

2019

Time : 3 hours

Full Marks : 70

Pass Marks : 32

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

The questions are of equal value.

Answer any five questions.

1. (a) Find the value of cosine of the side of a spherical triangle in terms of cosines and sines of angle.

(b) In a spherical triangle prove the formula :

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

2. (a) In a spherical triangle, prove that :

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

- (b) In a spherical triangle prove that :

$$\frac{\sin \frac{A-B}{2}}{\cos \frac{C}{2}} = \frac{\sin \frac{a-b}{2}}{\sin \frac{c}{2}}$$

3. (a) In a spherical triangle, in which $\angle C = \frac{\pi}{2}$ prove that :

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

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

4. (a) What do you mean by twilight ? Find the condition for twilight to last all night.

(b) If twilight begins or ends when the sun is 18° below the horizon, show that so long as the sun's declination is less than 18° , all places have a day of more than 12 hours including the twilight.

5. (a) Establish Simpons Hypothesis.
 (b) What is effect of Refraction on sunrise and sunset ?
6. (a) Establish Bessel's formula for correction to the observed time of transit of a star on account of all the three errors a, b and c considered together.

- (b) Prove that the error in the time of transit of a star due to the three instrumental errors is a minium for a star whose declination is

$$\sin^{-1}\left(\frac{a \cos \phi - b \sin \phi}{c}\right), \text{ where } \phi \text{ is the}$$

latitude of the observatory and a, b, c are respectively the azimuth, level and collimation error.

7. (a) State Kepler's laws of planetary motion and show that Kepler's laws can be deduced from Newton's Laws of gravitation.

- (b) Prove that :

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

8. (a) Find the equation of time and show that the equation of time vanishes four times in an year.
 (b) Prove that if the eccentricity of the earth's orbit were zero, the equation of time in mintutes would be.

$$\frac{720}{\pi} \tan^{-1} \left[\frac{(1 - \cos \epsilon) \tan \theta}{(1 + \cos \epsilon) \tan^2 \theta} \right].$$

9. Find the effect of aberration on latitude and longitude of a star.
10. Find the Geocentric parallax in right ascension and declination when earth is taken as spheroid.



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