SUMMER– 19 EXAMINATION

Subject Name: **Model Answer** Subject Code: 17310

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)		**Attempt any SIX**	**12Marks**
	(i)	**State the principles of surveying.**	
	Ans.	Main principles of surveying are: 1) To work from whole to part. 2) To locate a point at least by two independent processes	***(01 Mark)*** ***(01 Mark)***
	(ii)	**Enlist uses of survey.**	
	Ans.	Uses of surveys. 1. To record relative positions of various points on the surface of earth. 2. Prepare plans and maps required for various works. 3. Layout of various engineering works. 4. Compute areas and volumes using survey data required for various purposes. 5. To prepare a topographic map 6. To prepare military map 7. To prepare archeological map	***Any four 1/2 Mark for each***

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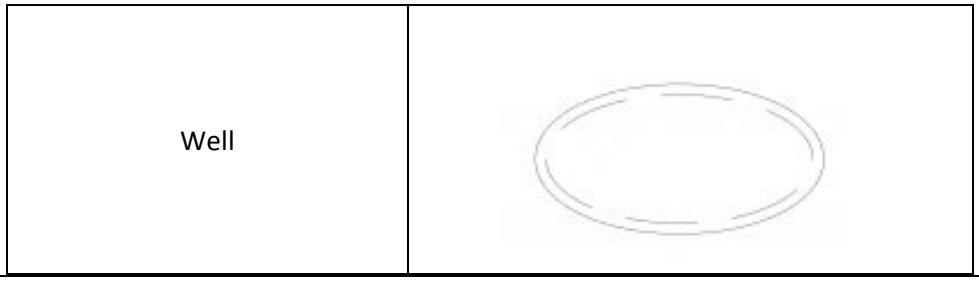
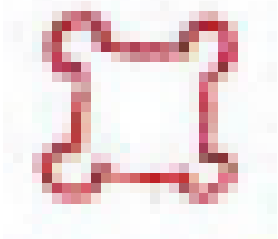
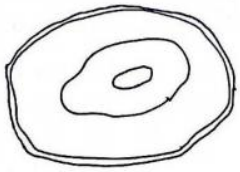
Q. No.	Sub Q.N.	Answer	Marking Scheme
1.a)	(iii)	**Define 1)Ranging 2)Chaining**	
	Ans.	**1) Ranging** The method of establishing intermediate points on a straight line between the two fixed points is known as ranging. **2)Chaining** The method of measuring the distance with the chain or tape is called as Chaining.	**(01 Mark)** **(01 Mark)**
	(iv)	**State the principle of compass survey.**	
	Ans.	The principle of compass survey is traversing, which involves a series of connected survey lines (may be open or closed) whose lengths and bearing are measured by linear and angular measuring instruments.	**(02 Marks)**
	(v)	**State the function of reflecting mirror in prismatic compass.**	
	Ans.	Function of reflecting mirror is to get image of an object located above or below the instrument level while bisection.	**(02 Marks)**
	(vi)	**State the suitability of plane table survey**	
	Ans.	The plane tabling is generally suitable for surveys in which high precision is not required. It is mainly employed for small-scale or medium size mapping.	**(02 Marks)**
	(vii)	**Define leveling.**	
	Ans.	Levelling is an 'art of determining relative heights or elevations of different points on the earth's surface so that the same may be represented on a plan or map'. It is essentially a process dealing with the measurements in vertical plane.	**(02 Marks)**
	(viii)	**Define : 1) Change point 2) Height of instrument.**	
	Ans.	**1) Change point** It is point on which fore and back sights are taken. **2) Height of instrument.** It is the reduced level of line of collimation when the leveling instrument is properly leveled. It is obtained by adding the BS reading to RL of bench mark or change point on which the staff reading was taken.	**(01 Mark)** **(01 Mark)**

1.b)		**Attempt any TWO**	**08 Marks**
	(i)	**Describe in brief primary classification of surveying**	
	Ans.	**Primary Classification** ▪ **Geodetic Survey** The geodetic surveying is that type of surveying which takes into account the curvature of earth's surface. It is generally adopted for large area (more than 250 Sq.Km). A line connecting two points is regarded as an arc. The distance between two points is corrected for the curvature and then it is plotted on the plan. The geodetic surveying deals with fixing widely spread control points, which may afterwards used for fixing minor control points for plane survey. It is performed by government agencies. In India it is done by Great Trignometrical Survey Department (G.T.S). It is carried out with high degree of precision and accuracy. ▪ **Plane Survey** Plane surveying is that type of surveying which does not take into account the curvature of the earth, and the surface of the earth is treated as plane surface. When we deals with only small portion of earth's surface , the above statement is justified. Plane survey is carried out for small areas (upto 250 Sq.Km). Measurements plotted will represent the projection on the horizontal plane of the actual field measurements. The degree of accuracy is comparatively low. It involves plain trigonometry. Plane survey can be carried out by any agency concerned. Plane survey are done for engineering projects on large scale such as Bridges, Dams, Location and Construction of canals, highways, railways etc.	***(02 Marks)*** ***(02 Marks)***
	(ii)	**Draw conventional symbol for 1) Well 2) Fort 3) Lake 4) Church**	
	Ans.		***1 Mark for each***

Fort	
Lake	
Church	

(iii) Ans. **Enlist method of ranging and explain any one in brief.**

Ranging

The method of establishing intermediate points on a straight line between the two fixed points is known as ranging. It is done before chaining started. It may be done by eye or by using some instruments such as line ranger or theodolite.

Ranging may be

a) Direct Ranging

b) Indirect Ranging

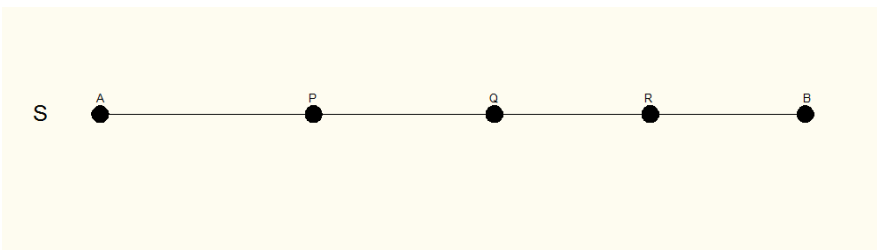
(01 Mark)

Direct Ranging

Let A and B are the two ends of line AB as shown fig and they are intervisible. On this line let three intermediate points P, Q and R are to be established. To perform ranging for establishing the points P, Q, and R, the surveyor stands at a point S, close to the end A on line BA produced. The assistant holds a ranging rod vertically, approximately near to line AB. By eye judgment the surveyor directs the assistant to move the ranging rod so that A, P and B appear to be in one line . Similarly the other points Q and R also fixed.

(03 Marks)

For any one method

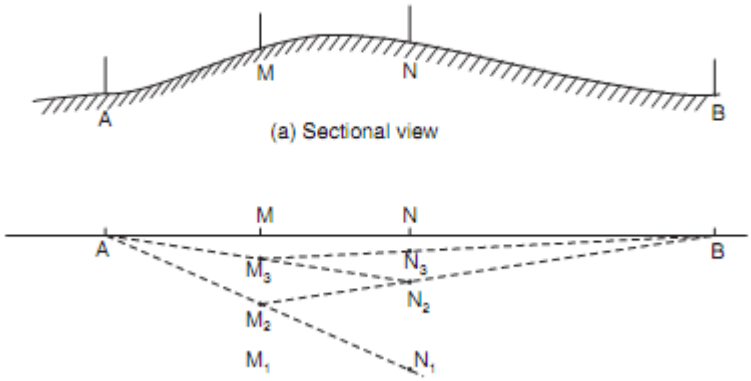


Direct Ranging

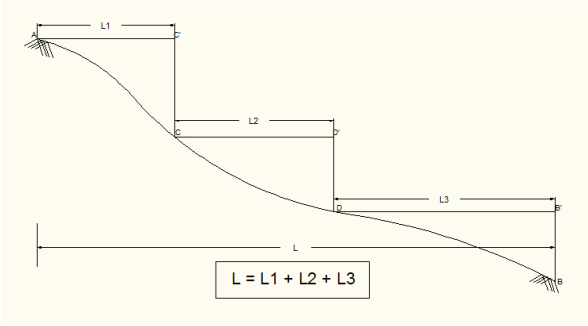
Indirect Ranging

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 M1 direct N1 in line BM1, N2 be the new position of N1 on line M1B. The assistant on N2 direct the M1 on line N2A and M2 be the new position of M1.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.

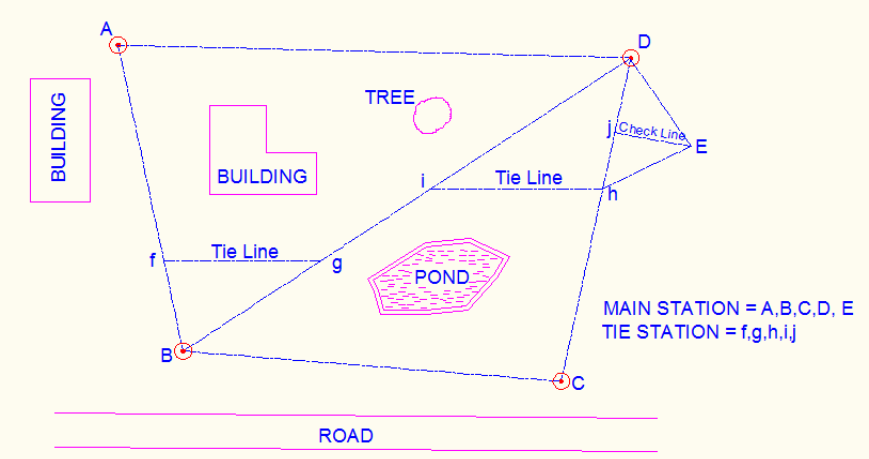


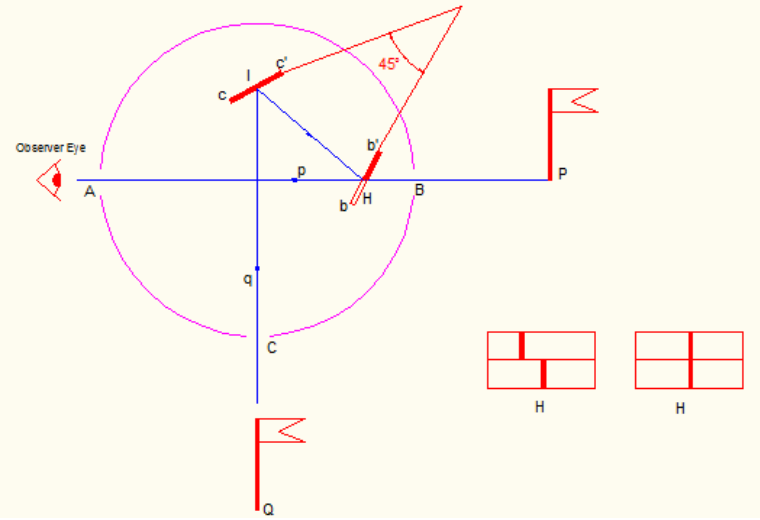
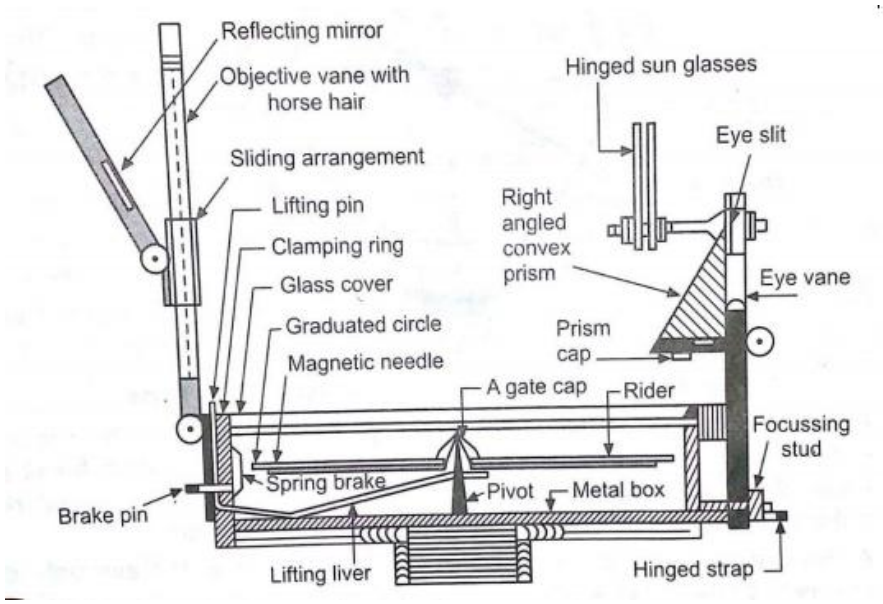
Indirect Ranging

2.		**Attempt any <u>FOUR</u> of the following**	**16 Marks**
	a)	**Describe in brief process of chaining on sloping ground.**	
	Ans.	In direct method which is also known as stepping method horizontal distance is directly measured as shown in fig.  	***(01 Mark)***

		Stepping Method 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.	***(03 Marks)***
	b) **Ans.**	**Enlist the sources of error in chaining and state the precautions to be taken against error.** In general, the distance measurement obtained in the field will be in error. Errors in the distance measurement can arise from a number of sources: **1. Instrument errors:** A chain may be faulty due to a defect in its manufacturing. **2. Natural errors.** The actual horizontal distance between the ends of the chain can vary due to the effects of • temperature, • elongation due to tension • sagging. **3. Personal errors.** Errors will arise from carelessness by the survey crew: 1. poor alignment 2. faulty reading on the chain **Precautions:** **Displacement of arrows:** When the arrow is displaced, it may not be replaced accurately. To guard against this mistake, the end of each chain length should be marked both by the arrow and by a cross (+) scratched on the ground. **Failure to observe the position of the zero point of the tape**: The chainmen should see whether it is at the end of the ring or on the tape. **Adding or omitting a full chain length (due to wrong counting or loss of arrows**): This is the most serious mistake and should be guarded against. This is not likely to occur, if the leader has the full number (ten) of arrows at the commencement of chaining and both the leader and follower count them at each transfer. A whole chain length may be dropped, if the follower fails to pick up the arrow at the point of beginning. **Reading from the wrong end of the chain:** e.g. reading 10 m for 20 m in a 30 m chain, or reading in the wrong direction from a tally, e.g. reading 9.6 m for 10.4 m. The common mistake in reading a chain is to confuse 10 m tag with 20 m tag. It should be avoided by noticing the 15 m tag.	**(02 Marks)** **(02 Marks)** **For any four**

	c) **Ans:**	**The length of line measured with a chain was found to be 250m. Calculate the true length of line if** **i) The length was measured with 30 m chain and the chain was 10cm too long and** **ii) The length of chain was 30 m in the beginning and 30.10 m at the end of the work.** Given Data: L = 30 m Measured Length = 250 m Solution: **Case i) The length was measured with 30 m chain and the chain was 10cm too long** L' = 30 + 0.1 = **30.1 m** Correct Distance = (L'/L) x Measured Length = (30.1/30) x 250 **= 250.83 m** **Case ii) The length of chain was 30 m in the beginning and 30.10 m at the end of the work.** Avg. error = (0 + 0.1) /2 =0.05m L' = 30 + 0.05 = **30.05 m** Correct Distance = (L'/L) x Measured Length = (30.05/30) x 250 **= 250.42 m**	**(02 Marks)** **(02 Marks)**
	d) **Ans.**	**Enlist the factors affecting on selection of survey station or survey line in chain survey.** Following are the factors affecting on selection of survey station for chain surveying. 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 intervisible. 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.	***Any four 1 Mark for each***

	e) **Ans.**	**Describe in brief with neat sketch: i) Base line ii) Check line** **i) 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. The whole frame work is built upon this line. **ii) 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.  	**(01 Mark)** **(01 Mark)** **(02 Marks)**
	f) **Ans.**	**Describe in brief obstacles in chaining.** There are 3 types of obstacles 1. Obstacle to ranging 2. Obstacle to chaining 3. Obstacle to both ranging & chaining. **1) Obstacle to Ranging:** The type of obstacle in which the ends are not inter visible is quite common except in flat country. These may be two cases. i) Both end of the line may be visible form intermediate points on the line ii) Both ends of the line may not be visible from intermediate points on the line **2) Obstacle to chaining but not ranging:** There may be two cases of this obstacle i) When it is possible to chain round the obstacle ex: a pond ii) When it is not possible to chain round the obstacle ex: a river **3) Obstacles to both chaining & ranging** A building is the typical example of this type of obstacle the problem lies in prolonging the line beyond the obstacle & determining the distance across it.	**(01 Mark)** **(01 Mark)** **(01 Mark)** **(01 Mark)**
3.		**Attempt any <u>FOUR</u> of the following**	**16 Marks**

	a) **Ans.**	**Draw sketch of optical square and state its principle.**  The optical square is an instrument used to set perpendicular offset on the chain line. The optical square works on the principle of optics. **Principle of optical square:** The angle between the incident ray and reflected ray is twice the angle between mirrors.	**(02 Marks)** **(02 Marks)**
	b) **Ans.**	**Draw labeled sketch of prismatic compass.** 	**(03 Marks) fig** **(01 Mark) labeling**
	c) **Ans.**	**Describe in brief errors in compass survey.** **Errors in Compass Surveying.** The errors are classified as: 1. Instrumental errors. 2. Personal or Observational errors. 3. Errors due to External Influences (Natural errors etc.).	**(01 Mark)**

(1) Instrumental errors: These errors are due to faulty compass, not being in adjustment and perfect working order i.e. **(01 Mark)**

(i) The needle not being perfectly magnetized, not pointing exact meridian.
(ii) The pivot being bent and not in the center.
(iii) The pivot being dull and not sharp.
(iv) The needle not being perfectly straight.
(v) The needle and graduated ring not being horizontal.
(vi) The object vane not being in plumb.
(vii) The horse hair being loose, not straight.

(2) Personal or Observational errors: **(01 Mark)**

The personal errors may be due to
(i) Inaccurate centering of compass over the station.
(ii) Inaccurate leveling of compass.
(iii) Inaccurate bisection of ranging rod or other objects.
(iv)Carelessness in taking readings.
(v) Carelessness in booking the readings in field boo

(3) Errors due to External Influences: **(01 Mark)**

(i) Magnetic changes in the atmosphere -
(ii) Variations in magnetic declination.
(iii) Local attraction due to proximity of electric lines, steel structures etc.

d) Differentiate between reduced bearing and whole circle bearing **01 Mark each**

Ans.

Quadrantal Bearing/Reduced Bearing	Whole Circle Bearing
The horizontal angle made by a line with the magnetic north or south (whichever is closer from the line) in the eastward or westward direction is the Quadrantal Bearing or Reduced Bearing of the line	The horizontal angle made by a line with the magnetic north in the clockwise direction is the whole circle bearing of the line
Both magnetic north and south lines are considered as reference line in quadrantal bearing system	Only the magnetic north line is considered as reference line in whole circle bearing system.
Both clockwise and anticlockwise angle from the reference line is Only taken	The clockwise angle from the reference line is Only taken
The value of the reduced bearing varies from 0° to 90°	The value of the whole circle bearing varies from 0° to 360°

e) Convert following bearing from RB to WCB: **01 Mark each**

i) N65˚12'E ii) S36˚48'E iii) S38˚18'W iv) N26˚32'W

Ans.

i) N65˚12'E
WCB = RB
= 65˚12'

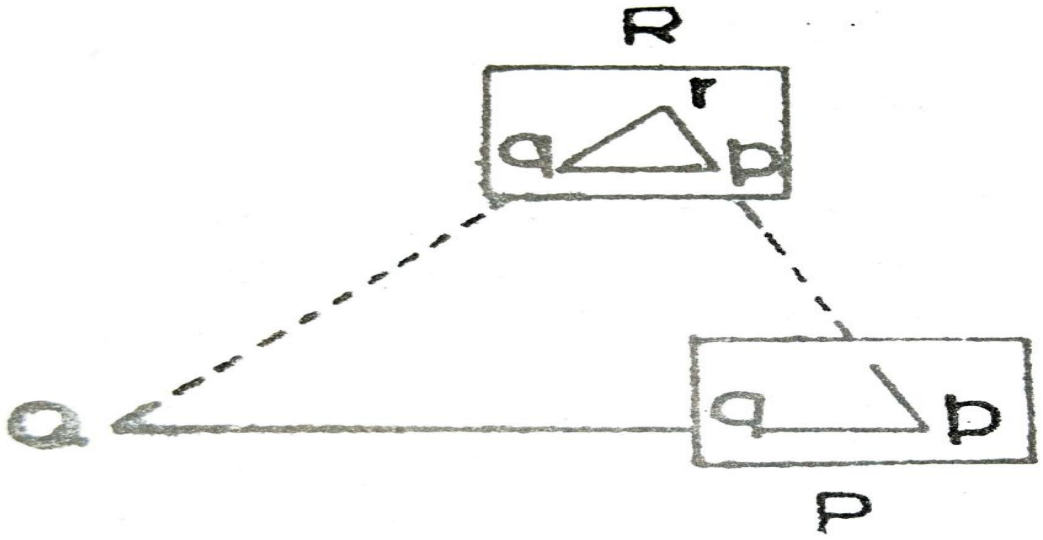
ii) S36˚48'E
WCB = 180˚-RB
= 180˚ - 36˚48'
= 143˚12'

ii) S38˚18'W
WCB = 180˚ + RB
= 180˚ + 38˚18'
= 318˚18'

iv) N26˚32'W
WCB = 360˚ - RB
= 360˚ - 26˚32'
= 333˚28'

	f)	**State the causes of local attraction.**	
	Ans.	**Causes of Local Attraction** (1) Electric wire,poles. (2) Steel tape. (3) Chain, arrows, ranging rod. (4) Bunches of key. (5) Area affected by magnetic field	***Any four 01 Mark for each***

Q.4		**Attempt any FOUR of the following:**	**(16)**
	a) ANS:	**Find the back bearing of following fore bearing.** **i. AB N 26^0 $14'$ E** **ii. BC S 78^0 $18'$ E** **iii. CD S 69^0 $09'$ N** **iv. DE N 32^0 $15'$ W** i. FB OF AB = N 26^0 $14'$ E **BB OF AB = S 26^0 $14'$ W** ii. FB OF BC = S 78^0 $18'$ E **BB OF BC = N 78^0 $18'$ W** iii. FB OF CD = S 69^0 $09'$ N **BB OF CD = If student assume S 69^0 09' E, Then BB = N 69^0 09' W** **BB OF CD = If student assume S 69^0 09' W, Then BB = N 69^0 09' E** ***NOTE:*** **Appropriate marks should be given for any of this assumption.** iv. FB OF DE = N 32^0 $15'$ W **BB OF DE = S 32^0 $15'$ E**	**4M** **(1 Mark for each)**
	b) ANS:	**Enlist different accessories of plane table survey with their use.** **i) The plane table:** It is used for fixing a drawing sheet over it. To locate the position of the objects on the sheet by drawing rays and plotting to suitable scale. **ii) The Alidade (plain Alidade, Telescopic Alidade):** It is used to sight the objects. To draw rays along the fiducial edge. **iii) The spirit level:** It is used for levelling the plane table. **iv) The compass:** (Trough Compass, Circular compass): It is used for marking the North direction on the map. To orient the plane table. **v) U-Fork or Plumbing fork with plumb bob:** It is used for centering the table over the station.	**4M** **(1 Mark for each)** (Any four)
Q.4	c)	**Describe in brief resection method of plane table surveying.**	**4M**

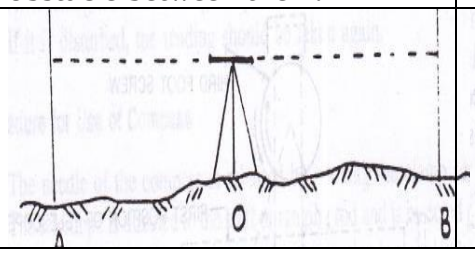
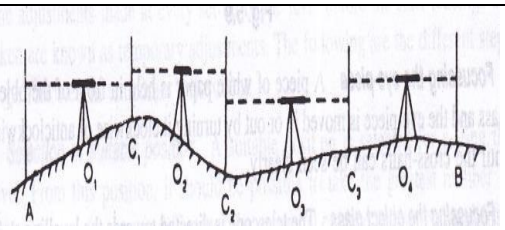
	Ans:	 This method is used for establishing the instrument stations only. After fixing the stations, details are located either by radiation or intersection. The characteristic feature of resection is that the point plotted on plan is the station occupied by the plane table. Procedure: (1)As in the intersection method select a base line PQ on the ground. Measure it accurately with the steel tape and plot it to scale on the sheet as **pq** in suitable position. (2)Set up the table at P. Centre it so that **p** is vertically over P and level it. (3)Placing the alidade along **pq**. Orient the table by turning the board until the signal at Q is bisected, and then clamp it. (4)With the alidade touching **p**, sight the station **R** which is to be located by resection and draw a ray along the ruling edge of the alidade. Mark the point **r** along the ray by estimation. (5)Shift the table and set it up at **R** with **r** over **R**. Orient the table by taking a back sight on **P** and clamp it. (6) With the alidade centered on **q**, sight the station **Q** and draw a ray. The point of intersection of this ray and that previously drawn from **p** gives the required point **r**. (7)Continue the process to establish other station points. The method described above is called the **back ray method** as it is necessary to draw a ray from the preceding station to the station to be occupied by the instrument. This method requires the previous selection of the instrument station .It is a particular case of resection. Errors of centering though inevitable in this method will not affect the accuracy of work since resection is used for small scale work only. The other cases of resection are (1)The Two Point Problem, and (2)Three Point Problem.	**(1 Mark for diagram & 3 Marks for descriptio n.)**
Q.4	d)	**State the limitations of plane table surveying.**	**4M**

	ANS:	1) It is not suitable for work in wet climate 2) Several accessories are required to be carried hence possibility lost. 3) Replotting of survey work to different scale is difficult in absence of field notes. 4) It is heavy and difficult to carry. 5) It is not intended for accurate work. 6) The plane table is essentially a tropical instrument.	**(1 Mark for each)**
Q.4	(e) ANS:	**Describe in brief errors in plane table survey.** 1) The board not being horizontal. 2) The table not being accurately centered. 3) The table not being Correctly oriented. 4) The objects not being sited accurately. 5) The alidade not being correctly centered on the station point on the paper. 6) The rays not being accurately drawn through the station point. 7) Inaccuracy in plotting. 8) The expansion and contraction of the paper.	**4M** **(1 Mark for each)**
Q.4	(f) ANS:	**Enlist the advantages of Auto level.** Following are the advantages of auto level: 1) **Operational Comfort:** Use of Auto level is free of fatigue, does not cause strain on eyes, nerves etc. 2) **High precision :** Precision of auto level is about ± 0.5mm to 0.8 mm for one km 3) **High speed:** Time required for leveling is about half of that required with ordinary level. 4) **Freedom from errors:** Bubble usually remain in center and image of staff is erect, easy to read 5) **Freedom from external influences:** No influence of cloud, rain, magnetic field, vibrations, etc. on the levelling work with Auto level. 6) **Range of application:** Auto can be used for medium and large size project. To establish bench marks accurately.	**4M** (***Any four one mark each.)***
Q.5		**Attempt any FOUR of the following:**	**16 M**
	(a) Ans:	**Define bench mark and enlist the types of bench mark.** It is fixed reference point of known or assumed elevation. It is used either as a starting point for levelling or as a check while closing. • There are four kinds of bench marks. i. Great Trigonometrically Survey (G.T.S) bench mark. ii. Permanent bench mark. iii. Arbitrary bench mark. iv. Temporary bench mark.	**4M** **2M(def)** **2M (half mark for each type)**

Q.5 b) Differentiate between simple levelling and differential levelling with neat sketch. — **4M**

Ans:

(1 marks for each point any three point & 1 marks for diagram.)

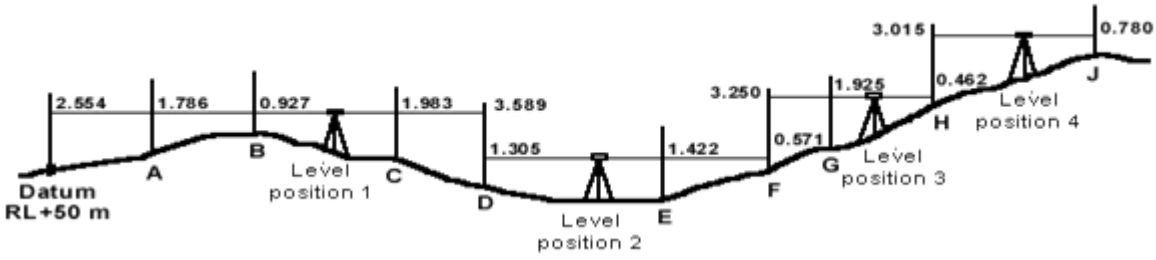
S.N	Simple Levelling	Differential levelling
1	Instrument is not shifted till the end of survey work.	Instrument is shifted as per requirements.
2	In this difference in elevation between two point is determined, when two points are visible from instrument, small distance apart.	In this difference in elevation between two point is determined, when two points are too far & staff reading is not possible.
3	Difference in elevation between two points is small & no obstacle between them.	Difference in elevation between two points is more or any obstacle between them.
4		

Q.5 c) Describe in brief profile levelling. — **4M**

Ans:

- The operation of taking levels along the center line of any alignment at regular interval is called longitudinal or profile levelling.
- 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 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.

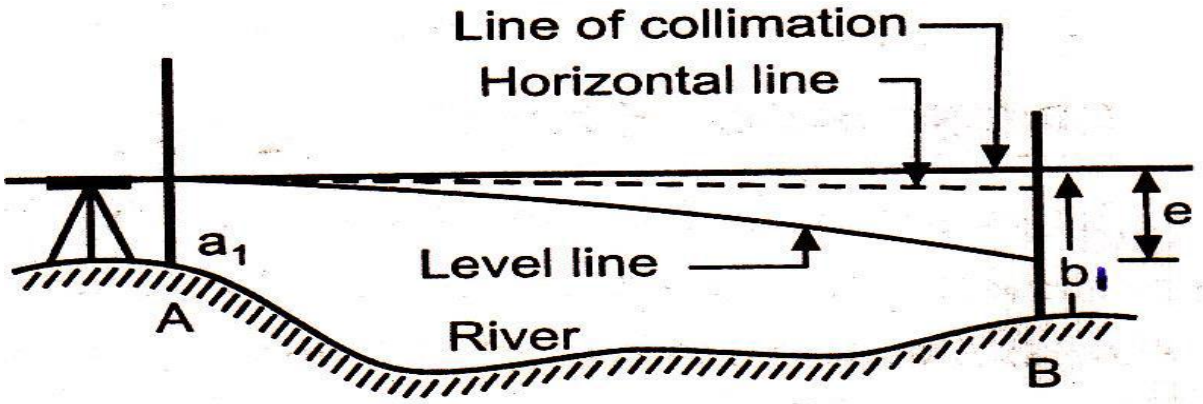
3M



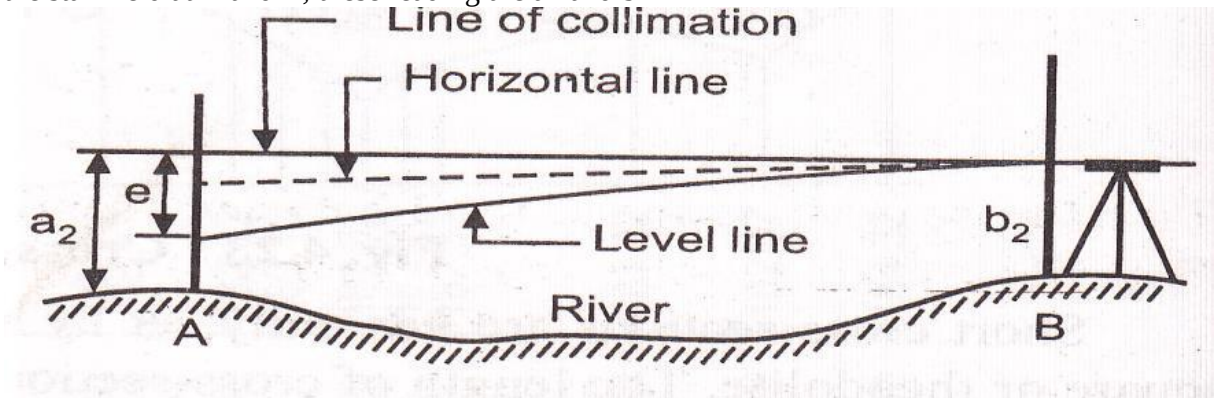
1M

Fig. Profile Levelling.

Q.5	d)	**Explain reciprocal levelling with neat sketch.**	**4M**
	Ans:	Reciprocal levelling is adopted i) To find the difference in level accurately Between the two points considerably apart. ii) When it is not possible to set up the level in between the two points due to river or pond etc. In this error due to curvature and refraction, collimation errors, error in instrument adjustment are eliminated. **Procedure:** Let A and B be the two points on opposite banks of the river. Let it is required to find out the level difference between A and B Step 1) Case I:Set up the level very near to A and with bubble in centre take the readings on the staff held at A and B Let these reading are a1and b1	**1M** **(Procedure 02 mark and sketch 01 mark)**



2) Case II: Shift the level and set up very near to B and with bubble in center take the readings on the staff held at A and B, these reading are a2 and b



3) Let d=true difference of level between A and B
Let e= Total error (error due to curvature and refraction , imperfect adjustment)
In Case I, The correct reading on B = b1-e
In case II , the correct reading on A = a2- e
From A, the true difference of level between A and B, d = (b1-e)-a1
Or d= (b1-a1)-e equation 1
From B, the true difference of level between A and B , d= b2-(a2-e)
= (b2-a2)+e equation 2
To eliminate total error e adding equation 1 and 2
2d= (b1-a1) –e + (b2- a2) +e
d = ((b1-a1) + (b2-a2))/2
The error is eliminated and the true difference is equal to the mean of the two apparent differences of level between A and B

Q.5 e) **Differentiate between plane of collimation and rise and fall method.** **4M**

Ans:

S.N	Rise and fall method	Plane of collimation
1	It is slow and more tedious.	It is more rapid and less tedious
2	It is laborious as it involves more calculations.	It is simple as it involves less calculation.
3	In this method there is complete check on all calculation work.	In this method there is no check on calculations of R.L. of intermediate sight and mistakes made remain unchecked.
4	In this method the mistake made in calculating the R.L. of any point will be carried forward.	In this method the error in calculating the R,L, of I.S. is not carried forward as the R,L, are calculated from the respective plane of collimation.
5	It is used in precise levelling work, check levelling calculations.	It is usually used in profile levelling calculation.
6	Arithmetical check Σ B.S.- Σ F.S= Σ Rise- Σ fall =Last RL-First RL	Arithmetical check Σ B.S.- Σ F.S=Last RL-First RL

(Any four points 1 mark each)

Q.5 f) **Describe in brief errors in levelling.** **4M**

Ans:

The sources of error in levelling are as below
1) Instrumental errors: Error due to imperfect adjustment, Sluggish bubble, Faulty Focusing tube, Erroneous leveling staff.
2) Personal errors: Errors of manipulation, Imperfect sighting ,Errors due to settlement of staff and level stand
3) Errors due to natural sources

1) Instrumental errors:

i) Error due to imperfect adjustment: Line of sight is inclined upward or downwards. Axis of the bubble tube not being perpendicular to the vertical axis, line of collimation not being parallel to the bubble axis. Instrument should be get tested and adjusted before use, equalize the fore sight and back sight distance to minimize this error.

ii) Sluggish bubble: when bubble is sluggish then it does not show correct horizontal Line of sight. To get good work replace it by good bubble tube.

iii) Faulty focusing tube : Due to this object does not move in horizontal plane during focusing

iv) Erroneous levelling staff: Division on the leveling staff are faulty. Replace it by correct staff.

2) Personal Errors:

i) Errors of manipulation: Careless levelling, Bubble not in center, Resting hands on tripod, Staff not being held exactly vertical.

ii) Imperfect sighting: Poor focusing, Parallax error not removed.

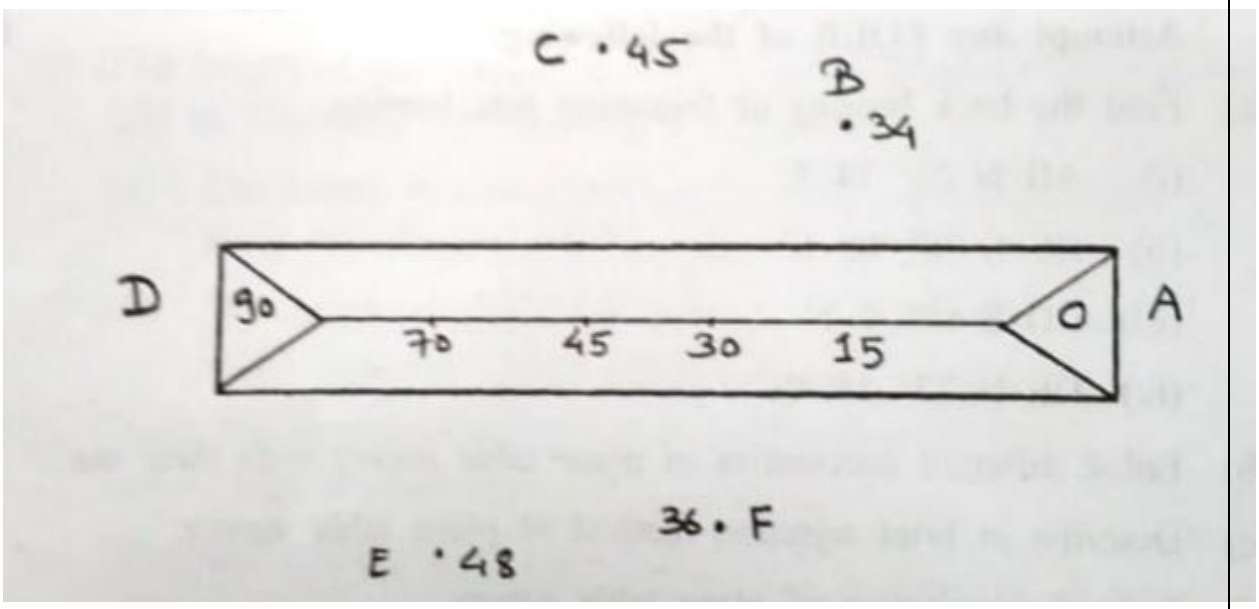
iii) Error due to settlement of staff and level: set up the instrument, and hold the staff on firm ground, proper selection of C.P. and instrument station location.

(four marks for any two type of errors)

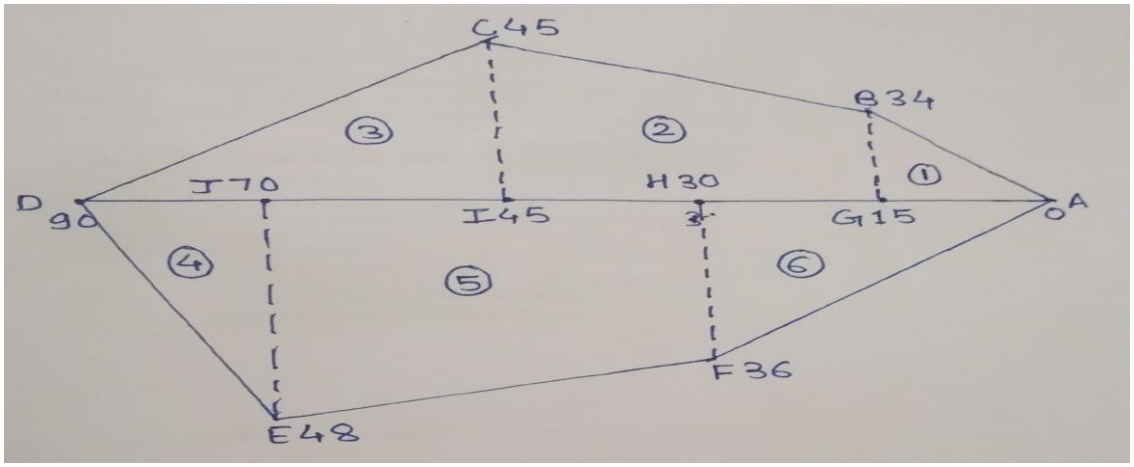
3) Errors due to natural causes:
i) Curvature of earth ii)Refraction iii)Effect of wind iv) effect of sun
In ordinary levelling the curvature and refraction error are not consider as they are very less 0.003m for 300m length. Use umbrella to shelter the instrument, use sun shade, avoid levelling work during wind.

Q.6 **Attempt any <u>TWO</u> of the following :** **16M**

a) **Plot the following cross staff survey of field and calculate area.** **8M**



Ans:



1 mark for diagram

Sr.No.	Fig.	Chainages (m)		Base (m)	Offsets		Mean offset (m)	Area (m^2) (Base x Mean offset)
		From	To		O_1	O_2		
1	△ ABG	0	15	15	0	34	17	255
2	⏢ GBCI	15	45	30	34	45	39.5	1185
3	△ CID	45	90	45	45	0	22.5	1012.5
4	△ DJE	90	70	20	0	48	24	480
5	⏢ EJHF	70	30	40	48	36	42	1680
6	△ FHA	30	0	30	36	0	18	540
							Total Area = 5152.5 m^2	

6M

(1M for each calculation)

1M(Total area)

Q.6 b) **The bearing observed in traversing with compass at a place where local attraction was suspected are given below :** **8M**

Line	FB	BB
AB	**S 45^0 30′ E**	**N 45^0 30′ W**
BC	**S 60^0 00′ E**	**N 60^0 40′ W**
CD	**N 30^0 20′ E**	**S 05^0 30′ W**
DA	**S 85^0 00′ W**	**N 83^0 30′ E**

at what station do you suspect local attraction? Find the corrected bearing of lines.

Ans:

The difference of fore bearing and back bearing of only line AB is Exactly 180° Hence station A & B are free from local attraction. At station C & D local attraction is suspected.

At the line AB, BB. of AB –FB. of AB = 314°30′ – 134°30′= 180°

Therefore A and B are free from local attraction.

Corrected FB of BC = 120°00′

Corrected Back bearing Of BC = Corrected FB of BC + 180°

= 120° 00′ + 180°= 300°00′

Correction at C =Corrected Back bearing of BC – Observed fore bearing of BC

= 300°00′- 299°20′= 0° 40′

4M

Corrected FB of CD = Obs. FB of CD + correction at C
= 30°20' + 0°40' = 31°00'
Corrected BB of CD = 31°00' + 180°= 211°00'
Correction at D =211°00' -185^0 30$'$ = +25^0 30$'$
Corrected BB of DC = 185^0 30$'$+25^0 30$'$= 211°00'
Corrected FB of DA = 265^0 00$'$ + 25^0 30$'$ =290^{0}30$'$

Correction at AD = Corrected FB of DA - 180^0
= 290^{0}30$'$ - 180^0 = 110^{0}30$'$

Line	Observed R.B	W.C.B	Correction	Correct-ed W.C.B	Corrected R.B	Remark
AB	S 45^0 30$'$ E	134^0 30$'$	0	134^0 30$'$	S 45^0 30$'$ E	
BA	N 45^0 30$'$ W	314^0 30$'$	0	314^0 30$'$	N 45^0 30$'$ W	
BC	S 60^0 00$'$ E	120^0 00$'$	0	120^0 00$'$	S 60^0 00$'$ E	
CB	N 60^0 40$'$ W	299^0 20$'$	+0^0 40$'$	300^0 00$'$	N 60^0 00$'$ W	**Stations C and D affected from local attraction.**
CD	N 30^0 20$'$ E	30^0 20$'$	+0^0 40$'$	31^0 00$'$	N 31^0 00$'$ E	
DC	S 05^0 30$'$ W	185^0 30$'$	+25^0 30$'$	211^{0}00'	S 31^0 00$'$ W	
DA	S 85^0 00$'$ W	265^0 00$'$	+25^0 30$'$	290^{0}30$'$	N 69^0 30$'$ W	
AD	**N 83^0 30$'$ E**	***110^{0}30$'$**	**0^0**	**110^{0}30$'$**	**S 69^0 30$'$ E**	

Note : * The actual value given in table is N 83^0 30$'$ E . Appropriate marks should be given if student have calculated up to this step.

Corrected FB and BB

LINE	FB	BB
AB	134^0 30$'$	314^0 30$'$
BC	120^0 00$'$	300^0 00$'$
CD	31^0 00$'$	211^{0}00'
DA	290^{0}30$'$	***110^{0}30$'$**

4M

Q.6 c)

The following is the page of level book where some reading were missing. Fill in the missing readings and calculate the reduced levels of all the points.

Station	BS	IS	FS	Rise (+)	Fall (-)	R.L	Remark

8 M

		1	**3.250**					**249.260**	**B.M**
		2	**1.755**	**1**	**?**		**0.750**		**C.P**
		3		**1.950**					
		4	**?**		**1.920**				**C.P**
		5		**2.340**		**1.500**			
		6		**?**		**1.000**			
		7	**1.850**		**2.185**				**C.P**
		8		**1.575**					
		9		**?**					
		10	**?**		**1.895**	**1.650**			**C.P**
		11			**1.350**	**0.750**			

Ans:

The fore sight of station No.2 is missing.
Difference of station 1 and 2.
station 2 is higher than station 2 by 0.750
Hence, missing reading at station = 3.250 + 0.750 **= 4.000**
R.L at station 2 = 249.260 – 0.750 = **248.51**
Fall at station 3 is missing. It is the difference of staff reading on station 2 and station 3
= 1.755 – 1.950 **= 0.195**
The rise of station 4 = 1.950 – 1.920 **= 0.030**
Similarly, the B.S reading of station 4 is found from the rise of station 5
= 2.340 + 1.500 = **3.840**
The RLs of station 1 to 5 can now be worked out as all the readings upto station 5 are available.
Hence missing IS of station 6 = 2.340 – 1.000 = **1.340**
Fall of station 7 = 1.340 – 2.185 = **0.845**
Rise at station 8 = 1.850 – 1.575 = **0.275**
The RLs of station 6 to 8 can now be worked out.
Hence IS at station 9 = 1.895 + 1.650 = **3.545**
Similarly, Fall at station 9 = 1.575 – 3.545 = **1.970** **1M**
B.S at station no. 10 = 1.350 + 0.750 = **2.100**
The RLs of station 9 to 11 can now be worked out similarly.
Thus, all the missing readings are worked out and RLs are calculated.
The results are entered in the following table –
The readings which were missing are bold :

Station	BS	IS	FS	Rise	Fall	R.L	Remark

				(+)	(-)		
1	3.250					249.260	B.M
2	1.755		**4.000**		0.750	**248.510**	C.P
3		1.950			**0.195**	**248.315**	
4	**3.840**		1.920	**0.030**		**248.345**	C.P
5		2.340		1.500		**249.845**	
6		**1.340**		1.000		**250.845**	
7	1.850		2.185		**0.845**	**250.000**	C.P
8		1.575		**0.275**		**250.275**	
9		**3.545**			**1.970**	**248.305**	
10	**2.100**		1.895	1.650		**249.955**	C.P
11			1.350	0.750		**250.705**	

6M

Arithmetic Check:

Σ BS – Σ FS = Σ Rise – Σ Fall = Last R.L. – First R.L.

Therefore, 12.795 – 11.350 = 5.205 – 3.760 = 250.705 – 249.260

1.445 = 1.445 = 1.445

OK

NOTE: **If students attempted to solve with assuming appropriate data in above table, give appropriate marks accordingly.** **1M**