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Model Solution : Summer 2015

SUMMER – 2015 EXAMINATION
MODEL ANSWER

Subject: Surveying   **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 the candidate and those in the 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 the model answer.
6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.
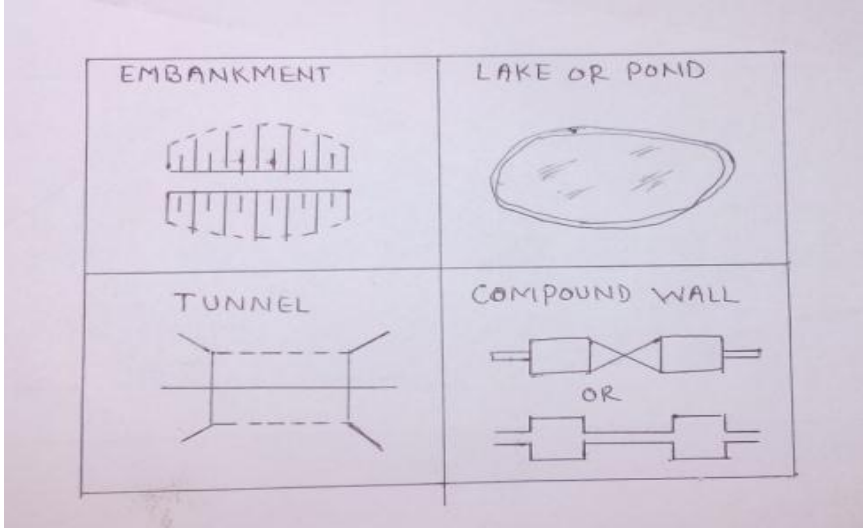7) For programming language papers, credit may be given to any other program based on equivalent concept.

Model Answer

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	**A)** **a)** **Ans :**	**Write four uses of surveying.** Uses of surveying are: 1) Surveying is useful to plot ground details in various maps like topographic and cadastral maps. 2) It is useful in navigational movement planning through military survey. 3) Surveying is also useful in almost all civil projects i.e. road, railway, dam, bridge and airport construction for longitudinal and transverse details. 4) It is highly needed in land cover and land use analysis through remote sensing techniques. 5) Surveying is a helping hand in tunnel excavation, underground piping and mining works. 6) It is truly beneficial in collecting details of water bodies on earth like lake, pond, river, sea etc.	½ mark each (any four)	**02**
	b) **Ans :**	**Differentiate primary classification of surveying with respect to extent of area and curvature of earth.**	**01 mark each**	**02**

Plane Surveying	Geodetic Surveying
1) The curvature of earth is not taken into account	1) The curvature of earth is taken into account.
2) Covered Area is less than 250 Sq.Km	2) Covered Area is more than 250 Sq.Km.

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	**c)** **Ans :**	**Define Ranging and Chaining.** **Ranging :** The operation of establishing intermediate points on a straight line between two survey stations, when distance between them is more than one chain length is known as ranging.	**01**	
		Chaining : The process of measuring distance of a line with the help of chain is called chaining.	**01**	**02**
	d) **Ans :**	**Define : i) Traversing ii) Magnetic Meridian** **i) Traversing :** Traversing is the series of survey lines connecting successive established traverse stations along the route of survey	**01**	
		ii) Magnetic Meridian : The direction indicated by freely suspended and properly balanced Magnetic needle unaffected by local attractive force is called magnetic meridian.	**01**	**02**
	e) **Ans :**	**Define local attraction. State two causes of local attraction.** **Local attraction**: It is the deviation or deflection of magnetic needle from its normal position under influence of external magnetic forces is called as local attraction.	**01**	
		Causes of local attraction : 1. Iron or steel structure 2. Electric cable line 3. High voltage current 4. Bunch of key 5. Steel Tape	**½ mark (any two)**	**02**
	f) **Ans :**	**State two principle of plane table survey.** Principle of plane table survey- 1. The rays drawn from different points should pass through a single point i.e. position of station point.	**01**	
		2. The position of table should be same as that of previous station i.e. orientation should be done at each changed station.	**01**	**02**
	g) **Ans :**	**Define horizontal line and vertical line.** **Horizontal line :** A straight line tangential to the level line and perpendicular to the plumb line is called horizontal line.	**01**	
		Vertical line : A line perpendicular to horizontal line and coinciding plumb line is known as vertical line	**01**	**02**

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	**h)** **Ans :**	**Define Change point and its necessity in leveling.** **Change point :** It is the point at which both backsight and foresight readings are taken before and after shifting the level instrument.	**01**	
		Necessity of change point in leveling : It is required to take change point when it is not possible to take all observations from single station due to large area, abrupt ground level variation and unavoidable obstruction.	**01**	**02**
	B) **a)**	**Draw Conventional symbol for** **i) Embankment ii) Pond or Lake** **iii) Tunnel iv) Compound Wall**		
	Ans :		**01 mark each**	
				04
	b)	**What are the objectives of following one each.** **i)Topographic Survey ii)Cadastral Survey** **iii)Engineering Survey iv)Mine Survey**		
	Ans :	i)**Topographic Survey** : To determine natural features like river, streams , lakes , hills etc and artificial features like roads , railways , canal , town and villages .		
		ii) **Cadastral Survey** : To fix property line , calculation of land area , and to transfer of land property from one owner to another.	**01 mark each**	
		iii) **Engineering Survey** :To collect of required data for planning , design and execution of engineering project such as design of road , bridges, dams and transmission line.		
		iv)**Mine Survey** :To explore mineral deposits and to guide tunneling and other operations associated with mining.		**04**

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	**c)**	**Explain in brief linear measurement using :** **i) Pacing ii) Digital Tape**		
	Ans :	**i) Pacing** : This method is used only for knowing approximate distance between the objects. In preliminary survey this method can be used for linear measurement. This method consists of counting the number of paces between the two points of a line. The length of the line can then be computed by knowing the average length of the pace. The length of the pace varies with individuals, and also with the nature of the ground and the speed of pacing.	**2**	
		ii) Digital Tape : Digital tape measured features a top mounted LCD screen i.e. display measurement digitally allowing for user to easily read the measurement.It is easily convert from metric to imperial with touch of button. Digital tape is light in weight and compact and measures accurate reading. The maximum measuring length of digital tape is 4.8m.	**2**	**04**
Q.2	**a)**	**Write the code of signals used in ranging with respect to :** i) **Correct position** ii) **Fix the ranging rod** iii) **Vertical position of ranging rod** iv) **Move slowly to left of observer**		
	Ans :	**i) Correct position :** Both hands above Head and then Brought Down **ii) Fix the ranging rod :** Both Arms extended forward horizontally and the hands depressed briskly **iii) Vertical position of ranging rod :** 1 Right arm Up and moved to the right.2. Left arm Up and moved to the Left **iv) Move slowly to left of observer :** Slow sweeps with Left Hand	**01 mark each**	**04**
	b) **Ans :**	**Explain with sketch method of stepping of chaining on sloping ground.** **Fig. : Method of stepping** 	**1**	

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.2	**b.**	**Procedure :** To measure the horizontal distance between points A & B on sloping ground following steps should be followed (Refer above figure.) 1. Starting from point A, the chain is unfolded and straightens by applying jerks up to maximum possible distance (say P1) without any sag in it. 2. Now suspend the plumb bob from point P1 vertically to touch the ground at point P2. 3. Measure the horizontal distance on straightened chain using tally, ring and links as d(AP1). 4. Now repeat and follow the same steps at point P2 and P4 to measure the horizontal distances d(P2P3) and d(P4P5) to reach at point B. 5. Finally calculate total chained distance as d(AB) = d(AP1) + d(P2P3) + d(P4P5)	**3**	**4**
	c.	**A 20m chain was found to be 6cm too long after chaining a distance of 1059m. It was found to be 9cm too short after chaining at the end 1985m. If the chain was correct before commencement of work find the true distance.**		

	Ans :	**Given :** Line ABC, AB=1059m, AC=1985m
		 L= 20m, No error at start, 0.06m too long at B,
		 0.09m too short
		 Find : True distance of AC = ?
		 Solution :
		 For part AB
		 L = Length of chain= 20 m
		 e = Average error in Chain = 0+0.06 /2 = 0.03m
		 L' = Incorrect length of chain = L + e = 20 + 0.03 = 20.03 m
		                             (since chain is too Long)
		 Measured Distance AB = 1059 m
		 True Distance = (L'/L) X Measured distance
		 True Distance AB = (20.03/20) X 1059 = **1060.59 m**
		
		 Similarly,
		 For part BC
		 L = Length of chain= 20 m
		 e = Average error in Chain = 0.06+0.09 /2 = 0.075m
		 L' = Incorrect length of chain = L + e = 20 - 0.075 = 19.925 m
		                           (since chain is too Long)
		 Measured Distance BC = 1985 – 1059 = 926m
		 True Distance = (L'/L) X Measured distance
		 True Distance AB = (19.925/20) X 926 = **922.52 m**
		
		 Total true distance of AC = True distance of (AB + BC)
		                         = 1060.59 m + 922.52 m
		                         = **1983.11 m**
			01 ½
			
			 01 ½
			
			 01
				04

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.2	**d.**	**Defines the terms : i) Survey Station ii) Survey Line iii)Offset iv)Triangulation**		
	Ans :	**i) Survey Station :** It is the point on ground from which various observations are taken around it.		
		ii) Survey Line : It is the straight line joining two successive survey stations is known as survey line.	**01 mark each**	
		iii) **Offset** : It is the lateral distance measured from the survey line to the object in right or left side is called as offset.		
		iv)**Triangulation** : The frame work consist of number of connected well conditional triangle is called Triangulation.		**04**
	e)	**i) State four instruments used for setting offsets.** **ii) State principle of optical square.**		
	Ans :	**i) Instruments used for setting offsets:** 1)Chain 2)Tape 3) Open & French Cross Staff 4) Circular & Indian Optical Square	**½ mark each**	
		ii) Principle of optical square: The angle between the first incident ray and the last reflected ray is twice to that of angle between two mirrors in optical square.	**02**	**04**
	f)	**Draw sketch and write the procedure for setting offset to the left or right side of suvey line with open cross-staff.**		
	Ans :	**Procedure for setting offset with open cross staff :** 	**01**	
		1. Keep the ranging rods at point P(fixed on survey line) and at point A1 approximately. **2.** The cross staff with stadia rod is fixed at point B. **3.** Now two surveyors will observe both rods at A1 and P simultaneously. **4.** If both rods are not bisecting at a time, then rod at A1 should move towards right parallel to survey line (towards left if rod is at A2) as shown in above fig.	**03**	
		5. Once both rods are bisected simultaneously then point A can be fixed and perpendicular offset AB is said to be set to given survey line PQ in left side.		**04**

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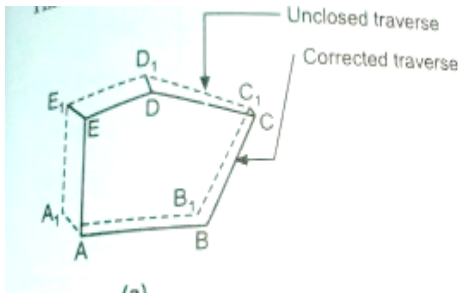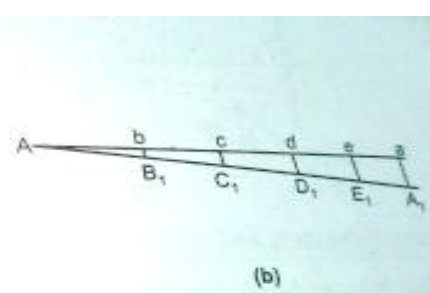
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.3	**a)**	**i) Write three types of obstacles in chaining with examples.**		
	Ans :	1. Obstacle which can be chained across but cannot be ranged across. , *Examples:* Hill Intervening , rising ground.	**01 mark each**	
		2. Obstacle which can be ranged but cannot be chained across., *Example:* River, pond etc.	**(any two)**	
		3. Obstacle which can be neither be ranged across not be chained across, *Example:* Building obstruction		**02**
		ii) Draw sketches (two), how to overcome pond across the chain line		
			01 mark each **(any two)**	
				02
	b)	**i)Define Dip and deflection of needle.**		
	Ans :	**Dip of the magnetic needle:** It is the upward or downward movement of magnetic needle in vertical plane due to earth's gravitational force is known as dip of needle.	**01**	
		Deflection of needle : It is the shifting or deviation of magnetic north from true north direction towards east or west direction, that horizontal angle between magnetic and true north is said to be declination of needle.	**01**	
		ii)Find the magnetic declination if the magnetic bearing of the sun at noon is $355^0 30'$.		
	Ans :	The true bearing at noon is will be 360^0		
		As,True Bearing = Magneic Bearing +_ Declination		
		Declination = TB – MB = $360^0 – 355^0 30' = 4^0 30'$ (East)	**01**	
		The declination will be towards East, because MB observed is lesser than TB	**01**	**04**
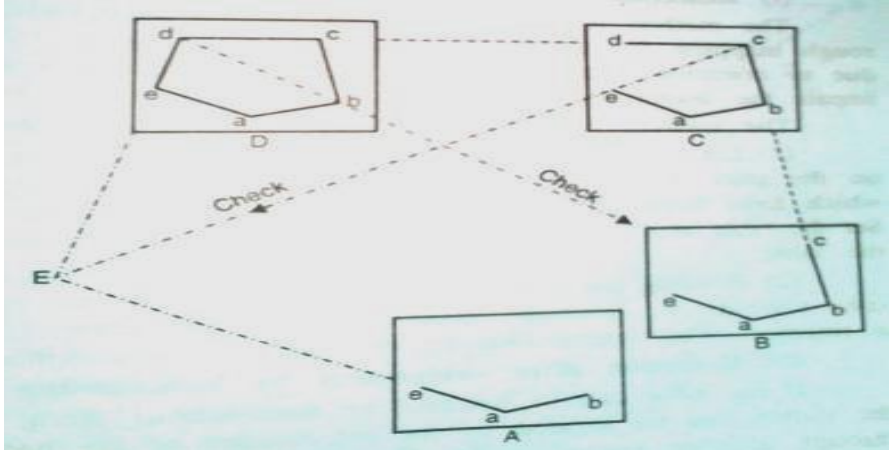
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.3	**c)**	**Write the functions of the following components of prismatic compass i) Prism, ii) Lifting pin, iii) Prism cap, iv) Agate cap**		
	Ans :	**i) Prism:** Reading printed on horizontal face of compass ring can be read from vertical position		
		ii) Lifting pin: When the instrument not in use the sight vane passes against the lifting pin which lift the needle off the pivot and holds it against a glass lid ; thus it prevents the undue wear of pivot point	**01 mark each**	
		iii) Prism cap: Provided at the bottom of prism, closes window of prism when not in use		
		iv) Agate cap: A small piece of hard glass provided on top of pivoted point, to reduce wear and tear of the point		**04**
	d)	**Define the terms i) Fore Bearing, ii) Open traverse, iii) Closing error, iv) Reduced bearing**		
	Ans :	**i) Fore bearing :** The bearing observed in the direction of progress of survey in clockwise manner is called fore bearing		
		ii) Open traverse : When the first and last survey lines does not meets at common point and hence does not form a closed polygon, then it is said to be open traverse	**01 mark each**	
		iii) Closing error : While plotting compass traverse, when first and last survey line does not coincides by some amount of distance, that distance is called as closing error.		
		iv) Reduce bearing : The bearing measures with respective to either north or south direction in clockwise or anticlockwise manner is known as reduced or quadrantal bearing.		**04**
	e) **Ans:**	**i) State temporary adjustments of prismatic compass**		
		a) Setting the prismatic compass over prefixed survey station		
		b) Centering the compass over nail point of station using plumb bob		
		c) Leveling of compass in horizontal plane using level tube	**½ mark each**	
		d) Focusing of prism by raising and lowering the focussing stud		
		ii) Why zero is marked at south end on a graduated circle of prismatic compass?		
	Ans:	As bearing of any line is measured with respective north direction, while observing north direction, reading should be $0^0 0'$. Therefore when object vane is bisecting north direction, at the same time zero marked at south end gets reflected through prism. Thus to get bearings with respective north direction always, zero is marked at south end of magnetic needle.	**02**	**04**

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.3	**f)**	**Draw and explain graphical adjustment of closing error in compass traverse survey.**		
	Ans :	**Compass Traverse** **Bowditch Rule**	1	
		Explanation : 1. To distribute the closing error AA_1 (Fig. a), draw one horizontal line of length equal to perimeter of traverse with some reduced scale. 2. Now mark the survey stations on it proportionally (Fig. b) and transfer closing error of same length using roller scale to point a. 3. Join the point A and A_1 with straight line. Also draw parallel lines at point b,c.d and e. 4. Transfer B_1b, C_1c, D_1d and E_1e to point B_1, C_1, D_1 and E_1 respectively in compass traverse. 5. Finally join new points to get corrected traverse ABCDEA after graphical adjustment of closing error.	3	4
Q.4	**a)**	**i) Correct the following bearings.** **Reduced bearing S $65^0$15' W and Whole circle bearing 372^0**		
	Ans :	Corrected RB = **S $65^0$15' W** Corrected WCB = 372^0-360^0 = **12^0**	1 1	
		ii) Convert the following bearings. **RB to WCB = N $30^0$15' W** **WCB to RB = $119^0$45'**		
	Ans :	WCB = 360^0- $30^0$15'= **$329^0$45'** RB = 180^0 - $119^0$45' = **S 60^0 15' E**	1 1	4

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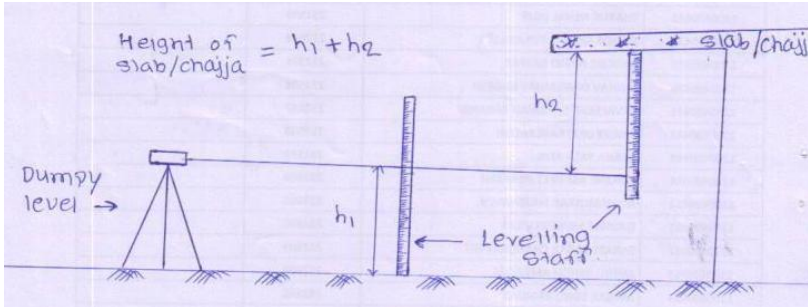
Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.4	**b)**	**Define orientation. State two methods of orientation. Which method is most accurate and why?**		
	Ans :	**Orientation** is the process of keeping plane table in same position as that is occupied in previous station.	**01**	
		Methods of orientation:		
		i) Magnetic meridian method using trough compass		
		ii) Back sighting method using alidade	**01**	
		Out of two, the most accurate method is orientation by back sighting.	**01**	
		Because in this method orientation is done by using alidade and not by using trough compass. Therefore there is no error occurring due to local attraction.	**01**	**04**
	c)	**Draw sketch and explain method of traversing of plane table surveying.**		
	Ans :	**Procedure:**		
		1.Set plane table over station A use plumbing fork for transferring station point from ground on sheet. Draw the direction of magnetic meridian with the help of compass.
2. With the alidade pivoted about 'a' sight it to B and draw a ray. Measure AB and scale off 'ab' to some scale similarly draw a ray towards E measure AE and plot 'e'
3.Shift the table to B and set it. Orient the table accurately by back sighing A. clamp the table
4.Pivoting the alidade about 'b',sight to C. measure BC and plot it on the drawn ray to the same scale Similarly, the table can be set at other successive station and traverse is completed.	**03**	
Traversing method | **01** | **04** |

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.4	**d)**	**Write any four advantages of intersection method of plane tabling over radiation method of plane tabling.**		
	Ans :	**Advantages of intersection method:**		
		1. Interection method requires less ground distance measurement than radiation method.	**01 mark each**	
		2. By this method we can locate inaccessible points which cannot be located by radiation method i.e. from single station.		
		3. As objects can be located by intersection of lines, this method is more accurate in positioning and verifying the objects than radiation method.		
		4. As compared to radiation method, intersection method eliminates undulation error, bisection error and plotting errors.		**4**
	e)	**i) State two advantages of telescopic alidade over simple alidade.**		
	Ans :	**Advantages of telescopic alidade :** i) Telescopic alidade is more accurate in bisection than simple alidade	**01 mark each**	
		ii) Telescopic alidade is useful in comparatively longer range objects.	**(Any two)**	
		iii) It can be easily bisect the objects at higher elevation or depressions which is not possible by simple alidade.		
		iv) It gives quicker bisection which saves time ultimately.		
		ii)State advantages of plane table survey one each with respect to booking and suitability **Booking of observations:** i) Field work and plotting work done simultaneously	**01 mark each (Any one)**	
	Ans :	ii)) Notes of measurement are seldom required and possibility of mistakes in booking is eliminated.		
		Suitability of PT Survey: i) Plane table is suitable for small scale map and work where great accuracy is not required.	**01 mark each (Any one)**	
		ii) Mostly suitable for survey in plain terrain		**4**

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.4	**f)**	**State fundamental lines and their relationships with each other of dumpy level.**		
	Ans :	**Fundamental axes of dumpy level :** i) The vertical axis ii) The axis of bubble tube iii) The line of collimation iv) The axis of the telescope	**2**	
		Relations of Fundamental axes : i) The axis of the level tube should be perpendicular to the vertical axis. ii) The line of collimation should be parallel to the axis of the bubble tube. iii) Axis of telescope and line of collimation should coincide.	**2**	**4**
Q.5	**a)**	**i) Explain temporary adjustment. (only leveling with help of foot screws)**		
	Ans :	1) Place the telescope parallel to foot screw (fig. a) 2) Bring the bubble at Centre by moving foot screw inward or outward simultaneously. 3) Then turn the telescope through 90^0 so that it lies on third foot screw (fig. b) 4) Then turn this foot screw until bubble is centered 5) Now rotate the instrument through 360^0 and check the position of bubble and repeat the procedure till in both positions, bubble will remain at center. 6) Once both positions give centered bubble, leveling of instrument is said to be completed.	**1**	
			1	
				02

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.5		**ii) Write two advantages of Auto level over dumpy level**.		
		1) Auto level gives quick and easy leveling with less efforts than dumpy level.		
		2) It is most accurate and precise which gives least error about 0.5 to 0.8 in 5km.	**01 mark each (any two)**	
		3) It is simply to use, compact in nature and easy to handle than dumpy level		
		4) Auto level telescope facilitates normal readings to read; which reflects inverted in some dumpy level.		**02**
	b)	**Draw a sketch and explain how to find height of chajja or slab using dumpy level.**		
	Ans :		**01**	
		Explanation :		
		1. First the back sight reading is taken on floor level whose RL is known to us; from which RL of instrument axis can be find out by adding RL of BM and BS reading.		
		2. Now the inverted staff is kept touching to bottom of slab and from same instrument station the reading is taken on it.	**03**	
		3. Then RL of chajja is calculated by adding RL of instrument axis to inverted staff reading.		
		4. Finally height of chajja is calculated as RL of slab bottom – RL of floor top.		**04**
	c)	**State the purposes of following methods of leveling.** **i)Profile leveling, ii)Fly leveling, iii)Check leveling iv)Reciprocal leveling**		
	Ans :	**1. Profile leveling-** To determine the undulation of ground surface along given line for alignment of road, canal or pipe, railway line		
		2. Fly leveling-It is used to for connecting B.M. to the starting point and to establish the B.M.	**01 mark each**	**04**
		3. Check leveling-It is used to check the accuracy of the leveling work		
		4. Reciprocal leveling- It is used to find the difference in leveling between two points two point obstructed due to river or pond.		

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.5	**d)**	**State the important points kept in mind while recording the staff readings in level pages with respect first reading, intermediate reading, last reading, change point, carry forward from one page to next page-Remark**		
	Ans :	1) First reading is on bench mark point and should be noted in back sight(BS) column 2) Intermediate reading (IS) should be taken on the points between first and last station. 3) Last reading should be noted in Fore sight(FS) column. 4) Both reading BS and FS reading should be entered in same row and can be denoted by change point 5) On each page last reading should be enter in FS column and same should be carried forward in BS column of next page 6) Remark column should have denote First and Last RL along with change points.	**1 mark each** **(any four)**	**04**
	e) **Ans :**	**Write errors in leveling and corresponding precaution** **i) Instrument error with respect to bubble tube, leveling staff.** 1.If bubble tube is sluggish it may apparently be in the center though the bubble line is not horizontal. **Precaution** – Sluggish bubble tube should be replaced by good one. **2.**Erroneous divisions of the leveling staff will cause some error. **Precaution**-Replace the leveling staff by standard leveling staff	**1** **1**	
		ii) Manipulation error respect to parallax, leveling of instrument 1. Poor object image is appearing due to reading taken without removing parallax. **Precaution** - Focussing of object glass and eye piece should be properly done. 2.Improper leveling of instrument causes serious error of incorrect reading. **Precaution**- Leveling should be properly done by bringing the bubble of bubble tube at Centre.	**1** **1**	**04**
	f)	**Distinguish between HI method and Rise-Fall method with respect to time, checks,application and simplicity.**		

	Ans :	Sr. No.	Points	H.I method	Rise & Fall method		
		1	Time	The method is more rapid & require less time	The method is tedious & require more time	**1mark each** **(any four)**	
		2	Check	ΣB.S.-F.S=Last RL-first RL	ΣB.S.-ΣF.S= Last RL-first RL =ΣRise - ΣFall		
		3	Application	It is used for calculating RL of Profile leveling & in construction work Like canal, roads etc.	It is used for calculating RL of Precise leveling work & check leveling		
		4	Simplicity	It is simple & requires less calculation.	It is complicated require more calculations.		**04**

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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks s
Q.6	**a)**	**Draw and calculate the area of plot ABCDEFA in m^2, and, hectares, from given following data:**		

Offset pt.	A	B	C	D	E	F	A
Chainage(m)	12	35	57	88	72	57	12
Offset length	0	50(L)	00	18(R)	18(R)	60(R)	00

Ans :

Cross staff Traverse

Sr. No.	Fig.	Chainage	Base	Offset	Mean Offset	Area (Mean Offset X Base)
1	Δ ABP	12-35	23	0&50	25	575
2	Δ DPC	35-57	22	0%50	25	550
3	□ QEFC	57-72	15	18&60	39	585
4	Δ ACF	12-57	45	0&60	30	1350
5	□ RDEQ	72-88	16	18&78	18	288
6	Δ RCD	57-88	31	0&18	9	-279
	3069/10000= 0.307 hect.					**3069 m^2**

04

04

08

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.6	**b.**	**i) Following are the FB and BB of the a closed traverse ABCDA. Detect the station affected by local attraction. Calculated corrected bearings. Show sample calculation.**		

Ans :

Line	FB	BB
AB	S 45^0 $30^'$ E	S 45^0 $30^'$ E
BC	N 60^0 0'E	N 60^0 $40^'$ E
CD	N 5^0 $30^'$ W	N 5^0 $30^'$ W
DA	S 55^0 $30^'$ W	S 55^0 $30^'$ W

Line	FB	BB	Diff.	Corrected FB	Corrected BB	Remark
AB	134^0 $30^'$	314^0 $10^'$	180^0	134^0 $30^'$	314^0 $10^'$	All stations are free from Local attraction.
BC	60^0 $00^'$	240^0 $40^'$	180^0 $40^'$	60^0 $00^'$	240^0 $00^'$	
CD	354^0 $30^'$	174^0 $30^'$	180^0	354^0 $30^'$	174^0 $30^'$	
DA	235^0 $30^'$	55^0 $30^'$	180^0	235^0 $30^'$	55^0 $30^'$	

Marks: **3**

As there is no station affected by Local attraction, there is no error at all in observed bearings.

But there is an error of $40^'$ in BB of BC, which may be natural error or personal error OR Values given in problem are already corrected.

Therefore to calculate BB of BC = FB of BC + 180^0
$$= 60^0 \ 00^' + 180^0$$
$$= 240^0 \ 00^'$$

Marks: **1**

Total Marks: **4**

ii) The following bearing were taken in traversing with a prismatic compass, calculate back bearing and interior angles in closed traverse PQRS. Apply usual check.

Line	FB
PQ	124^0 $30^'$
QR	68^0 $15^'$
RS	310^0 $30^'$
SP	200^0 $15^'$

Ans ;

∟P = 124^0 $30^'$ – 20^0 $15^'$ = 104^0 $15^'$

∟Q = (360^0 – 304^0 $30^'$) + 68^0 $15^'$ = 123^0 $45^'$

∟R = 310^0 $30^'$ – 248^0 $15^'$ = 62^0 $15^'$

∟S = 200^0 $15^'$ - 130^0 $30^'$ = 69^0 $45^'$

Marks: **1 mark each**

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.6				

Line	F.B.	B.B.	Calculation
PQ	$124^0\ 30^,$	$304^0\ 30^,$	Angle (P)=$104^0\ 15^,$
QR	$68^0\ 15^,$	$248^0\ 15^,$	Angle (Q)=$123^0\ 45^,$
RS	$310^0\ 30^,$	$130^0\ 30^,$	Angle (R)=$62^0\ 15^,$
SP	$200^0\ 15^,$	$20^0\ 15^,$	Angle (S)=$69^0\ 45^,$

P + Q + R + S = 104^0 15' +123^0 45' + 62^0 15' + 69^0 45' =360'

04 (Total Marks column)

c) **i)The following page of odd level book having few staff readings missing. Find out the missing reading and rewrite the page. Apply usual check**

Ans :

Staff Station	Staff reading			Rise	Fall	R.L.(M)	Remark
	BS	IS	FS				
1	**2.15**					450	B.M.
2		1.65		0.5		**450.50**	
3	**2.225**		1.965		**0.315**	**450.185**	C.P
4			1.825	**0.4**		450.585	Last Reading

Marks column:
01 mark for table

2 marks for calculations

1 mark for check

X − 1.65 = 0.5   **X= 450 + 0.5**

X = 2.15   **= 450.50**

Check, Σ B.S. − Σ F.S. = Σ Rise − Σ Fall = Last RL − First RL

          0.585   =   0.585   =   0.585

04 (Total Marks column)

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.6	**c.**	**ii)The followings reading were taken with a dumpy level and 4 m staff over downward slope of hill 0.570(First point) 1.925, 3.78, 0.430 , 3.250(Last point). The RL of first staff station is 245.500m. Prepare the level page ,enter all the staff readings and calculate RL by HI method. The staff interval is 20 m between two consecutive staff. Find gradient in percentage of a line joining first and last point, Apply usual checks.**		
	Ans :			

Staff Station	Staff reading			HI	RL	Remark	Distance
	BS	IS	FS				
1	0.570			246.07	245.50	BM	0
2		1.925			244.145		20
3	0.430		3.780	242.72	242.29	CP1	40
4			3.250		239.47	Last Reading	60

Marks: **2**

Check,   Σ B.S. – Σ F.S. = Last RL – First RL

**   6.03   =   6.03**

Gradient of Line = (Last RL-First RL)/Distance

                    =6.03/60

                    =1 / 9.95   (Approx. 1 in 10)

Marks: **1**

Marks: **1**

Total Marks: **4**