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Reg. No. :

Code No. : 40575 E Sub. Code : SEMA 5 A

B.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2019.

Fifth Semester

Mathematics — Core

Major Elective – ASTRONOMY I

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The sum of the three sides of a spherical triangle is less than _____
- (a) 360° (b) 270°
(c) 245° (d) 185°

2. In the spherical triangle ABC, the cotangent formula is given by $\cos b \cos C =$ _____

- (a) $\sin b \cot a + \sin C \cot A$
(b) $\sin b \cot a - \sin C \cot A$
(c) $\sin b \cot a + \sin A \cot C$
(d) $\sin b \cot A + \sin A \cot C$

3. The _____ secondaries to the horizon are called _____

- (a) declination circles
(b) meridian circles
(c) vertical circles
(d) equator

4. Condition for a star of to circumpolar if _____

- (a) $\delta \geq 90 + \phi$ (b) $\delta \geq 90 - \phi$
(c) $\delta \leq 90 - \phi$ (d) $\delta \leq 90 + \phi$

5. For a place in the north temperature zone, _____ is the longest day

- (a) Dec 22 (b) March 21
(c) Sep 23 (d) June 21



6. Due to refraction, the altitude is _____ and zenith distance is _____ of a celestial body

- (a) Increased, decreased
- (b) Increased, increased
- (c) Decreased, increased
- (d) Increased, decreased

7. The horizontal parallax of the sun is _____

- (a) 8".5 (b) 8".9
- (c) 8".8 (d) 8".6

8. The formula for geocentric parallax is _____

- (a) $p = \frac{a}{d} \sin z$ radians
- (b) $\sin p = \frac{a}{d} \cos z$ radians
- (c) $\sin p = \frac{a}{d} \sin z \times \frac{180}{\pi} \times 60$ seconds
- (d) $p = \frac{a}{d} \sin z \times \frac{180}{\pi}$ seconds

9. The position of the earth in its actual orbit around the sun when it is farthest from the sun is called _____

- (a) Perihelion (b) Aphelion
- (c) Perigee (d) Apogee

10. Apogee falls on _____

- (a) January 3 (b) January 13
- (c) July 3 (d) July 13

PART B — (5 × 5 = 25 marks)

Answer ALL questions choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) In a spherical triangle ABC, Prove that $\frac{\sin(A+B)}{\sin C} = \frac{\cos a + \cos b}{1 + \cos c}$

Or

(b) In a spherical triangle ABC, right angle at C, prove that $\sin a = \tan B \cot B$ and $\sin b = \tan a \cot A$.



12. (a) Find the azimuth of a star at rising.

Or

- (b) Find the condition that a star is circumpolar.

13. (a) Find the effect of refraction on a small horizontal arc.

Or

- (b) Find the effect of refraction on a small vertical arc.

14. (a) Find the relation between horizontal parallax and angular radius of a body.

Or

- (b) Find the change in declination of a body due to geocentric parallax.

15. (a) State Kepler's of planetary motion.

Or

- (b) In V_1 and V_2 are the velocities of the earth at perihelion and aphelion, prove that $v_1(1 - e) = v_2(1 + e)$ where e is the eccentricity of the earth's orbit.

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PART C — (5 × 8 = 40 marks)

Answer ALL questions choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) In a spherical triangle ABC, prove that

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

Or

- (b) Find the relation between the elements of a spherical triangle and its polar triangle.

17. (a) Find the duration of twilight.

Or

- (b) Find the number of consecutive nights having twilight throughout night.

18. (a) Explain the method to find cassin is constants A and B.

Or

- (b) Find the effect of refraction on any small arc.

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19. (a) Find the effect of parallax on the latitude of a star.

Or

- (b) Find roughly the distance of a star in light years, given that the parallax of the star is $0''.15$, The sun's parallax $9''$, The earth's radius 4000 miles and the velocity of light 186400 miles per second.

20. (a) Derive Kepler's third law from Newton's law of gravitation.

Or

- (b) With usual notation, show that

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

