Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	GEOMATIC ENGINEERING
COURSE CODE	:	BFC 20703
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY 2020
DURATION	:	6 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1 (a) Explain the following survey terms;

(i) Hydrographic survey.
(ii) Construction Survey.
(iii) Geographical Information System (GIS).

(6 marks)

(b) A map and plan are graphical representation of a portion and characteristic of the earth's surface. Differentiate between Geographic map (small scale) and Topographic map (big scale).

(4 marks)

(c) Demonstrate the procedures of temporary adjustment for Automatic levelling instrument.

(5 marks)

(d) As a civil engineer, you are involved in highway road construction. Briefly explain with appropriate illustrations the purpose of super-elevation in transition curve road design.

(5 marks)

Q2 (a) Describe the usage of levelling for tachometry survey.

(3 marks)

(b) A few difficulties are commonly met while levelling such as across a lake or pond. Briefly explain the method to carry out the levelling process to overcome the problems.

(4 marks)

(c) Two points, A and B, were established for a two-peg-test. Distance A to B was measured as 30 m. When the auto level was at C (midpoint between A and B) the staves readings at A and B were 1.376 m and 1.332 m, respectively. Then the auto level was setup at point D, 3 m from B along the line A to B extended. Staff readings at A and B were 1.456 m and 1.414 m respectively. In the above case prove that the difference between readings determine the collimation error of the auto level.

(5 marks)

(d) **Table Q2(d)** shows a leveling survey data was conducted by Civil Engineering student from UTHM. Initial datum from Bench Mark (BM) 1, with reduced level 5.777 m and closing to Bench Mark (BM) 2, with the reduced level 6.043 m. Verified the data acceptant for levelling reduction and indicated the maximum height of vehicle to cross under the bridge.

(8 marks)

Q3 (a) Calculate the missing bearing and the mean bearing for the traverse booking in **Table Q3(a)**.

(5 marks)

(b) **Table Q3(b)** shows the adjusted latitude and departure for traverse line 1-2-3-4-5-1. Calculate the bearing and distance for all lines and plot the orientation of traverse without scale.

(10 marks)

(c) From **Table Q3(c)**, the sum of latitude calculated as 0.014 m and, departures are 0.003 m. Apply the corrections to latitude and departures using transit method and determine the miclosure of the traverse.

(5 marks)

Q4 (a) Tachometry is used to determine the elevation of the reduce level at Station 2 based on elevation of Station 1. Define the tachometry stadia formula below by using illustrations.

$$R.L._{STN\,2} = R.L._{STN\,1} + H.i + V - h$$

Where:
R.L. $_{STN\,1}$ = Reduced Level of instrument station 1
R.L. $_{STN\,2}$ = Reduced Level of instrument station 2
H.i = Instrument height
h = Middle stadia
V = Vertical distance

(4 marks)

(b) **Table Q4(b)** shows the tachometry data from station 1 to staff 2 and from station 1 to staff 3 with multiplying and additive constant are given as 100 and 0. The distance from staff 2 to staff 3 was measured as 157m. Compute the horizontal distance and vertical distance for station 1 to Staff 2.

(6 marks)

(c) A series of electronic tachometry data is shown in **Table Q4(c)** in which some readings marked are missing. Calculate and complete the page with all checks.

(10 marks)

Q5 (a) The existing topography reduced level of part of construction site in the grid form are as shown in **Figure Q5(a)**. The distance between the grid points is at 20 m interval. If the required formation level of the construction is to be at 168.00 m, calculate the volume of materials need to be excavated within the grid area using Square Method.

(5 marks)

(b) A digital planimeter was used to measure the plan areas contained between the proposed position of a dam wall and several contour lines. The areas obtained from digital planimeter is shown in **Table Q5(b)**. If the proposed maximum water level is 93 m. Estimate the volume of the reservoir between contour line 70 m and 93 m to the nearest 1000 m^3.

(5 marks)

(c) A circular curve is connected two straight roads and the data given as follows:

Deflection angle : 15° 46' 00"
Radius : 700 m
Intersection Chainage : 4017.86 m
Interval distance : 25 m

Compute the following items;

(i) Tangen distance (T).
(ii) Distance of chord (L).
(iii) Chainage of T1 and T2.
(iv) Refraction angle (δ).
(v) Table data for 25 meter setting-out.

(10 marks)

- END OF QUESTIONS -

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TABLE Q2(d)

Back-sight	Inter-mediate sight	Fore-sight	H O C	Reduce level (m)	Distance (m)	Remark
1.326				*5.777*		*(BM 1=5.777)*
1.219		*1.272*			*30*	*cp1*
1.401		*1.219*			*30*	*cp2*
1.329		*1.371*			*30*	*cp3*
	-1.512					*Under the bridge*
1.271		*1.361*			*30*	*On the road*
1.365		*1.348*			*30*	*cp5*
		1.100			*30*	*(BM2=6.043)*

$\Sigma BS =$ $\Sigma FS =$

* Used your own table to complete this question

TABLE Q3(a)

STN		Bearing / Angle								
		Face left			Face right			Mean Bearing		
		DD	MM	SS	DD	MM	SS	DD	MM	SS
		Datum from PA						210	0	0
2	1	210	0	0	30	0	0			
	3	85	42	15	265	42	20			
3	2									
	4	263	10	0	83	10	0			
4	3									
	5	224	41	10	44	41	0			
1	4									
	2	29	59	50	209	59	35			

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TABLE Q3(b)

Line	Adjusted Latitude		Adjusted Departure	
	N	S	E	W
1				
2	*20.728*		*45.501*	
3		*53.568*	*36.817*	
4		*65.673*		*24.228*
5	*22.506*			*38.968*
1	*76.007*			*19.123*

TABLE Q3(c)

Line		Bearing	Distance	Latitude		Dipatures	
From	To	dd.mmss	(m)	N	S	E	W
15							
	16	301°17'00"	44.860	23.294			38.338
	17	321°10'00"	44.593	34.737			27.962
	18	69°50'30"	43.538	15.004		40.871	
	15	160°48'30"	77.348		73.049	25.427	
			Σ = 210.339	73.035	73.049	66.298	66.300
				Σ_L=0.014		Σ_D=0.003	

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TABLE Q4(b)

Station	Staff	Staff Readings (m)			Vertical Angle
		Below	Middle	Upper	
1	2	1.48	2.73	3.98	+ 7° 36'
	3	2.08	2.82	3.56	- 5° 24'

TABLE Q4(c)

From Stn	To Stn	RL. Stn	Inst. Height	Bearing	Horizontal Distance	Target Height	Vertical Distance	RL. Point	Remaks
1	2	1.902	1.530			1.350	-0.347		Back stn
						1.350		2.096	Tree
						1.550	0.115		Lamp Pole
3	4	1.732	1.290			1.540		2.190	Back stn
							0.216	2.038	TNB
							0.252	1.824	Fence
						1.050	0.447		Road
						1.100		2.548	Road
5	6		1.400			1.500	0.234	1.936	Back stn
						1.500		0.650	Culvert

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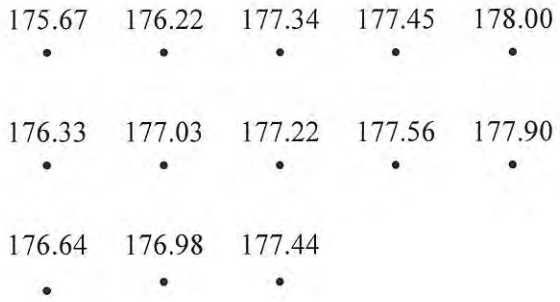

FIGURE Q5(a)

TABLE Q5(b)

Area (mm^2)	7760	9750	10980	11900	12760	15690
Contour (m)	70	75	80	85	90	93

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EQUATIONS

Traverse

$latitude = distance \times cos(bearing) \quad departure = distance \times sin(bearing)$

Bowditch correction ; $latitude\ correction = \Delta latitude \times \frac{distance}{\Sigma distance}$

$departure\ correction = \Delta departure \times \frac{distance}{\Sigma distance}$

Levelling

$Allowable\ error = (\pm 20\sqrt{J})\ mm$

Detailing

$H = slope\ distance \times \cos(vertical\ angle) \quad ; \quad V = slope\ distance \times \sin(vertical\ angle)$

$Reduced\ Level = Station\ reduced\ level + Instrument\ height \pm V - Height\ of\ reflector$

Cicular Curves

$IT_1 = IT_2 = R\tan\frac{\theta}{2} \quad ; \quad \delta = \frac{1718.9 \times chords}{R} \quad minutes$

Vertical Curves

$y = \frac{(p \pm q)}{400l}x^2 \quad ; \quad location\ of\ highest/lowest\ point,\ x = \frac{2p}{p+q}l \quad ;$

$Curve\ Length,\ 2l = (p \pm q)\frac{v^2}{100f}$

$(S = 2l) \quad h = \left(\frac{p+q}{400}\right)l \quad ; \quad (S > 2l) \quad h = \left(\frac{S-l}{400}\right)(p+q) \quad ; \quad (S < 2l) \quad h = \left(\frac{p+q}{1600}\right)\left(\frac{S^2}{l}\right)$

Areas & Volumes

$Trapezoidal : A = \frac{d}{2}\{O_1 + O_n + 2(O_2 + O_3 + ... + O_{n-1})\}$

$Simpson : A = \frac{d}{3}\{O_1 + O_n + 4\Sigma(O_{odd}) + 2\Sigma(O_{even})\}$

$End - areas : A = \frac{d}{2}\{A_1 + A_n + 2(A_2 + A_3 + ... + A_{n-1})\}$

$Prismoidal : V = \frac{d}{3}\{A_1 + A_n + 4\Sigma(A_{odd}) + 2\Sigma(A_{even})\}$