understanding	3	4.38
II.6	3.02	Understanding	3	4.38
II.7	3.04	Understanding	3	4.38
II.8	4.02	Understanding	3	4.38
II.9	4.03	Understanding	3	4.38
II.10	4.04	Understanding	3	4.38
III	1.01	Applying	7	10.22
IV	1.03	Understanding	7	10.22
V	1.04	Understanding	7	10.22
VI	1.04	Understanding	7	10.22
VII	2.04	Applying	7	10.22
VIII	2.03	Applying	7	10.22
IX	2.01	Understanding	7	10.22
X	2.02	Applying	7	10.22
XI	3.03	Understanding	7	10.22
XII	3.04	Understanding	7	10.22
XIII	4.04	Understanding	7	10.22
XIV	4.01	Remembering	7	10.22