

Time: Three hours

Full Marks: 100

Assume any data, if required, reasonably  
(Figures in the margin indicate full marks)

First Half

Answer Q.1 and any two from the rest.

1. Write short notes on the following (any four): (4 × 4 = 16)
- (a) Tropical year and Sidereal year
  - (b) Topographic displacement in aerial photogrammetry
  - (c) Convergence of meridian
  - (d) Azimuth and altitude system of coordinate
  - (e) Crabbing in aerial photogrammetry
  - (f) Geocentric Parallax Correction
2. (a) Explain Refraction Correction and Semi-diameter Correction in astronomical observations. (6)  
How does the magnitude of these corrections vary?
- (b) Draw a neat diagram of the celestial sphere to show the followings (11)
- i. Zenith, Nadir and celestial horizon
  - ii. Celestial poles and equator
  - iii. First point of Aries and first point of Libra
  - iv. Ecliptic
  - v. Position of the Sun
  - vi. Position of the Earth
  - vii. Position of a star whose RA is 4h 15m and declination  $46^{\circ}18'$  south
- Given that i. The place of observation is  $30^{\circ}N$  and  $85^{\circ}E$  ii. The time of observation is 5h 15m LAT iii. The date of observation is May 05, 2006.
3. (a) Explain Napier's rules. (4)
- (b) Deduce the expression for spherical excess. (5)
- (c) What is the geodetic area enclosed by the spherical triangle ABP on the earth's surface when the coordinates of the stations are as follows: (8)  
coordinates of A =  $32^{\circ}N44^{\circ}E$ , coordinates of B =  $52^{\circ}N59^{\circ}E$ , coordinates of P = Pole  
What will be the area of ABP when the sphericity of the triangle is ignored? Hence calculate the percentage error. Assume radius of earth is 6378 km.
4. (a) Explain LST at LMM = GST at GMM +  $9.86s \times \text{longitude } W$  (4)
- (b) Given that GST at GMM = 7h 25m 8s ; what will be the LMT at LST 11h 10m 5s at a place , longitude 5h 30m E? (8)
- (c) The distance from the principal point to the base an image on a photograph is 75 mm and the height of the object is 350 m and its base is 50 m above the ground level. What is the photographic displacement of the object if the RF with respect to datum is 1/8000 and the focal length of the camera is 250 mm and shutter speed 1/1000? (5)

5. (a) In stereoscopic study of aerial photogrammetry, find out the relation between airbase B and width of the photographic plate w, when the ratio of overlap is K, flying height H and focal length of the camera f are known and the position of the camera is vertical. (6)
- (b) At a place in latitude  $50^{\circ}N$  and longitude  $70^{\circ}W$  a star (declination  $60^{\circ}17'29''N$  and R.A. 0h 52m 1.5s) elongates on the eastern sky. What is the azimuth and altitude of the star at the time of elongation? What is the hour angle at that time? What is the LST at observation? (11)

Second Half

Answer Q.6 and any two from the rest.

6. Write short notes on the following (any four): (4 × 5 = 20)
- (a) Systematic error and Accidental error
  - (b) True value and most probable value of a quantity
  - (c) Geostationary satellite and Sun-synchronous satellite
  - (d) Passive sensing and active sensing
  - (e) Spatial resolution
  - (f) Weisbach triangle
7. (a) Find the most probable values of the angles A, B and C from the following observations at a station P by  
i) Method of Correlates and ii) Reduced Observation Equation (10)
- $A = 35^{\circ}22'25.6''$  weight 1  
 $B = 38^{\circ}20'7.7''$  weight 1  
 $A + B = 73^{\circ}42'32.5''$  weight 1  
 $A + B + C = 148^{\circ}6'45.4''$  weight 1  
 $B + C = 112^{\circ}44'29.1''$  weight 2
- (b) Calculate the most probable value and the probable error of the area of a rectangle whose sides are  $100 \pm 0.02$  m and  $150 \pm 0.01$  m. (5)
8. (a) Find the most probable values of the angles A and B from the following observations at a station O: (5)
- $A = 49^{\circ}48'36.6''$  weight 2  
 $B = 54^{\circ}37'48.3''$  weight 3  
 $A + B = 104^{\circ}26'28.5''$  weight 4
- (b) The following are the direct observations of the angle B: (5)
- |                                 |                                 |
|---------------------------------|---------------------------------|
| $45^{\circ}17'34.26''$ weight 2 | $45^{\circ}17'33.96''$ weight 2 |
| $45^{\circ}17'35.82''$ weight 3 | $45^{\circ}17'36.28''$ weight 1 |
| $45^{\circ}17'35.04''$ weight 4 | $45^{\circ}17'33.44''$ weight 3 |
- Find the probable error of the angle B.
- (c) Find the most probable values of the angles A, B and C of the triangle ABC from the following observation equations (5)
- $A = 58^{\circ}24'36''$                        $B = 52^{\circ}12'43''$                        $C = 69^{\circ}22'45''$
9. (a) Describe how you would make the trunnion axis perpendicular to vertical axis of a transit theodolite. (8)
- (b) Define remote sensing. Explain the steps in the process of remote sensing. (7)
10. (a) For setting out a sewer between sections A and B, the following data is available: (8)
- Gradient of the sewer = 1 in 200, Depth of the invert at lower end A is 2.65m below the peg A, Distance between Section A and B = 75m, Staff reading on peg A = 1.855m, Staff reading on peg B = 2.35m, Height of collimation of level setup nearby = 250 m, The length of boning rod = 4 m. Make necessary calculations for fixing the sight rails at A and B.
- (b) Explain setting out of a tunnel when surface alignment is possible and a vertical shaft can be easily constructed. (7)