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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, DEC 2024

Common to B.E.Geoinformatics and B.E. Civil Engineering (English Medium), Semester V

GI5551 Total Station and GPS Surveying

(Regulation 2019)

Time: 3hrs Max. Marks: 100

CO 1	Learn the fundamentals of Total Station.
CO 2	Provides knowledge about electromagnetic waves and its usage in Total Station and GPS
CO 3	Understand the measuring and working principle of electro optical and Microwave Total station and GPS
CO 4	Learn the basic concepts of GPS
CO 5	Gains knowledge about Total station and GPS data downloading and processing

BL – Bloom's Taxonomy Levels

(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

General Instructions

Assume values wherever necessary

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1	What are the sources of errors in total station surveying?	2	1	L1
2	Discuss the classification of the EDM instruments	2	1	L2
3	Summarize the factors that affect the refractive index in the total station.	2	2	L2
4	Compute the group refractive index for light at standard conditions if the total station emits laser at 860 nm.	2	2	L1
5	Compare Electro–Optical and Microwave Total Station System.	2	3	L2
6	Explain the concept of trilateration. Outline its application.	2	3	L2
7	Explain signal multipath. How do we plan to overcome signal multipath while calculating a positional value?	2	4	L1
8	Explain the reason behind setting the elevation mask angle to a value above 10 degrees.	2	4	L1
9	Outline the salient features and importance of GAGAN.	2	5	L2
10	Demonstrate the importance of GPS Masks.	2	5	L2

PART- B (5 x 13 = 65 Marks)

Q. No	Questions	Marks	CO	BL
11 (a) (i)	A Total Station instrument operates with basic modulation of 299.792477 MHz and 299.852435 MHz. Estimate the distance displayed by the instrument. (Note: R1= R2=0).	6	1	L5
(ii)	Evaluate the working principle of EDM in detail, including the basic functions of each step, supported by a sketch.	7		
	OR			
11 (b)	The Electro-optical EDM was designed to measure a maximum distance of 5km. The EDM uses an electromagnetic wave frequency (f_1) of 14.9896229MHz. The survey work was carried out using Digital Theodolite and EDM. The height of the instrument and prism are 1.485m and 1.800m. The R.L. of the instrument station is 90.105m.	13	1	L5

	i. Estimate the second electromagnetic wave frequency (f_2). ii. What values of slope distance will be displayed by EDM, from the Instrument station to points A to E? iii. Estimate horizontal distance and vertical distance for given points A to E with respect to the instrument station. iv. Estimate the coordinates of measured points.							
	Target Station	**Magnetic Bearing**	**Zenith Angle**	**Phase angle (Φ)**				
				$\Delta\Phi_1$	**$\Delta\Phi 2$**			
	A	22° 44' 36"	89° 26' 51"	10° 32' 52.80"	19° 12' 32.75"			
	B	98° 18' 24"	91° 09' 27"	359° 58' 55.20"	23° 44' 31.07"			
	C	200° 32' 41"	90° 32' 32"	345° 12' 14.40"	14° 41' 39.87"			
	D	266° 00' 15"	88° 59' 15"	180° 50' 45.60"	199° 55' 36.69"			
	E	359° 25' 15"	95° 22' 46"	263° 50' 38.40"	264° 22' 18.08"			
12 (a) (i)	Solve for the second velocity correction to be applied to the observed distance of 100 km for **i.** An electro-optical Total Station with k_L= 0.13. **ii.** A microwave Total Station with k_M= 0.25.					**7**	2	L3
(ii)	Use the given modulation frequency of 33 MHz to compute the velocity of a microwave at a temperature of 18.2°C, an atmospheric pressure of 754.8 mmHg, and a partial water vapour pressure of 4.5 mmHg.					**6**		
	OR							
12 (b)	Apply the principles of atmospheric correction to compute the distance displayed by an electro-optical total station and determine the first velocity correction for the instrument at a temperature of 25°C and atmospheric pressure of 758 mmHg, given that the instrument emits a carrier wavelength of 820 nm at a reference condition of -21.5°C, 650 mmHg, and a displayed distance of 2131.046 m.					**13**	2	L3
13 (a) (i)	Analyse the working principle of a microwave distance meter based on the tellurometer principle and employing analog phase measurement techniques, and illustrate it with a sketch.					**7**	3	L4
(ii)	Examine the concept of trilateration using a total station, including its principles, applications, and advantages.					**6**		
	OR							
13 (b)	Inspect the COGO functions in a total station, detailing how they are used to compute inverse, point, area, volume, azimuth, average, arc, triangle, distance, and transformations.					**13**	3	L4
14 (a) (i)	Examine the basic principle behind position determination using GPS, including its signal structure and the basis for making pseudo-range measurements in detail."					**7**	4	L4
(ii)	Distinguish between ephemeris data and almanac data in GPS, explaining their roles and characteristics.					**6**		
	OR							

14 (b) (i)	Classify the three segments of GPS and explain the concept of GPS in detail.	**13**	4	L4
15 (a)	Describe the GPS observables and elaborate on the important tasks of a receiver.	**13**	5	L6
	OR			
15 (b) (i)	Compile the concept and importance of the GNSS CORS network.	**7**	5	L6
(ii)	Elaborate about single differencing, double differencing and triple differencing.	**6**		

PART- C (1 x 15 = 15 Marks)
(Q.No.16 is compulsory)

Q. No	Questions	Marks	CO	BL
16. (i)	Compare and describe different types of artificial satellites with examples.	**8**	4	L4
(ii)	How would you apply knowledge of satellite geometry and signal interference to effectively plan a GPS survey with minimal errors?.	**7**	5	L3