



WINTER- 17 EXAMINATION

Subject Name: SURVEYING

Model Answer

Subject Code:

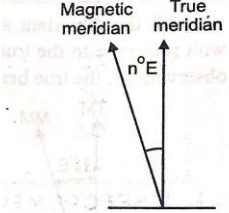
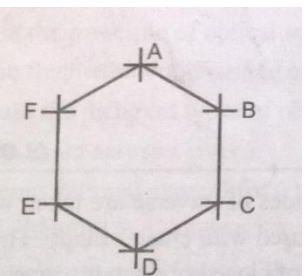
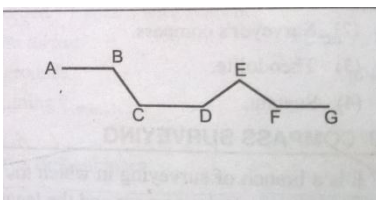
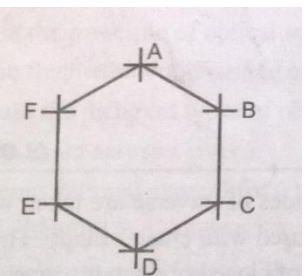
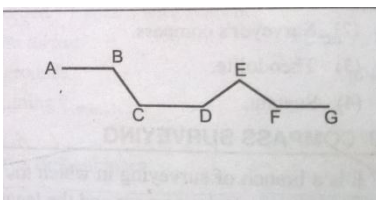
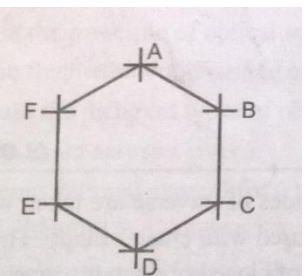
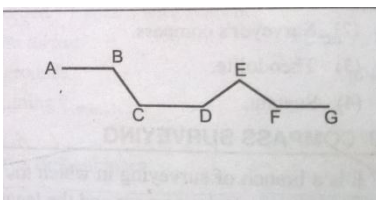
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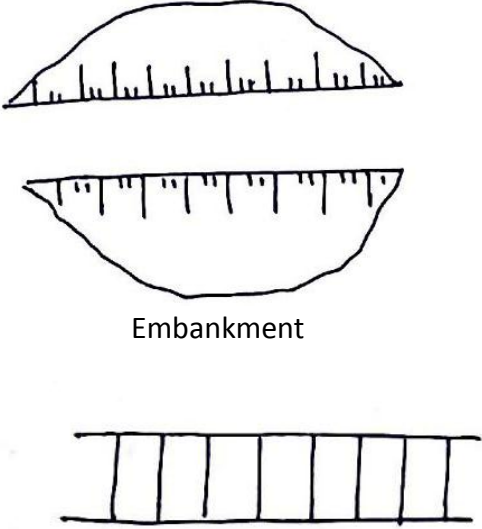
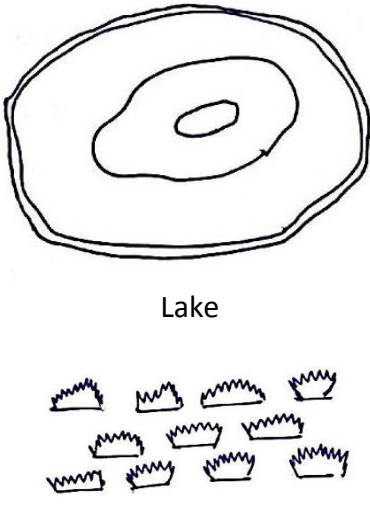
Important Instructions to examiners:

- 1) The answers should be examined by key words 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 errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures 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 some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answer	Marking Scheme						
1.	(a) Ans.	Classify survey as per instruments used. Classification of Survey as per Instruments. 1) Chain Survey 2) Compass Survey 3) Plane Table Survey 4) Theodolite Survey 5) Tachometric Survey 6) Photogrammetric Survey	(Two Marks) ½ each, any four						
1.	(b) Ans.	State two principles of survey. Following are the two principles of survey. 1) To work from whole to part. 2) To locate a point at least by two independent processes.	(Two Marks) 01 Mark each						
1.	(c) Ans.	State the use of arrows and invar tape in surveying. Use of Arrow and invar tape <table border="1" style="margin-left: 40px;"> <thead> <tr> <th>Instrument</th> <th>Use</th> </tr> </thead> <tbody> <tr> <td>Arrow</td> <td>To mark end of chain.</td> </tr> <tr> <td>Invar Tape</td> <td>To measure distance at a place where temperature variation is more.</td> </tr> </tbody> </table>	Instrument	Use	Arrow	To mark end of chain.	Invar Tape	To measure distance at a place where temperature variation is more.	(Two Marks) 01 Mark each
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Invar Tape	To measure distance at a place where temperature variation is more.								
1.	(d) Ans.	What is mean by magnetic declination? The magnetic meridian at a place does not coincide with the true meridian at that place. The horizontal angle made by the magnetic meridian with the true meridian is called as magnetic declination.	(02 Marks)						



			Figure is optional												
1.	(e) Ans.	<p>Differentiate between open traverse and closed traverse on any two points.</p> <p>Differentiation between Open Traverse and Closed Traverse</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Closed Traverse</th> <th style="width: 50%;">Open Traverse</th> </tr> </thead> <tbody> <tr> <td>When a traverse forms a closed polygon it is called as "Closed Traverse"</td> <td>When a traverse does not form a closed polygon it is called as "Open Traverse"</td> </tr> <tr> <td>It is a series of line which begins and ends a same point.</td> <td>It is the series of lines which extends in same direction but not return to starting point.</td> </tr> <tr> <td>It is suitable for locating boundaries like ponds forest etc.</td> <td>It is suitable for long narrow strip of ground like river , valley , road etc.</td> </tr> <tr> <td>In closed traverse sum of included angles = $(2n - 4) \times 90$ OR Sum of exterior angles = $(2n + 4) \times 90$</td> <td>There is no such check</td> </tr> <tr> <td style="text-align: center;">  </td> <td style="text-align: center;">  </td> </tr> </tbody> </table>	Closed Traverse	Open Traverse	When a traverse forms a closed polygon it is called as "Closed Traverse"	When a traverse does not form a closed polygon it is called as "Open Traverse"	It is a series of line which begins and ends a same point.	It is the series of lines which extends in same direction but not return to starting point.	It is suitable for locating boundaries like ponds forest etc.	It is suitable for long narrow strip of ground like river , valley , road etc.	In closed traverse sum of included angles = $(2n - 4) \times 90$ OR Sum of exterior angles = $(2n + 4) \times 90$	There is no such check			(Two Marks) 01 mark each any two
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1.	(f) Ans.	<p>State any two desired relationship between fundamental axes of dumpy level.</p> <p>Following are the desired relationship between fundamental axes of dumpy level.</p> <ol style="list-style-type: none"> 1. The axis of level tube should be perpendicular to the vertical axis. 2. The line of collimation should be parallel to the axis of bubble (level) tube. 3. Axis of telescope and line of collimation should be coinciding. 	(Two Marks) 01 mark each any two												
1.	(g) Ans.	<p>State the principle of plane table survey.</p> <p>Principle of plane table survey</p> <ol style="list-style-type: none"> 1) The principle of plane table surveying is that the rays drawn from different points should pass through a single point i.e. a position of station point. 2) Plane table surveying is based on the principle, that lines drawn during plotting always lie parallel to the corresponding lines actually present on the ground if plane table is in properly oriented position. 	(02 marks) for any one												
1.	(h) Ans.	<p>Define the term:</p> <p>(1) Level surface (2) Line of collimation</p> <p>Level surface: It is a surface parallel to the mean spheroidal surface of the earth. It is normal to the direction of plumb line at all points. The surface of still water is an example of level surface.</p> <p>Line of collimation: It is the line joining the intersection of cross hairs of diaphragm to the optical center of object glass and its continuation. It is also called as line of sight.</p>	(01 mark) (01 mark)												

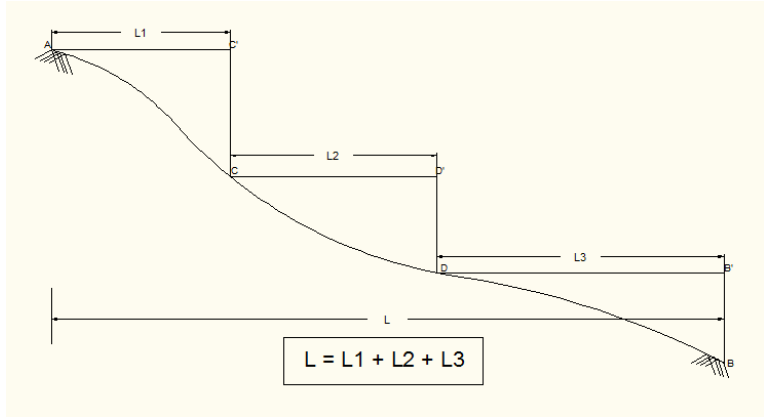
1.	(B) a Ans	<p>Differentiate between plane and geodetic survey on any four points. Difference between Plane Surveying and Geodetic Surveying</p> <table border="1" data-bbox="228 264 1393 814"> <thead> <tr> <th>Points</th> <th>Plane Surveying</th> <th>Geodetic Surveying</th> </tr> </thead> <tbody> <tr> <td>Definition</td> <td>Plane surveying is that type of surveying in which mean surface of earth is considered as plane and the spheroidal shape is neglected</td> <td>Geodetic surveying is that type of surveying in which mean surface of earth is considered as spheroidal. All lines laying in the surface are curved lines.</td> </tr> <tr> <td>Area</td> <td>It is carried out upto area less than 250 km²</td> <td>It is carried for area more than 250 km²</td> </tr> <tr> <td>Accuracy</td> <td>Accuracy of plane survey is less as compared to geodetic survey.</td> <td>Accuracy is more in geodetic survey.</td> </tr> <tr> <td>Agencies</td> <td>It is carried out by any agencies like PWD, Builder etc.</td> <td>It is carried out by G.T.S</td> </tr> <tr> <td>Equipment</td> <td>Traditional survey equipment is used</td> <td>Precise and modern survey equipment are required</td> </tr> </tbody> </table>	Points	Plane Surveying	Geodetic Surveying	Definition	Plane surveying is that type of surveying in which mean surface of earth is considered as plane and the spheroidal shape is neglected	Geodetic surveying is that type of surveying in which mean surface of earth is considered as spheroidal. All lines laying in the surface are curved lines.	Area	It is carried out upto area less than 250 km ²	It is carried for area more than 250 km ²	Accuracy	Accuracy of plane survey is less as compared to geodetic survey.	Accuracy is more in geodetic survey.	Agencies	It is carried out by any agencies like PWD, Builder etc.	It is carried out by G.T.S	Equipment	Traditional survey equipment is used	Precise and modern survey equipment are required	(Four Marks) Any four 01 Mark each
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1.	(B) b Ans	<p>Draw the conventional symbols for embankment, lake, railway line double, marshy land.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Embankment</p> <p>Railway line (Double)</p> </div> <div style="text-align: center;">  <p>Lake</p> <p>Marshy Land</p> </div> </div>	(Four Marks) 01 Mark each																		
1.	(B) c Ans	<p>State any four codes of signals in ranging with their meaning. In guiding the assistant into line, the surveyor should use following code of signals.</p> <table border="1" data-bbox="228 1598 1393 1988"> <thead> <tr> <th>Sr. No.</th> <th>Signal by the Surveyor</th> <th>Action by the Assistant</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Rapid sweeps i.e. up and down movement with right hand on right side.</td> <td>Move considerably to the right.</td> </tr> <tr> <td>2.</td> <td>Rapid sweeps i.e. up and down movement with left hand on left side.</td> <td>Move considerably to the left.</td> </tr> <tr> <td>3.</td> <td>Slow sweeps with right hand on right side.</td> <td>Move slowly to the right.</td> </tr> <tr> <td>4.</td> <td>Slow sweeps with left hand on left side.</td> <td>Move slowly to the left.</td> </tr> </tbody> </table>	Sr. No.	Signal by the Surveyor	Action by the Assistant	1.	Rapid sweeps i.e. up and down movement with right hand on right side.	Move considerably to the right.	2.	Rapid sweeps i.e. up and down movement with left hand on left side.	Move considerably to the left.	3.	Slow sweeps with right hand on right side.	Move slowly to the right.	4.	Slow sweeps with left hand on left side.	Move slowly to the left.	(Four Marks) 01 Mark each, any four			
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5.	Right arm extended.	Continue to move to the right.
6.	Left arm extended.	Continue to move to the left.
7.	Right arm up and moved towards right.	Make the rod vertical by moving towards right.
8.	Right arm up and moved towards left.	Make the rod vertical by moving towards left.
9.	Both hands above the head and brought down.	Correct.
10.	Both arms extended forward horizontally and then depressed.	Fix the ranging rod.

2 (a) Ans.

Explain with neat sketch method of stepping of chaining on sloping ground.



Chaining on ground.

(02 Marks) for fig.

Horizontal distance between A and B is required to be measured.

Procedure:

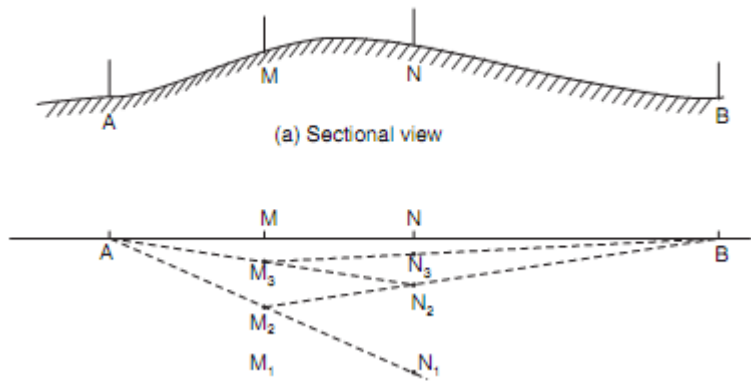
- i) A portion of tape say 2 to 4m is stretched horizontally with one end resting on ground and other end held horizontally at convenient height.
 - ii) The point vertically below the other end transferred on the ground with the help of plumb bob (Say C).
 - iii) The next step start from the C and the method is continued till point B reached.
- Then,

$$L = L1 + L2 + L3$$

(02 Marks)

2 (b) Ans.

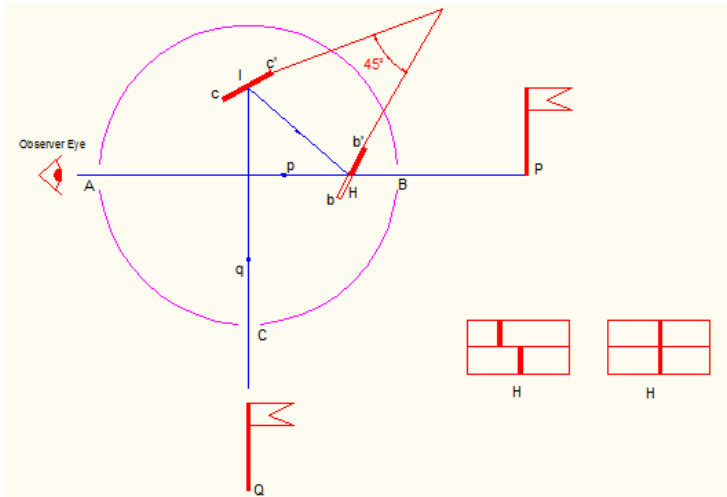
Explain with neat sketch the procedure of reciprocal ranging.



(02 Marks) for fig.



		<p>Procedure: Let A and B be two survey stations. They are not mutually visible due to high ground between them. Let two assistant stands at M1 and N1 as shown in fig. The assistant at M1 can see both the ranging rods at N1 and B, and assistant at N1 can see the ranging rod M1 and A. Now assistant at N1 directs M1 in line AN1, M2 be the new position of M1 on line N1A. The assistant on M2 directs the N1 on line M2B and N2 be the new position of N1. M2 and N2 be the new position of M1 and N1 which are nearer to line AB. Repeat same process until points M and N are established.</p>	(02Marks)
2	(c) Ans.	<p>The length of line measured by 20 m chain was found to be 751 m. The chain was tested before start of measurement and was found correct. The chain was again tested after measurement and was found 6 cm too short. What shall be the correct length of line ? Given Data: Standard length of chain (L)= 20m Measured Length (M.L.) = 751 m Error before start of measurement = 0.0 Error after measurement = 6 cm = 0.06 m</p> <p>To Find: Actual length or Correct length Solution: Average error = $(0 + 0.06) / 2 = 0.03\text{m}$</p> <p>Actual length of chain(L') = $20 - 0.03 = 19.97\text{ m}$</p> <p>Correct length = Measured length x (L'/L) = $(751) \times (19.97/20)$ = 749.87</p> <p>Correct length of line is 749.87 m</p>	(01 Mark) (01 Mark) (02 Marks)
2	(d) Ans.	<p>State any four precautions to be taken while selecting stations for chain surveying. Following are the precautions to be taken while selecting station for chain surveying.</p> <ol style="list-style-type: none">1) As far as possible the survey work should be based upon the basic principle of surveying i.e. working from whole to the part.2) Number of stations shall be minimum.3) Main station should be inter visible.4) Survey lines if possible should run through a level ground.5) If possible a long line should be run roughly through the middle of area.6) The stations should be so selected that the obstacles in chaining and ranging should be avoided.7) The stations should be so the area should be divided into well-conditioned triangles.8) Stations are selected on firm and level ground.9) The survey lines should run as far as possible nearer to object.	(Four Marks) 01 Mark each, any four
2	(e) Ans.	<p>Define the term – base line and check line. Base line: Base line is generally the longest line running roughly through the middle of the area. It is laid on a level ground as far as possible.</p>	(02 Marks)

		<p>The whole frame work is built upon this line. Check line: It is a line joining apex of triangle to some fixed point on the opposite side or a line joining some fixed point on any two sides of the triangle.</p>	(02 Marks)
2	(f) Ans.	<p>Draw a neat sketch of optical square. Explain its working. Optical Square:</p>  <p>Working: The optical square consists of circular box 50 mm in diameter, 12.5 mm in depth. The box has three slits as A,B, and C. bb' is horizon glass, half silvered i.e silvered at top and plane at bottom. Mirror cc'is set opposite to the opening C making an angle 45° with the half silvered mirror bb'.</p> <p>Ray from ranging rod P passes through the plane glass directly to the eye of the observer and ray from ranging rod Q falls on the mirror at cc'.i.e. index mirror and after reflecting falls on the mirror at H and again reflected towards observer.</p> <p>So the angle between the incident ray from p and reflected ray towards A is 90°. The images of ranging rod at P and Q are visible at A as shown in fig.</p> <p>Now observer moves the optical square forward or backward on chain line so that the images of ranging rods co insides. The point below the position of optical square is the point on the chain line where the offset can be dropped to meet point J as shown in fig.</p>	(02 Marks)
Q.3	a) Ans	<p>State any four types of offsets and define them.</p> <ol style="list-style-type: none"> i) Long offset: If length of offset more than 15 m. ii) Short offset: If length of offset less than 15 m. iii) Perpendicular offset: Offset taken perpendicular to chain line. iv) Oblique offset: Offset not taken perpendicular to chain line. 	02 marks for types and 02 marks for definition
Q.3	b) Ans	<p>State the functions of needle, glass cover, pivot and adjustable mirror of a compass.</p> <p>Needle: To direct north-south direction or to give magnetic meridian. Glass cover: To prevent entry of dust in box and movement of needle due to air or wind. Pivot: To support and balance the magnetic needle when it is in use. Adjustable mirror: For sighting object at high or below level of observer's eye.</p>	01 for each
Q.3	c) Ans	<p>i) Convert following bearings into reduced bearing. 315° 30' and 164° 30'.</p> <p style="margin-left: 40px;">R. B. = 360° - 315° 30' = N 44° 30' W -----</p> <p style="margin-left: 40px;">R. B. = 180° - 164° 30' = S 15° 30' E -----</p> <p>ii) Convert following bearings into WCB. N 23° 30' Wand S 35° 30' E.</p>	01 01



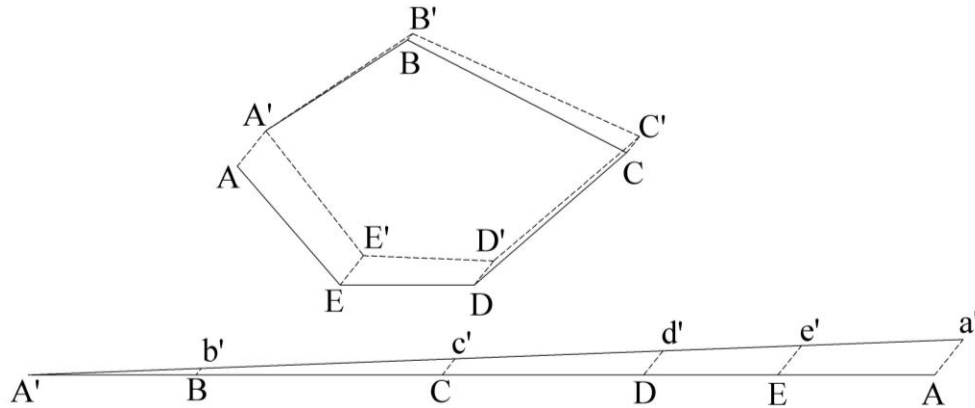
		$WCB = 360^{\circ} - 23^{\circ} 30' = 336^{\circ} 30'$ ----- $WCB = 180^{\circ} - 35^{\circ} 30' = 144^{\circ} 30'$ -----	01 01
Q.3	d) Ans	<p>Define the terms - dip of needle, magnetic bearing, fore bearing and back bearing. Dip of needle: It is downward inclination or small angle made by freely suspended magnetic needle with the horizontal. ----- Magnetic bearing: Magnetic bearing of a survey line is the horizontal angle between the line and magnetic meridian passing through one of its ends. ----- Fore bearing: Bearing of line measured in forward direction or direction of survey, is known as fore bearing. ----- Back bearing: Bearing of line measured in backward direction or opposite direction of survey, is known as back bearing. -----</p>	01 01 01 01
Q.3	e) Ans	<p>With neat sketch, write the procedure of measurement of fore bearing with compass.</p> <div style="text-align: center;"> </div> <p>For measuring fore bearing of line AB, i) Place the compass over station A, center and level it. ----- ii) Looking through eye slit towards object vane, bisect the ranging rod at station B ----- iii) Focus the prism; note the reading which coincides with horse hair at observer end. The observed reading is the fore bearing of line AB -----</p>	01 01 01
Q.3	f) Ans	<p>With neat sketch, explain the included angle method of plotting compass traverse.</p> <div style="text-align: center;"> </div> <ol style="list-style-type: none"> 1. Calculate all included angles of the traverse from observed bearings of the lines. e.g. $\angle A, \angle B, \angle C, \angle D, \angle E$ 2. Check sum of included angles as equal to $(2n - 4) \times 90$, where n is number of sides of closed traverse. 3. Pick a convenient point e.g. 'A'. The point is so chosen that the whole traverse can be plotted properly with a suitable selected scale. Mark the north direction through A, set out AB in direction of its bearing and measure the length AB to the scale to mark point B. 4. Set out the included angle B to obtain the direction of BC. Set out length BC to the scale to mark point C. 	01 03



5. Repeat the procedure at other stations to set out all lines of traverse. The last point when set should coincide with starting station (in case of closed traverse). If there is closing error, it needs to be corrected.

Q.4 a) Explain with neat sketch graphical adjustment of closing error.

Ans



Procedure:

1. Plot the traverse e.g. A'BCDEA to suitable scale and obtain magnitude and direction of closing error.
2. Draw a straight line A'BCDEA to some suitable scale representing the total length of traverse lines.
3. Mark on this straight line, closing error AA' as Aa' but to scale of traverse.
4. Join A' with a' as shown in fig.
5. Draw lines parallel to Aa' through points B,C,D and E giving points b' c' d' and e'.
6. Bb', Cc', Dd' and Ee' directly gives correction at stations B,C,D and E respectively.
7. Mark the corrections in same direction of AA' at plotted points and locate new position of station points to give correct traverse A'B'C'D'E'A'.

02

02

Q.4 b) State any four accessories of plane table with their use.

Ans

Alidade: For sighting the object and drawing the ray along it to a suitable scale. -----

Spirit level: To level the plane table. -----

Compass: To mark north direction and orienting the plane table. -----

Plumb bob and fork: It is used for centering the plane table. -----

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Q.4 c) State any four advantages and four disadvantages of plane table survey.

Ans

Advantages:

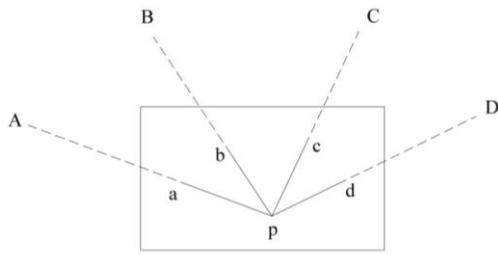
1. A field book is not required.
2. Errors of booking in field book avoided.
3. Errors of plotting can be readily checked.
4. Suitable in magnetic area.
5. Survey work with rapid speed.
6. Simple method and not special skills are required.
7. Plotted field and actual field can be compared on the site.
8. No office work of plotting.
9. Distance of inaccessible object can be determined.

Disadvantages:

1. Required many accessories and chances of loosing.

Any four
02 marks



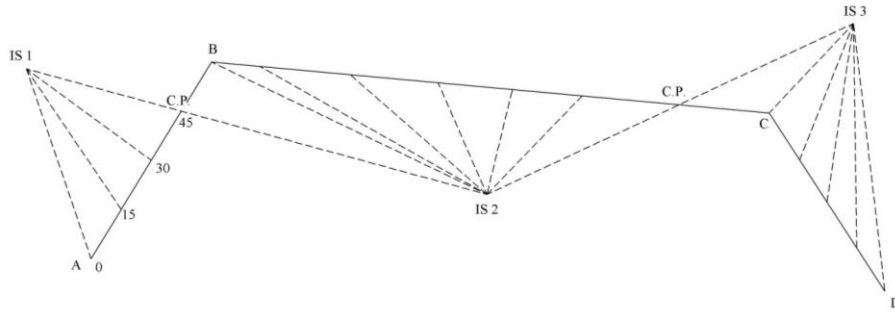
		<ol style="list-style-type: none">Equipment is heavy and cumbersome to carry.Not suitable when accuracy is required.Survey cannot be done in rainy season.Difficult to re-plot as field notes are not available.	Any four 02 marks
Q.4	d) Ans	<p>What is orientation of plane table? State the procedure of any one method of orientation.</p> <p>Orientation of plane table: It means placing table in parallel positions at all stations (or at successive station)</p> <ol style="list-style-type: none">Orientation using trough compass: Here north direction is marked at first station. When orientation is to be carried out at any station, then trough compass is placed along the north direction marked at first station and table is rotated till the needle exactly shows north direction (read zero). The table is clamped in this position.Orientation by back sighting: In this method, when orientation is to be carried out at any station, then alidade is kept along the ray already drawn on sheet from previous station to this station. That table is rotated till ranging rod at previous station is exactly bisected. The table is then clamped.	01 Any one 03 marks
Q.4	e) Ans	<p>Explain with neat sketch the procedure of radiation method of plane tabling.</p> <ol style="list-style-type: none">The table is set at suitable station e.g. P from where all stations can be sighted and measured.After centering and leveling, mark station P as 'P' on sheet.Suppose stations A, B, C, and D are to be plotted.Alidade is kept touching 'P' to station A is bisected. A ray is drawn along edge of alidade to represent line PA. The distance PA is measured and with suitable scale marked as pa.Similarly station B, C and D are bisected and marked as b, c and d. <div style="text-align: center;"></div>	02 02
Q.4	f) Ans	<p>State and explain temporary adjustments of dumpy level.</p> <ol style="list-style-type: none">Setting up the level: The instrument is set up on a tripod at convenient place. Tripod legs should be set well apart for stability of instrument.Leveling:<ol style="list-style-type: none">Approximate leveling: Approximate leveling is carried by tripod legs. For this two legs are firmly fixed and then third leg is moved circumferentially and inward/outward till bubble is approximately at center.Leveling by foot screws:<ol style="list-style-type: none">Bring all foot screws in their center of run.Bring the telescope parallel to any two foot screws and rotate both screws either inward or outward to bring bubble in center.Swing the telescope and bring the bubble over third foot screw. Center the bubble by rotating the third foot screw.Repeat the steps b and c till bubble remain at center in both directions.Swing the telescope through 180° and check whether bubble remains	01 01



		<p>at center.</p> <p>3. Focusing eye piece: i) Keep a piece of white paper in front of telescope or direct the telescope towards a clear sky. ii) Adjust the vision by rotating eye piece till the cross hairs come into sharp and clear view.</p> <p>4. Focusing the object: Direct the telescope towards the object (staff), rotate the focusing knob till object (staff reading) is in sharp view along with cross hair.</p>	01 01
Q.5	a) Ans	<p>State any four advantages of auto level. The advantages of auto level over the ordinary level are as follows.</p> <ol style="list-style-type: none">1. Operational comfort: It does not cause fatigue as there is no strain on eyes, head and hands of observer/surveyor.2. High precision: Elevation error is less and varies from ± 0.5 to 0.8 mm in one km.3. High speed: Time required for leveling is less.4. Freedom from external interference: The external interferences like rain, cloud, magnetic field, vibrations have no influences.5. Freedom from errors: Due to erect image, the leveling staff are read with erect figures.6. Range of application: This can be used for medium to large size project and for accurate leveling work.	Any four 01 mark for each
Q.5	b) Ans	<p>Define the terms - Foresight, back sight, intermediate sight and change point.</p> <ol style="list-style-type: none">1. Fore sight: It is the last staff reading from any set up of the leveling instrument and indicates the shifting of the instrument or end of leveling work.2. Back sight: It is the first staff reading taken from any set up of the leveling instrument after the leveling of instrument has been perfectly done. This reading is always taken on a point of known R.L. i.e. on Bench mark or change point.3. Intermediate sight: It is any other staff reading between the back sight and fore sight from the same set up of the instrument.4. Change point: This point in leveling indicates the shifting of instrument. At this point fore sight is taken from one set up and a back sight is taken from the next set up.	01 mark for each definition
Q.5	c) Ans	<p>State under what situations differential leveling and reciprocal leveling is adopted.</p> <ol style="list-style-type: none">1. Differential leveling is adopted when-<ol style="list-style-type: none">i. The points are at a great distance apart.ii. The difference of elevation between the points is large.iii. There is obstacle between the points.iv. The elevations of various points in the area of interest are required.2. Reciprocal leveling is adopted when the leveling operation is to be continued across the river or valley as it is not possible to place the level midway between two points on opposite banks.	02 02
Q.5	d) Ans	<p>Explain the procedure of profile leveling for construction of road.</p> <p>The operation of taking levels along the center line of any alignment at regular interval is called longitudinal or profile leveling. Along the alignment, spots are marked at regular interval along with the apex points where the alignment changes the direction. Setting the level midway between ends of stretch of road which can be controlled from one point and spot levels are taken on the points on the center line of the alignment. The</p>	04



staff readings and chainage of the points are noted in the field book. The RLs of all the points are calculated and the elevations of all the points are plotted against their chainage to obtain ground profile along the alignment.



Q.5 e) Compare collimation plane method and rise and fall method of reduction of levels.
Ans The comparison between collimation plane method and Rise and fall method is given below.

	Collimation plane method	Rise and Fall method
1.	1. It is rapid method as it involves few calculations.	It is laborious involving several calculations.
2.	There is no check on the correctness of R.L. of intermediate points, hence mistake remain unchecked	There is a check on correctness of intermediate points
3.	The error in calculating the R.L. of any point is not carried forward as the RLs are calculated from respective plane of collimation.	The mistakes made in calculation of RLs of any point are carried forward in this method.
4.	It is used for calculating the RLs of profile leveling operations, where there are more number of intermediate points.	This method is more suitable when the intermediate points are less. This method is also used when calculating RLs of precise leveling work, check leveling etc.
5.	Arithmetic check in this method is $\Sigma BS - \Sigma FS = \text{Last RL} - \text{First RL}$	Arithmetic check in this method is $\Sigma BS - \Sigma FS = \Sigma \text{Rise} - \Sigma \text{Fall} = \text{Last RL} - \text{First RL}$

Any four
01 for each

Q.5 f) Describe instrumental errors in leveling.
Ans The leveling process requires two instruments namely level and staff. The instrumental errors related to these are-

1. Error due to imperfect permanent adjustment: When the instrument is not in perfect permanent adjustment, the line of collimation may be inclined upward or downward causing serious errors. The line of collimation may not be parallel to the axis of bubble tube. Axis of telescope may not be perfectly perpendicular to vertical axis. These instrumental errors lead to errors in leveling.
2. Less sensitivity of bubble or bubble is sluggish: If the bubble is not sensitive or it is sluggish, it may apparently be in the center though the bubble line is not horizontal.
3. Faulty focusing tube: Sometimes the focusing tube is faulty. Due to this the objective does not move in horizontal plane but moves in inclined direction during

01 mark for
each point



		<p>focusing. This is compensatory error and can be eliminated by balancing back sight and fore sight.</p> <p>4. Errors in leveling staff: The graduations of the leveling staff may not be perfect. These errors can be neglected for ordinary work.</p>	
Q.6	a)j Ans	<p>What is local attraction? How it is deflected?</p> <p>The compass needle doesn't point to magnetic north or magnetic meridian when it is under the influence of the external attractive force. It is found to deviate from its normal position when compass is placed in the vicinity of magnetic substances like iron and steel objects, iron ore, electric conductors carrying current. This deviation is called local attraction.</p> <p>To detect the local attraction, the difference between fore bearing and back bearing of a line is found. If the difference is 180°, then the end station of that line are not affected by local attraction and if it is not equal to 180°, then either one or both end stations are affected by local attraction.</p>	02 02
Q.6	a)ii Ans	<p>Enlist different errors in compass surveying.</p> <p>Various errors in compass surveying are classified as-</p> <p>i) Instrumental errors.</p> <p>ii) Personal errors or observational errors</p> <p>iii) Errors caused due to external errors (natural errors)</p> <p>i) Instrumental errors:</p> <p>a) Needle is not perfectly magnetized, not pointing to exact meridian.</p> <p>b) The pivot point is blunt and not sharp</p> <p>c) Needle is not perfectly straight.</p> <p>d) Needle and graduated ring is not perfectly horizontal.</p> <p>e) Object vane is not vertical.</p> <p>f) Horse hair is not straight.</p> <p>ii) Personal or observational errors:</p> <p>a) Inaccurate centering of compass over the station.</p> <p>b) Inaccurate leveling of compass.</p> <p>c) Inaccurate bisecting of ranging rod or other objects.</p> <p>d) Carelessness in taking reading and booking the reading in field book.</p> <p>iii) Errors due to external influences (magnetic errors):</p> <p>a) Magnetic disturbances in the atmosphere stormy days.</p> <p>b) Variations in magnetic declination.</p> <p>c) Local attraction due to proximity of magnetic substances or magnetic field.</p>	01 01 for any two 01 for any two 01 for any two



Q.6

b)

Following consecutive readings were taken with level:
3.875, 2.100, 2.635, 1.895, 2.410, 0.540, 3.185, 2.155, 1.970, 2.675
The first reading was taken on BM of RL 575.000 m. The level was shifted after fourth and eighth reading. Rule out page of level field book. Using rise and fall method, calculate reduced levels of all stations. Apply check.

Ans

The above given staff readings are entered in the level book page and calculations performed. Sample calculations are given in the table below.

Station	B.S.	I.S.	F.S.	Rise	Fall	R.L.	Remark
A	3.875			--	--	575.000	B.M.
B		2.100		1.775	--	576.775	
C		2.635		--	0.535	576.240	
D	2.410		1.895	0.740	--	576.980	C.P.1
E		0.540		1.870	--	578.850	
F		3.185		--	2.645	576.205	
G	1.970		2.155	1.030	--	577.235	C.P.2
H			2.675	--	0.705	576.530	Last point
Σ	8.255		6.725	5.415	3.885		

Arithmetic check: $\Sigma BS - \Sigma FS = \Sigma Rise - \Sigma Fall = Last RL - First RL$

$$8.255 - 6.725 = 5.415 - 3.885 = 576.530 - 575.000$$

$1.530 = 1.530 = 1.530$ Hence checked that all arithmetic calculations are correct.

Sample calculation: For station A and B

Rise or fall = Staff reading at A – Staff reading at B

$$= 3.875 - 2.100 = 1.775 \text{ difference is +ve hence rise from A to B.}$$

R.L. of B = R.L. of A + rise

$$= 575.000 + 1.775 = 576.775.$$

02 marks for tabulation & proper entries of readings in level page.

02 Marks for calculation of rise & fall

02 Marks for calculations of RLs

01 marks for arithmetic check

01 mark for sample calculations

Q.6 c) Fig. shows data related to cross staff survey. Calculate the area of the field ABCDEF in tabular form.

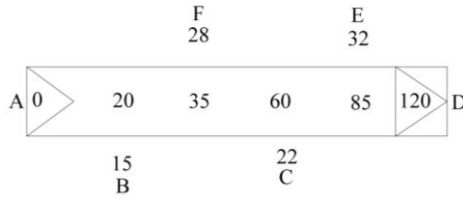


Fig. No. – 1

Note: All dimensions "are in 'M'.

Ans The plot of cross staff survey given in the noting is as shown in fig.

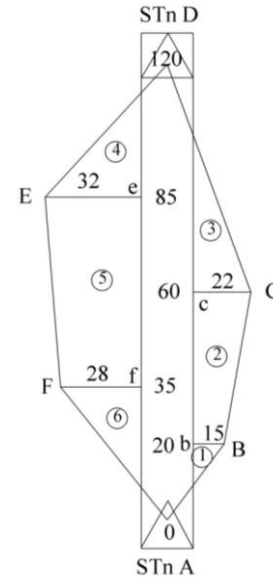


Fig No.	Fig.	Chainage (m)	Base (m)	Offsets (m)	Mean offset (m)	Area (m ²)	
						(+)	(-)
1		0; 20	20	0 & 15	7.5	150	
2		20; 60	40	15 & 22	18.5	740	
3		60; 120	60	22 & 0	11.0	660	
4		85; 120	35	32 & 0	16.0	560	
5		35; 85	50	28 & 32	30.0	1500	
6		0; 35	35	0 & 28	14.0	490	
					Total area	4,100	

Total area of the plot ABCDEF is 4100 Sq.m.

02 marks for plotting.

02 marks for tabulation & entries.

04 marks for calculation & answer.