

MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION

(Autonomous) (ISO/IEC - 27001 - 2005 Certified)

Model Answer: Summer 2016

Page No: 01/21

Subject & Code: Surveying (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.

Que. No.	Sub. Que.	N	Model Answers	Marks	Total Marks
Q.1	(a) 1)	positions of ground point angular measurement. Objectives: 1. To determine the relative ground 2. To layout our marked ground 3. To determine areas, volumes		1 1/2 mark Each (Any two)	12
	2)	and rivers. Draw conventional symbol Ans- 1. Cutting CUTTING	2. Embankment 2. Embankment EMBANKMENT	1 mark Each	2



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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	3)	State the use of following- 1. Arrow 2. Wooden peg Ans- 1. Arrow Arrows are used for counting the number of chains while measuring a chain line. 2. Wooden peg Pegs are used for fixing the instrument station on the ground permanent marking	1	2
	4)	Define - 1. Base line 2. Check line Ans- 1. Base line- The line on which the framework of the survey is built is known as Base line.	1	
		OR The longest of the main survey line is consider as Base line. 2. Check line The line joining the apex point of triangle to some fixed point on its base is known as the Check line	1	2
	5)	What is mean by perpendicular and oblique offset? Ans- Perpendicular offset- When the offset is taken at 90° or right angle to the survey line, then it is known as perpendicular offset.	1	
		Oblique offset - When the offset is taken at an angle other than 90° to the survey line, then it is known as Oblique offset.	1	2
	6)	State principle of plane table survey. Ans- Principle of plane table survey- 1. The rays drawn from different points should pass through a single point i.e. position of station point. 2. The position of table should be same as that of previous station i.e. orientation should be done at each changed station.	1 marks each	2
	7)	 Define True Meridian and Magnetic Meridian. Ans- 1. True Meridian: The line or plane passing through the geographical north pole, geographical south pole and any point on the surface of the earth is known as True Meridian. 	1	
		2. Magnetic Meridian: The direction indicated by freely suspended and properly balanced Magnetic needle unaffected by local attractive force is called magnetic meridian.	1	2



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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.1	8)	Define- 1. Datum 2. Change point Ans- 1. Datum- It is the imaginary level surface or level line from which the vertical distance of different points are measured.	1	
		2. Change point- It is the point at which both back sight and foresight readings are taken before and after shifting the level instrument.	1	2
	(B) 1)	Attempt any TWO of the following: State & explain principle of survey. Ans- Principle of surveys are as follows -		8
		1.To work from the whole to the part According to the first principle, the whole area is first enclosed by main stations and main survey lines. The area is then divided into a number of parts by forming well conditioned triangles. A nearly equilateral triangle is considered to be the best well conditioned triangle. The main survey lines are measured very accurately with a standard chain. The sides of triangles are measured. The purpose of this process of working is to prevent accumulation of error.	2	
		2.To locate a new station by at least two measurement. The new stations should always be fixed by at least two measurement from fixed reference points. Linear measurements refer to horizontal distance measured by chain or tape. Angular measurements refer to the magnetic bearing or horizontal angle taken by a prismatic compass or theodolite.	2	4
	2)	A line was measured by a 20 m chain which was accurate before starting the day's work. After chaining 900m, the chain was found to be 6cm too long. After chaining 1575m the chain was found to be 14cm too long. Find the true distance of the line. Ans-Given data Standard length of chain= $L=20m$, Measured length of chain (AB) = $ML=900$ m, Error at $B=0.06m$ long Measured length of chain (AC)= $ML=1575$ m, Error at $C=0.14m$ long To find- True length AC For 900 m distance (AB) Incorrect length = $20+((0+0.06)/2)=20.03$ m $TL(AB)=(L^1/L)$ X ML (AB) $TL(AB)=(20.03/20)$ X 900	1	
		TL(AB) = (20.03/20) A 900 TL(AB) = 901.35 m	1	



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Que. No.	Sub. Que.		Model A	nswers	Marks	Total Marks
Q.1	2)	Measured Incorrect Incorre	m Distance (BC) Distance(BC) = 675 m length = 20+ ((0.06+0.14)/ ((L¹/L) X ML (BC)) = (20.1/20) X 675 = 678.375m th (AC) = TL(AB) + TL(B) th (AC) = 901.35+678.375 gth (AC) = 1579.725 m four codes of signals in r	(C)	1	4
		Sr No.	Signal given by surveyor	Meaning of signal for the assistant		
		1	Rapid sweep with Right hand	move considerably to your left		
		2	Slow sweep with Right hand	move slowly to your left		
		3	Right arm extended	continue to move to your left		
		4	Right arm up & moved to the right	plumb the rod to your left	1 mark	
		5	Rapid sweep with Left hand	move considerably to your right	each (any	
		6	Slow sweep with Left hand	move slowly to your right	Four)	
		7	Left arm extended	continue to move to your right		
		8	Right arm up & moved to the Left	plumb the rod to your right		
		9	Both hand above head &then brought down	Ranging is correct		
		10	Both arm extended forward horizontally &hands brought down quickly	Fix the ranging rod		4



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Que. No.	Sub. Que.	Model Answers	Marks	Total Mark
Q.2	1)	Attempt any <u>FOUR</u> of the following: Explain in detail classification of survey.		16
		 Ans- A. primary classification- 1. Plane surveying: In this survey curvature of the earth is not taken in to consideration. 2. Geodetic surveying: In this survey curvature of the earth is taken in to consideration. 	1	
		B. Secondary surveying 1. Based on instrument: 1. Chain surveying 2. Compass surveying 3. Plane table surveying 4. The dolite surveying 5. Tacheometric surveying 6. Photographic surveying	1	
		2. Based on object: 1.Geological surveying 2.Mine surveying 3.Archaeological surveying 4.Military surveying	1	
		3. Based on nature of field: 1.Land surveying 2.Marine surveying 3.Astronomical surveying	1	4
	2)	Draw a neat labeled sketch of 30m chain. Ans-		
		Groove ring Brass Quevery Talley's 1m Quevery 5m	3 mark for sketch & 1 mark for lebelli ng	

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Que.	Sub.	Model Answers	Marks	Total
No.	Que.		IVIAINS	Marks
Q.2	3)	Explain principle, construction, use of optical square. Ans- Principle: The angle between the first incident ray and the last reflected ray is twice the angle between the mirrors. In this case, the angle between the mirrors is fixed at 45°.so the angle between the horizon sight and index sight will be 90°.	1	
		Working of optical square-		
		B G(b) Fig. 6: Optical square and its working	1	
		 Optical square works on principle of optical square to set perpendicular offset Keep ranging rods at point B and C as shown in fig. Observe the both rods through eye vane of optical square ass in figure 6(b) i.e. one direct image and other reflected image. Now, move the along survey line AB with looking through optical square, till both rods coincided as in figure6(c) Once, both rods matched each other point D can be marked on ground and distance CD is measured as perpendicular offset. Use: 	1	
	4)	It is used for setting out right angles. Convert following bearing to another bearing system. 1) N28°33'E 2) S41°5'E 3) 240°13' 0'' 4) 270°0'	1	4
		Ans- 1) N28°33'E WCB = RB WCB = 28°33'	1	
		2) S41°5'E WCB = 180°- RB WCB = 180° - 41°5' WCB = 138°55'	1	
		3) 240°13' 0'' RB =WCB -180° RB = 240°13' - 180° RB=\$60°13'W	1	



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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.2	4)	4) 270°0' RB = WCB - 180° RB = 270° - 180° RB = S90°W or N90°W	1	
	5)	What is meant by orientation in plane table survey? State its method and explain any one. Ans-		4
		Orientation is the process of keeping plane table in same position as that is occupied in previous station.	1	
		Methods of orientation: i) Magnetic meridian method using trough compass ii) Back sighting method using alidade	1	
		Backsight method of orientation- 1. Assume we have to orient the table at next station 'B' represented on paper by point 'b'.		
		 2.the line 'ba' is drawn on previous station 'A'. 3.the alidade is kept on line 'ba' and the table is turned around its vertical axis such a way that line of sight passes through ground station 'A'. 4. When the plotted line 'ab' coincides with line 'AB' and table will be oriented. 	2	
		OR		
		Magnetic meridian method of orientation- 1. The trough compass is placed on the top right corner of the plane table such a way that magnetic needle point exactly towards the N-S direction 2. Draw these line along the edge of compass. 3. Shift & set up the plane table on next station. 4. place the trough compass along the N-S line. Rotate the table till the magnetic needle coincides the N-S line drawn previously	2	4
	6)	Explain temporary adjustments of Dumpy Level.		-
		 Ans- 1. Setting up the level. a. The level fixed on tripod. b. The legs of tripod stand are well spread so that the level will remain stable on tripod. c. Bring all the three foot screws in the Centre of their run so that they can be turned clockwise or anticlockwise as required, for levelling purpose d. Adjust the height of the instrument so that the observer can comfortably see through the telescope and note the readings. e. Fix two legs of tripod and adjust third leg in such a way that the levelling head will become as horizontal as possible by eye judgment. 	1	



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Que.	Sub.	Model Answers	Marks	Total
No.	Que.		TTUINS	Marks
Q.2	6)	 a. The base of the tripod is already leveled with the help of cross bubble. b. To make accurate adjustment of the level, the longitudinal level is adjusted in the Centre of its run, with the help of three foot screws. c. Make the bubble parallel to the any selected pair of foot screws. Now; turn both the foot screws either inward or outward with the help of foot screws till the bubble appears in the center. d. Turn the telescope through 900 as shown in fig. below and now with the help of third screw bring the bubble of levelling tube in the center. 	1	
		 3. Focusing the Eye piece. a. Hold a sheet of white paper in front of the objective glass 4 to 6 cm away from objective glass and see through the eye piece. b. Turn the eye piece inwards od outwards in the socket so that the cross hair on the diaphragm appears sharp and clear. 4. Focusing the Object glass. 	1	
		a. Direct the telescope towards any object, say a levelling staff in the field which is kept at a distance. See through eyepiece whether the staff is visible, distinct or not.b. If not, then turn the focusing screw till the image is distinct and clear. The cross hair on the diaphragm should also be seen clearly.	1	4
Q.3	1)	Attempt any Four of the following Explain chaining on sloping ground. Ans.		16
		Fig. 5: Stepping method	1	
		 Procedure- If A and B are the two points on sloping ground, for which horizontal distance is to be measured. Unfold the chain. By touching handle to station A, stretch it up to maximum possible distance (without sag). Suspend the plumb-bob from that stretched point and mark the point C on ground. Now measure the distance I I on chain by counting brass rings. 	3	
		 4. Now measure the distance L1 on chain by counting brass rings, brass talleys and links accurately. 5. Now, from point C, repeat steps 2,3and 4 up to station B and note down corresponding horizontal distances L2, L3 etc. 6. Thus total horizontal distance on sloping ground is calculated as d(AB) = L1+L2+L3 in meters 		4



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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.3	2)	What is meant by well conditioned and ill conditioned triangles? Draw the fig. Ans. well conditioned triangles:		16
		60° 40° 80°	1	
		A triangle in which no angle is less than 30° or greater than 120° is said to be well conditioned triangles.	1	
		Ill conditioned triangles;	1	
	3)	A triangle in which an angle is less than 30° or more than 120° is said to be ill conditioned triangles Define- 1. Whole circle bearing 3. Fore bearing 4. Back bearing Ans.	1	4
		1.Whole circle bearing- The bearing measures only in the clockwise direction from meridian or north direction is known as whole circle bearing.	1	
		2.Reduced bearing The bearing measures with respective to either north or south direction in clockwise or anticlockwise manner is known as reduced or quadrantal bearing 3. Fore bearing	1	
		The bearing observed in the direction of progress of survey in clockwise manner is called fore bearing 4. Back bearing	1	
		The bearing observed in the direction of opposite of survey is called fore bearing.	1	4



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Que. No.	Sub. Que.			Mod	el Answers		Marks	Total Marks
Q.3	4)			the bearings of		sed traverse ABC	CD.	1.242110
		Curcu	1410 11101	Line	FB			
				AB	N45°10'E			
				BC	S60°40'E			
				CD				
					S9°50'W			
				DA	N80°40'W			
		Ans.	Line	FB (RB)	FB (WCB)	BB (WCB)		
			AB	N45°10'E	45°10'	225°10'		
			BC	S60°40'E	119°20'	299°20'		
			CD	S9°50'W	189°50'	9°50'		
			DA	N80°40'W	279°20'	99°20'		
		Interio	or angle A	A = BB of line DA $A = 99^{\circ}20' - 45^{\circ}1$ $A = 54^{\circ}10'$	A – FB of line AB 10'		1	
		Interior angle B = BB of line AB – FB of line BC Interior angle B = 225°10' - 119°20' Interior angle B = 105°50'					1	
		Interio	or angle C	C = BB of line BC $C = 299^{\circ}20' - 189$ $C = 109^{\circ}30'$	C – FB of line CD 9°50'		1	
		Interio Interio Interio	or angle D or angle D or angle D	$0 = 9^{\circ}50' - 279^{\circ}2$	is exterior angle)		1	
		Sum o	f Calcula	aded angle = (2N = (2X4 - = 360° ated interior angle ated interior angle	(-4)X 90 $(=54^{\circ}10'+105^{\circ}5)$	0'+109°30'+ 90°3	30'	
								4



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ue. lo.	Sub. Que.	Model Answers	Marks	Total Marks
.3	(5)	Explain Radiation method of plane method of plane table survey. Ans Radiation Method-		
		E A A B B	1	
		Procedure- 1. Select a suitable point P on the ground such that all the details are visible from it 2. Center and level the plane table over P 3. Mark the direction of the North on the sheet by using compass		
		 Locate instrument station p on the sheet by using plumbing fork, such that p on sheet is exactly over P on ground Centering the alidade on point p sight various details step by step and draw a ray from each detail along the fiducial edge of the alidade Let the details be named as A, B, C, D, E etc. Now measure the distances of each point from P i.e. PA, PB, 	3	4
	(6)	PC, PD, PE and plot them to scale on the sheet as pa, pb, pc, pd, pe respectively Joint a, b, c, d, and e to give the outline State fundamental axis of dumpy level and give their relationship		
		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	¹ / ₂ mark each	
		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.	1 mark each (any two)	4



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Que. No.	Sub. Que.					Model .	Answers				Marks	Tot Mar
Q.4	Que.		pt any F			_						16
	1)	Find t	the area o	f field d	one l	y cross	s staff su D	rvey				
				1								
		Fig. Chainage Offset Area										
		No.	Figure	From	To	Base	1	2	Mean	Base x mean		
		I	ΔAbB	0	20	20	0	32	16	320		
		II	□BbCc	20	35	15	32	40	36	540	1/	
		III	ΔCcD	35	84	49	40	0	20	980	¹ / ₂ mark	
		IV	ΔDeE	84	65	19	0	30	15	285	each	
		V	□EefF	65	50	15	30	45	37.5	562.5		
		VI	ΔAfF	50	0	50	45	0	22.5	1125		
	2)								Total Area	3812.5		4
		Ans. Following are the sources of errors in compass survey 1. Instrumental survey- a. Needle may not be perfectly straight and might not be balanced properly over the station. b. Graduations of the rings may not be uniform. c. The ring may not rotate freely, due to head of the pivot being broken or may be eccentric. d. The sight vane may not be vertical e. Horse hair may not be straight or vertical.									2	
		a. cent b. Gra c. The	sonal erre tering may duated rin object mi server may	y not be one of not light not l	ot be	leveled sected p	roperly.		tion.		1	



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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.4	3)	3. Other sources of substances-a. There may be attraction due to the presence of magnetic substances near the station.b. Magnetic field may vary on account of some natural causes.	1	4
	3)	Explain the intersection method of plane table survey. Intersection method Ans.		
		1. Lay out a base line AB and measure it and Plot a distance 'ab' on sheet using any scale. 2. Set up instrument at 'A' with 'a' over 'A' 3. Orient the table by placing alidade 'ab' and turn table until ranging rod at 'B' is bisected and clamp it. 4. With alidade touching point 'a' draw rays 1, 2,3,4,5 of indefinite length as shown in figure below. 5. The table is then moved to station 'B' orient by back sighting on 'A'. Draw rays towards points previously sighted i.e. 6,7,8,9 rays are drawn to determine points intersection, d, g, f, c. Explain types of bench marks.	3	4
	4)	Ans. Types of bench mark- 1.Great trignometrical survey bench mark- a. These are the bench marks established with very high precision at regular intervals by survey of India Dept. all over the country. Their positions and bench mark values with respect to the mean sea level at	1	
		Karachi are given in catalogue formed by department. 2. Permanent Benchmark: These are the benchmarks established by state government agencies like PWD. They are established with reference to GTS benchmarks. They are usually on the corner of plinth of public buildings.	1	
		3. Arbitrary Benchmark: In many engineering projects the difference in elevations of neighbouring points is more important than their reduced level with respect to mean sea level. In such cases a relatively permanent point, like plinth of a building or corner of a	1	



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Que.	Sub.	Model Answers	Marks	Total
No.	Que. (4)	culvert, are taken as benchmarks, their level assumed arbitrarily		Marks
Q.4	5)	 4. Temporary Benchmark: This type of benchmark is established at the end of the day's work, so that the next day work may be continued from that point. Such point should be on a permanent object so that next day it is easily identified. Difference between H.I method & rise and fall method. Ans 	1	4
		Sr. H.I method Rise & Fall method		
		1 The method is more rapid & The method is tedious &	-	
		required less time require more time		
		2 It is used for calculating RL It is used for calculating RL	-	
		of Profile leveling & in of Precise leveling work &	1 Mark	
		construction work Like canal, check leveling	each	
		roads etc.	Cach	
		3 It is simple & requires less It is complicated & requires	-	
		calculation more calculations		
		4 Arithmetical check ΣB.S Arithmetical check ΣB.S	-	
		Σ F.S=Last RL-First RL Σ F.S=Last RL-First RL =		
		Σ Rise - Σ fall		4
	6)	The Bearing of line AB is 153°30' and angle ABC is 135°40'. What is bearing of BC. Ans. CASE-1 FB of line AB = 153°30' BB of AB = FB of line AB + 180° = 153°30' + 180° = 333°30' FB of BC = BB of AB + <abc +="" 135°40'<="" 333°30'="" =="" th=""><th>1 1 1</th><th></th></abc>	1 1 1	
		= 469°10'		
		But bearing is greater than 360° Therefore, FB of BC = 469°10'- 360 FB of BC = 109°10'	1	4
		OR		
		CASE-2 FB of line AB = 153°30'		
		BB of AB = FB of line AB + 180°	1	
		= 153°30'+ 180°	1	
		$= 333^{\circ}30'$	1	
		<abc -="" =="" ab="" bb="" bc<br="" fb="" of="">153°30' = 333°30' - FB of BC</abc>	1	
		FB of BC = 197°50'	1	4
L		1		_1



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Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.5	(1)	Attempt any Four of the following Explain how will you overcome the obstacles over river during		16
	(1)	chaining operation.		
		Ans.		
		A) river across the chain line.		
		RIVER		
		C	1	
		90. 90.		
		1. Suppose AB is the chain line. Two points C & D are selected on		
		this line on opposite banks of the river.		
		2. At C a perpendicular CE is erected and bisected at F. A perpendicular is set out at E and a point G is so selected on it that	3	
		D,F & G are in The same straight line.		
		3 From triangles DCF & GEF,		
		GE=CD		
		This distance GE is measured and thus the distance CD is obtained		
		indirectly.		
		OR B) river across the chain line		
		B		
		E		
		=======================================		
		RIVER		
		P	1	
		90.	1	
		C H G		
		1.Suppose AB is the chain line. Points C, D & E are selected on this		
		line such that D & E are on opposite banks of the river.		
		2. The perpendicular DF & CG are erected on the chain line in such	3	
		way that E,F& G are on the same straight line. The line FH is taken		
		parallel to CD.		
		3.Now, from triangles DEF & HFG,		
		ED/DF = FH/HG Where FH=CD ED = (FU/HG) Y DE CH=DE		
		ED = (FH/HG) X DF CH=DF $= (CD/(CG-DF))X DF HG=CG-CH$		4
			<u> </u>	l



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Q.5	2)	What is meant by local attraction? How will you suspect local		Warks
		attraction at the field? state its effect on included angle.		
		Ans.		
		Local attraction : It is the deviation or deflection of magnetic needle		
		from its normal position under influence of external magnetic forces	2	
		is called as local attraction.	<i>2</i>	
		Suspect of local attraction		
		To suspect the presence of local attraction, the fore and back bearing		
		of a line should be taken. If the difference of the fore and back bearing		
		of a line is exactly 180°, then there is no local attraction.		
		Effect on included angle		
		The needle is affected by local attraction therefore it does not give a corrected angle	1	_
	3)	State any four advantages and disadvantages of plane table		4
		survey.		
		Ans-		
		Advantages of plane table surveying-		
		1. It is most rapid method and suitable for small scale.	1/2	
		2. there is no need of field book.	Marks	
		3. Irregular objects may be represented properly.4. it is suitable in magnetic area.	each	
		5. The surveyor can compare the plotted work with the actual features	(any	
		of the area.	four)	
		6. It is less costly.		
		7. No greater skill is required to prepare map.		
		Disadvantages of plane table surveying		
		1. The plane table survey is not possible in unfavorable climates such		
		as rain, fog etc.	1/2	
		2. This method of survey is not very accurate and thus unsuitable for	Marks	
		large scale or precise work.	each	
		3. As no field book is maintained, plotting at different scale require full exercise.	(any	
		4. The method requires large amount of time to be spent in the field.	four)	
		5. Quality of the final map depends largely on the drafting capability		
		of the surveyor.		
		6. This method is effective in relatively open country where stations		
		can be sighted easily .		
				4



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Que. No.	Sub. Que.				Model	Answers			Marks	Marks Total Marks				
Q.5	4)	What is Ans. profile To knot along the ground the ground the ground the statement of the st	2											
		also be line of section	ling should to the Centre ose of cross- I surface pon the	2	4									
	5) Ans.	2.930,	1.950, 0.8	55, 3.795 aifted aft	5, 2.640, er 5 th an	vith dumpy 1.540, 1.935 d 8 th readin	5, 0.865 and ng. The firs	d 0.665 st reading						
		was tal	ken on BI Apply U				KL of rem	aming						
		was tal points.	ken on BI Apply U		ck use H		RL of Femi	Remark						
		was tal points. Ans. Sr. No.	ken on BI Apply U Sta	sual che	ck use H	I method HI	RL	Remark						
		was tal points. Ans. Sr. No.	ken on BI Apply U	sual che	ck use H	I method	RL 150.250							
		was tal points. Ans. Sr. No. 1 2	ken on BI Apply U Sta	aff Read IS 3.345	ck use H	I method HI	RL 150.250 150.770	Remark						
		was tal points. Ans. Sr. No. 1 2 3	ken on BI Apply U Sta	aff Read IS 3.345 2.930	ck use H	I method HI	RL 150.250 150.770 151.185	Remark	3					
		was tal points. Ans. Sr. No. 1 2 3 4	Sta BS 3.865	aff Read IS 3.345	ing FS	HI 154.115	RL 150.250 150.770 151.185 152.165	Remark BM	3					
		was tal points. Ans. Sr. No. 1 2 3 4 5	ken on BI Apply U Sta	aff Read IS 3.345 2.930 1.950	ck use H	I method HI	RL 150.250 150.770 151.185 152.165 153.260	Remark	3					
		was tal points. Ans. Sr. No. 1 2 3 4	Sta BS 3.865	aff Read IS 3.345 2.930	ing FS	HI 154.115	RL 150.250 150.770 151.185 152.165	Remark BM	3					
		was tal points. Ans. Sr. No. 1 2 3 4 5 6	Sta BS 3.865	aff Read IS 3.345 2.930 1.950	ing FS	HI 154.115 157.055	RL 150.250 150.770 151.185 152.165 153.260 154.415	Remark BM CP1	3					
		was tal points. Ans. Sr. No. 1 2 3 4 5 6 7 8 9	Sta BS 3.865 3.795	3.345 2.930 1.950 2.640 0.865	ing FS 0.855 1.540 0.665	HI 154.115 157.055 157.450	RL 150.250 150.770 151.185 152.165 153.260 154.415 155.515	Remark BM CP1	3					
		was tal points. Ans. Sr. No. 1 2 3 4 5 6 7 8 9	Sta BS 3.865	3.345 2.930 1.950 2.640 0.865	ing FS 0.855 1.540 0.665	HI 154.115 157.055	RL 150.250 150.770 151.185 152.165 153.260 154.415 155.515 156.585	Remark BM CP1 CP2	3					
		was tal points. Ans. Sr. No. 1 2 3 4 5 6 7 8 9 9	Sta BS 3.865 3.795 1.935 ΣBS =9.59	3.345 2.930 1.950 2.640 0.865	ing FS 0.855 1.540 0.665 ΣFS	HI 154.115 157.055 157.450 =3.060	RL 150.250 150.770 151.185 152.165 153.260 154.415 155.515 156.585	Remark BM CP1 CP2	3					
		was talpoints. Ans. Sr. No. 1 2 3 4 5 6 7 8 9	Sta Sta BS 3.865 3.795 1.935 Δeric check ΣFS = 1.56	3.345 2.930 1.950 2.640 0.865	ing FS 0.855 1.540 0.665 ΣFS	HI 154.115 157.055 157.450 =3.060	RL 150.250 150.770 151.185 152.165 153.260 154.415 155.515 156.585	Remark BM CP1 CP2						
		was talpoints. Ans. Sr. No. 1 2 3 4 5 6 7 8 9	Sta Sta BS 3.865 3.795 1.935 ΣBS =9.59 netic chector c	3.345 2.930 1.950 2.640 0.865	ing FS 0.855 1.540 0.665 ΣFS	HI 154.115 157.055 157.450 =3.060	RL 150.250 150.770 151.185 152.165 153.260 154.415 155.515 156.585	Remark BM CP1 CP2	3	A				
		was tal points. Ans. Sr. No. 1 2 3 4 5 6 7 8 9 Arithm ΣBS - 9.595	Sta Sta BS 3.865 3.795 1.935 ΣBS =9.59 netic chector c	3.345 2.930 1.950 2.640 0.865	ing FS 0.855 1.540 0.665 ΣFS	HI 154.115 157.055 157.450 =3.060	RL 150.250 150.770 151.185 152.165 153.260 154.415 155.515 156.585	Remark BM CP1 CP2		4				
		was tal points. Ans. Sr. No. 1 2 3 4 5 6 7 8 9 Arithm ΣBS - 9.595	Sta Sta BS 3.865 3.795 1.935 ΣBS =9.59 netic chector c	3.345 2.930 1.950 2.640 0.865	ing FS 0.855 1.540 0.665 ΣFS	HI 154.115 157.055 157.450 =3.060	RL 150.250 150.770 151.185 152.165 153.260 154.415 155.515 156.585	Remark BM CP1 CP2		4				
		was tal points. Ans. Sr. No. 1 2 3 4 5 6 7 8 9 Arithm ΣBS - 9.595	Sta Sta BS 3.865 3.795 1.935 ΣBS =9.59 netic chector c	3.345 2.930 1.950 2.640 0.865	ing FS 0.855 1.540 0.665 ΣFS	HI 154.115 157.055 157.450 =3.060	RL 150.250 150.770 151.185 152.165 153.260 154.415 155.515 156.585	Remark BM CP1 CP2		4				



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Model Answer: Summer 2016

Que.	Sub.				Modo	l Answe	ore.			Marks	Tota
No.	Que.										Mar
Q.5	6)	ground v 2.895, 2.	with dur 895, 1.1 f RL 26 nts and	mpy lev 25, 0.96 0.865m apply u	el. 3.87 55 and Use Ri sual ch	5, 3.630 0.785. T ise and), 2.86 Γhe fii	5, 1.945, (est reading	usly sloping 0.920, 3.165, g was taken nd the RL 's		
		Sr. No.		ff Read		Rise	Fall	\mathbf{RL}	Remark		
		1	BS	IS	FS			260.965	D.M.		
		2	3.875	2 620		0.245		260.865	B.M.		
		3		3.630		0.245		261.11		3	
		4		2.865		0.765		261.875			
		5	3.165	1.945	0.920	1.025		262.795 263.82	CP1		
		6	3.103	2.895	0.920	0.27		264.09	CII		
		7		1.125		1.77		265.86			
		8		0.965		0.16		266.02			
				0.703		0.10		200.02			
		$\frac{9}{\Sigma BS} =$ Arithme : $ \Sigma BS - \Sigma $ $ 7.040 - 1.5.335 = 5$	tic chec 2FS = Σ 705 = 5	k:- ERise – 2 5.335 -0		Last R	L – Fir		all = 0	1	4
2.6	1)	$\Sigma BS =$ Arithmeter $ \Sigma BS - \Sigma $ $ 7.040 - 1.5.335 = 5$ Attempter Following compass	tic check FS = 2 705 = 5 .335 = 5 any TW g fore a travers	k:- ERise — 2 5.335 -0 5.335 VO of th and back	S =1.70: ΣFall = = 266. e follow k bearin	Last Rl 200 – 20 ving- ngs wer	L – Fir 60.865 re obse	5.315 ΣF st RL	all = 0		-
Q.6	1)	$\Sigma BS =$ Arithment $\Sigma BS - \Sigma$ $7.040 - 1.5.335 = 5$ Attempt Following compass 1) Figure Fig	tic check FS = 2 705 = 5 335 = 5 any TW g fore a travers ind the	k:- ERise — 2 5.335 -0 5.335 VO of the and back e. Station	S =1.703 ΣFall = = 266. e follow k bearing	Last R1 200 – 20 ving- ngs wer	L – Fir 60.865 re obse	5.315 ΣF st RL			
Q.6	1)	$\Sigma BS =$ Arithment $\Sigma BS - \Sigma$ $7.040 - 1.5.335 = 5$ Attempt Following compass 1) Figure Fig	tic check FS = 2 705 = 3 .335 = 5 any TW g fore a travers ind Cor	k:- ERise — 2 5.335 -0 5.335 VO of th and back e. Station rected I	S =1.703 ΣFall = = 266. e follow k bearing	Last Rl 200 – 20 ving- ngs wer al attra BB	L – Fir 60.865 re obse	5.315 ΣF st RL			
Q.6	1)	$\Sigma BS =$ Arithment $\Sigma BS - \Sigma$ $7.040 - 1.5.335 = 5$ Attempt Following compass 1) Figure Fig	tic check FS = 2 705 = 5 .335 = 5 any TW g fore a travers ind the 5 ind Cor	k:- ERise – 2 5.335 -0 5.335 VO of the and back e. Station rected I	S =1.70: ΣFall = = 266. The following the bearing of the second	Last Rl 200 – 20 ving- ngs wer al attra BB	L – Fir 60.865 re obse ction	5.315 ΣF st RL			
Q.6	1)	$\Sigma BS =$ Arithment $\Sigma BS - \Sigma$ $7.040 - 1.5.335 = 5$ Attempt Following compass 1) Figure Fig	tic check $ FS = \Sigma $ $ 705 = \Sigma $ 335 = 5 any TW g fore a travers ind the Σ ind Cor Line AB	k:- ERise – 2 5.335 -0 5.335 VO of the hand backe. Station rected I FB 44°30	ΣFall = = 266. the following bearing free loce	Last Rl 200 – 20 ving- ngs wer al attra BB	L – Fir 60.865 re obse ction BB 226°30	5.315 ΣF st RL erved in ru			
Q.6	1)	$\Sigma BS =$ Arithment $\Sigma BS - \Sigma$ $7.040 - 1.5.335 = 5$ Attempt Following compass 1) Figure Fig	tic check $ FS = \Sigma $ 705 = S 335 = S any TW g fore a travers and the S and Cor Line AB BC	k:- ERise – 2 5.335 -0 5.335 VO of the had backe. Station rected I FB 44°30 124°3	S =1.70: ΣFall = = 266. e follow k bearing free loce B and 2	Last Rl 200 – 20 ving- ngs wer al attra BB	L – Fir 60.865 re obse ction BB 226°30 303°15	5.315 ΣF st RL erved in ru			
Q.6	1)	$\Sigma BS =$ Arithment $\Sigma BS - \Sigma$ $7.040 - 1.5.335 = 5$ Attempt Following compass 1) Figure Fig	tic check $ FS = \Sigma $ 705 = S 335 = S any TW g fore a travers and the S and Cor Line AB BC CD	k:- ERise – 2 5.335 -0 5.335 VO of the had backe. Station rected I FB 44°30 124°30 181°0	ΣFall = = 266. the following bearing free loce	Last Rl 200 – 20 ving- ngs wer al attra BB	L – Fir 60.865 re obse ction BB 226°30 303°15	5.315 ΣF st RL erved in ru			
Q.6	1)	$\Sigma BS =$ Arithmet $ \Sigma BS - \Sigma $ $ 7.040 - 1.5.335 = 5$ Attempt Followin compass 1) Fi 2) Fi	tic check $ FS = \Sigma $ 705 = S 335 = S any TW g fore a travers and the S and Cor Line AB BC	k:- ERise – 2 5.335 -0 5.335 VO of the had backe. Station rected I FB 44°30 124°3	ΣFall = = 266. the following bearing free loce	Last Rl 200 – 20 ving- ngs wer al attra BB	L – Fir 60.865 re obse ction BB 226°30 303°15	5.315 ΣF st RL erved in ru			
Q.6	1)	ΣBS = Arithmet ΣBS – Σ 7.040 -1. 5.335 = 5 Attempt Followin compass 1) Fi 2) Fi	tic check $ FS = \Sigma $ 705 = S 335 = S any TW g fore a travers and the Sind Cor Line AB BC CD DA	k:- ERise – 2 5.335 -0 5.335 VO of the had backe. Station rected I FB 44°30 124°30 181°0 289°30	ΣFall = = 266. the following bearing free loce	Last Rl 200 – 20 ving- ngs wer al attra BB	L – Fir 60.865 re obse ction BB 226°30 303°15	5.315 ΣF st RL erved in ru eventually served in ru eventually ser	inning close		
Q.6	1)	ΣBS = Arithmen ΣBS – Σ 7.040 -1. 5.335 = 5 Attempt Followin compass 1) Fi 2) Fi Ans. Lin	tic check $ FS = \Sigma $ 705 = S 335 = S any TW g fore a travers and the S and Cor Line AB BC CD DA	k:- ERise – 2 5.335 -0 5.335 VO of the had backe. Station rected I FB 44°30 124°30 181°0 289°30 FB	S = 1.70: ΣFall = = 266. Le follow k bearing free loce TB and The second of the secon	Last Rl 200 – 20 ving- ngs wer al attra BB	L – Fir 60.865 re obse ction BB 226°30 303°15 1°0' 108°45	5.315 ΣF st RL prved in ru y Difference	ence		
Q.6	1)	ΣBS = Arithmet ΣBS – Σ 7.040 -1. 5.335 = 5 Attempt Followin compass 1) Fi 2) Fi	tic check FS = 2 705 = 5 335 = 5 335 = 5 335 = 5 34 34 35 35 35 35 35	k:- ERise – 2 5.335 -0 5.335 VO of the had backe. Station rected I FB 44°30 124°30 181°0 289°30	ΣFall = = 266. te follow k bearing free loc FB and 1 0° 0°	Last Rl 200 – 20 ving- ngs wer al attra BB	L – Fir 60.865 re obse ction BB 226°30 303°15 1°0' 108°45	5.315 ΣF st RL erved in ru eventually served in ru eventually ser	ence		
Q.6	1)	SBS = Arithmet ΣBS - Σ 7.040 -1. 5.335 = 5 Attempt Followin compass 1) Fi 2) Fi Ans. Lin AB	tic check FS = 2	k:- ERise – 2 5.335 -0 5.335 VO of the had backe. Station rected I FB 44°30° 181°0° 289°3° FB 44°30°	ΣFall = = 266. te follow k bearing free loc FB and 1 0° 0°	Last Rl 200 – 20 ving- ngs wer al attra BB 226°30°	L – Fir 60.865 re obse ction BB 226°30 303°15 1°0' 108°45	5.315 ΣF st RL erved in ru y Different 182°	ence 0' 45'		16

The observed FB of line DA & CD and BB of DC & BC is correct.

1

are free from local attraction.



Model Answer: Summer 2016

Subje	ct & Co	de: Su	rveying	(1731	0)					Page No	o. 19/2			
Que. No.	Sub. Que.				Mo	odel Ans	wers			Marks	Tota Mark			
Q.6	1)	Sample calculations- Corrected BB of DA= Correct /Observed FB of DA - 180° = 289°30° - 180°												
		=109°30' Correction At A = Corrected BB of DA – Observed BB of DA = 109°30' - 108°45'												
					+ 0°45'	100 73				2				
		Corr	ected F	B of A				+ Correct	ion at A					
					$= 44^{\circ}30$ = $45^{\circ}13$	0' + 0°4:	5'			(any				
		Corr	one statio											
		Corr	ected Di	D UI A	B= Corre = 45			100						
		= 45°15'+ 180° =225°15'												
		Corre	ection A	= 2	25°15'- 2		3 – Obs	served BB	of AB					
		Corr	ected F		- 1°15' SC = Obse	rved FB	of BC	- Correcti	on at B					
		Corr	ceteu I	DOLL		30'- 1°1		Correct	ion at D	n) 3				
		Lin	ne	Obse			4.	Cor	rected					
				В	BB	Corre	ction	FB	BB	_				
		AE		230'	226°30'	A = 0		45°15'	225°15'	3				
		BC		°30' 1°0'	303°15' 1°0'	B = -1 $C =$		123°15' 181°0'	303°15' 1°0'					
		DA		°30°	108°45°	D =		289°30°	109°30'		8			
	2)	Ein d				Calaula	4a DI							
	,		metical			Calcula	ite KL	S OI AII S	tations apply					
		St.	BS	IS	FS	Rise	Fall	RL	Remark					
		1	2.345					129.50	BM1					
		$\frac{2}{3}$	1.650	2 21/	X	0.035	v							
		4	X	2.210	1.850	X	X							
		5	1.850		1.925	21	0.455	5						
		6			X	0.37		129.00	BM2					
		Ans.	~.			_								
					station 6 i	-	g , ther	efore only	BS &FS &					
			x ran ch) FS of			eci.								
			, _~			- FS of S	Station	2 = Rise at	station 2	1				
					5 - FS of 3			35		1				
		2) Fall a		f Station 2	= 2.310								
) Fall o			- IS of S	Station	3 =Fall at s	tation 3	1./				
					0-2.210=					1/2				
					at station 3	8 = -0.56								
		3) Rise o			FG 6.0	•	4 D' .						
					station 3 - -1.85 = Ris			4 = Rise at	station 4	1/2				
					-1.0J — KIS		1011 1							

Rise at station 4 = 0.36



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Model Answer: Summer 2016

Subje	ct & Co	de: Su	rveying	(17310)						Page No	. 20/21
Que. No.	Sub. Que.				Mo	odel Ans	wers			Marks	Total Marks
Q.6	2)	4)	BS of	Station	1 4 =						
				BS of	station	4 - FS c	f Statio	n 5 = Fall	at station 5	1	
				BS of	station	4 - 1.92	25 = -0.4	455			
				BS of	station	4 = 1.47	70				
		5	. FS of	Station	1 6 =						
		BS of station $5 - FS$ of Station $6 = Rise$ at station									
				1.85 -	1/2						
				FS of	Station	6 = 1.48	30			72	
		6	. RL of	f Station	n 2 =						
				RL o	f Station	12 = RI	of Stat	ion 1 + Ri	se at St. 2		
				RL o	f Station	12 = 12	9.50 + 0	0.035		1	
				RL o	f Station	12 = 12	9.535				
		7)	RL of	Station	1 3 =						
		RL of Station $3 = RL$ of Station $2 - Fall$ at st. 3									
				RL o	f Station	12 = 12	9.535 -	0.56		1/2	
				RL o	f Station	12 = 12	8.975				
		8	RL of	Station	1 4 =						
				RL of	Station	4 = RI	of Stat	ion 3 + Ri	se at St. 4	1/2	
				RL o	f Station	12 = 12	8.975 +	0.36		72	
				RL o	f Station	12 = 12	9.335				
		9)	RL of	Station	1 5 =						
				RL o	f Station	15 = RI	of Stat	ion 4 – Fa	ll at st. 5	1/2	
				RL o	f Station	12 = 12	9.335 -	0.455			
				RL o	f Station	12 = 12	8.88				
		Arith	metic ch	eck:-							
					$e - \Sigma Fall$			rst RL			
		7.31			5 -1.015		129.5				
			-(0.25 = -0	.25 = -0.	50					
		C4	DC	TC	EC	Digg	Fall	DI	Domo		
		St.	BS	IS	FS	Rise	Fall	RL	Rema	2	
		1	2.345			-		129.50	rk BM1		
		2	1.650		2.310	0.035		129.50 129.535	DIVII		
		3	1.050	2.210	2.310	0.033	0.560	129.333			
		4	1.470	2.210	1.850	0.360	0.200	129.335			
		5	1.850		1.925	0.200	0.455	128.88			
		6	1.500		1.480	0.37	0.100	129.00	BM2		8

6 | 1.480 | 0.37 | 129.00 | BM2 | 3) What is meant by closing error? How will you adjusted i) graphically? Ans. **Closing error:** While plotting compass traverse, when first and last 1 survey line does not coincides by some amount of distance, that distance is called as closing error.



Model Answer: Summer 2016

Subject & Code: Surveying (17310) Page No. 21/21

Que. No.	Sub. Que.	Model Answers	Marks	Total Marks
Q.6	i)	Adjustment of closing error		
	Ans.	Unclosed traverse Corrected traverse B ₁ C ₁ B ₂ (b)	1	
		Compass Traverse Bowditch Rule		
		 Explanation: To distribute the closing error AA1 (Fig. a), draw one horizontal line of length equal to perimeter of traverse with some reduced scale. Now mark the survey stations on it proportionally (Fig. b) and transfer closing error of same length using roller scale to point a. Join the point A and A1 with straight line. Also draw parallel lines at point b,c.d and e. Transfer B1b, C1c, D1d and E1e to point B1, C1, D1 and E1 respectively in compass traverse. Finally join new points to get corrected traverse ABCDEA after graphical adjustment of closing error. 	2	4
	ii)	State any four advantages of auto level.		
		Advantages of auto level: 1. Auto level gives quick and easy leveling 2. It is most accurate and precise which gives least error about 0.5 to 0.8 in 5km 3. It is simply to use, 4. compact in nature and easy to handle.	1 mark each (any four)	4
		5.Regular reading can be observed		•