

2019

Time : 3 Hrs

Full Marks : 100

Candidates are required to give their answers in their own words as far as practicable.

The questions are of equal value.

Answer any six questions.

1. (a) Prove that the sine s of the angles of a spherical triangle are proportional to the sine s of the opposite sides.
- (b) For any spherical triangle ABC prove that

$$\cos \frac{A}{2} = \sqrt{\frac{\sin s \sin(s-a)}{\sin b \sin c}}$$

2. (a) State and prove Napier's Analogies for a spherical triangle ABC.

- (b) For any spherical triangle,

$$\sin \frac{a}{2} = \sqrt{\frac{\cos S \cos(S-A)}{\sin B \sin C}}$$

3. (a) In any spherical triangle ABC, prove that $\tan \frac{A-a}{2}$

$$\tan \frac{B+b}{2} = \tan \frac{B-b}{2} \tan \frac{A+a}{2}$$

- (b) If in a spherical triangle ABC, if $C = A + B$ prove that $1 - \cos a - \cos b + \cos c = 0$

4. (a) In a spherical triangle ABC, in which $\angle C = \wedge > 2$, Prove that $\tan^2 \frac{a}{2} = \tan \frac{c+b}{2} \tan \frac{c-b}{2}$

$$\tan^2 \frac{a}{2} = \tan \frac{c+b}{2} \tan \frac{c-b}{2}$$

- (b) In a spherical triangle if

$$A = \frac{\pi}{5}, B = \frac{\pi}{3} \text{ and } C = \wedge > 2$$

Show that

$$a + b + c = \pi/2$$

5. (a) Discuss the phenomenon of rising and setting of stars

- (b) If h be the hour angle of a star at rising, then prove

$$\text{that } \tan^2 \frac{h}{2} = \frac{\cos(\phi - \delta)}{\cos(\phi + \delta)}$$

6. (a) Show that attitude of pole is equal to Latitude of observer.

- (b) If evening twilight ends when the sun's centre is $18''$ below the horizon show that at the equator the duration of evening twilight is given in hour by

$$\frac{12}{\pi} \sin^{-1}(\sin 18'' \sec \delta)$$

7. (a) Establish Simpson's hypothesis on refraction.
 (b) Show that the effect of refraction on zenith distance of a star, decrease it.

8. (a) Establish the formula

$$\tan \frac{v}{2} = \sqrt{\frac{1+e}{1-e}} \tan \frac{E}{2}$$

- (b) If $e = \sin \phi$, prove that the relation between true anomaly v and eccentric anomaly E is

$$\tan \frac{V}{2} = \tan \left\{ 45'' + \frac{\phi}{2} \right\} \tan \frac{E}{2}$$

9. Discuss the effect of aberration on right ascension and declination.
 10. What is the effect of precession on right ascension and declination.
 11. What is Geocentric parallax, also discuss the effect of geocentric parallax in right ascension and declination when earth is taken as spheroid.

12. Write short notes on any two of the following:

- (a) Meridian Circle
 (b) Kepler's laws of planetary motion
 (c) Equation of time
