Time : Three hours   **Full Marks: 100**

First Half

Answer any three questions

^2 mark w *allottedfor neatness.*

1. What do you understand by 'Spherical Triangle*? Establish that "arc of a great circle is the shortest distance between any two points upon the surface of a sphere". Prove that in a spherical triangle ABC,

   Cos a = Cos b,Cos c + Sin b. Sin c. Cos A

   Where, all the notations carry their usual meaning.   (2 + 3 + 6 ^ = 1 1 ^)

2. State 'Napier's Formula' with appropriate illustration. What is 'Spherical excess'? How can you calculate the area of a

   spherical triangle.   (4+2+5 ^ = 11 ^)

3. What is the geodetic area enclosed by the spherical triangle ABP, on the earth's surface when the co-ordinates of the stations are as follows :
   Co-ordinate of A = 38°N 50°E
   Co-ordinate of B = 42°N 55°E
   Co-ordinate of C = Pole

   Also calculate the area of ABP ignoring the sphericity of the triangle. Consider the radius of the earth as 6400 km.

   Define the term "convergence of meridian".   (6+3+2 = 11 ^)

4. The results of a traverse survey for a proposed rail route are shown below.

Station	A	B	C	D	E	F
Deflection Angle	-	10°R	15°R	I8°L	20°R	-
Length (km)	-	AB = 12	BC - 20 **1**	CD = 25	DE = 22	EF = 30

The latitude of A was 38°N and the azimuth of AB was 160°E of N. Calculate the correction required for the convergence of meridian at F. Radius of the earth can be assumed as 6400 km.

Comment on the application of'Field astronomy' in geodetic surveying. State the 'Kepler's law' regarding the earth's motion.

                                                 (6 + 3 + 2 ^ = 1 1 ^)

Second Half
Answer Q.S and any two from the rest
One mark is reserved for neatness.

5. Write short notes on any four of the following:

   (a) Spectral resolution

   (b) Spatial resolution

   (c) Sun-synchronous satellite

   (d) Passive sensor

   (e) Consecutive Coordinates and Independent Coordinates

   (0 Spectral reflectance of leaves   (4x3=12)

6. (a) Describe briefly clock-timing error of GPS with an example.

   (b) Describe the different segments of Global Positioning System.

   (c) Explain why four satellites are required for Global Positioning System?   (4+4+3=11)

7(a) Deduce expressions for vertical and horizontal distances when the staff is held normal to the line of sight for the case of angle of depression.

(b) A traverse was conducted using tacheometry. The line of sight was horizontal in all the cases and the following data was obtained. Find the lengths of the sides and the length and bearing of line AC. Find also the gradient from A to C if the reading on a staff held at a benchmark is 2.415 from A arid 0.645 from C. The instrument constants were 100 and 0.3.

Line	Bearing	Instrument Stn.	Staff Stn.	Cross hair readings
AB	70°30*	A	B	1.535,2.214,2.893
BC	120°45*	A	D	2.018,2.70,3.708
CD	223°30'	C	B	1.033, 1.733,2.432
DA	320°47'	C	D	1.363,2.243,3.123

                                                                                                (4+7=11)

8. (a) Due to certain obstructions in running a traverse ABCDE, bearing of DE and EA were not measured and the remaining observations were taken as follows. Calculate the bearings of DE and EA.

Line	AB	BC	CD	DE	EA
Length(m)	725	1060	1250	945	577.2
Bearing	S49°45'E	N62°30'E	N37°36'W	-	-

   (b) Calculate the area of the closed traverse by Departure and Total Latitude method.

Line	Latitude (m)	Departure(m)
AB	204.6	113.9
BC	-234.9	205.8
CD	-150.7	-86.0
DA	+181.0	-233.7

                                                                                                (6+5=11)

9. A closed traverse survey involved the measurement of angles at and distances between five stations A,B, C, D and E which is as follows.

Line	Length(m)	Whole Circle Bearing
AB	293	49°45*
BC	721	72°05'
CD	496	16I°52'
DE	522	228"43*
EA	762	300°42*

   Calculate the closing error and determine the corrected station coordinates if the known coordinates of station A are 1500(N) and 650(E). Assume all angles are correct and require no adjustment.   (11)