Reg. No. : ....

Code No. : 20307 E   Sub. Code : SEMA 5 A

B.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2021.

Fifth Semester

Mathematics

Major Elective — ASTRONOMY — I

(For those who joined in July 2017–2019)

Time : Three hours   Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answers :

1. The plane section of a sphere not through its center is called a ——————

    (a) great circle   (b) small circle

    (c) spherical radius   (d) angular radius

2. The vertices of one triangle are diametrically opposite to the vertices of another triangle, then the triangles are called —————

(a) colunar (b) lunar

(c) primitives (d) antipodal

3. The tangent plane at the position of the observe to the surface of earth produced in all directions meets the celestial sphere along a great circle. This great circle is called —————

(a) zenith (b) nadir

(c) celestial horizon (d) celestial meridian

4. The right ascension α and declination δ of the sun will always be connected by the equation —————

(a) $\tan \delta = \tan \omega \cos \alpha$ (b) $\tan \delta = \tan \omega \sin \alpha$

(c) $\tan \delta = \cos \omega \tan \alpha$ (d) $\tan \delta = \sin \omega \tan \alpha$

5. The region bounded by the tropic of cancer and the artic circle is called the —————

(a) North temperature zone

(b) North torrid zone

(c) North frigid zone

(d) North pole zone

6. Cassini's constants of refraction is defined by ————————

(a) 58".94 and 0.067
(b) − 58".94 and 0.064
(c) 58".94 and −0.067
(d) −58".94 and −0.067

7. Horizontal parallax of the sun is about ————————

(a) 5".8
(b) 57'
(c) 23'
(d) 8".8

8. The maximum value of the parallax of the star is called the ————————

(a) stellar parallax

(b) annual parallax

(c) heliocentric parallax

(d) geocentric parallax

9. The mean anomaly of a planet at time t is ————

(a) $\dfrac{2\pi}{t}$

(b) $\dfrac{2\pi}{T}$

(c) $\dfrac{2\pi T}{t}$

(d) $\dfrac{2\pi t}{T}$

10. The direction in which the body is seen from the center of earth is called —————

    (a) helio centric direction

    (b) stellar direction

    (c) geocentric direction

    (d) eccentri direction

    PART B — (5 × 5 = 25 marks)

    Answer ALL questions, choosing either (a) or (b)
    Each answer should not exceeding 250 words.

11. (a) If AD is the interval bisector of the angle CAB of the spherical triangle ABC, prove that $\cot AD = \dfrac{1}{2}(\cot b + \cot c)\sec \dfrac{A}{2}$.

    Or

    (b) By limiting process establish the cosine formula of plane trigonometry from the corresponding formula of spherical trigonometry.

12. (a) In a place of latitude 45°, show that the interval between a star's rising and the instant when it is due west is constant.

    Or

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    [P.T.O]

(b) *A* and *B* are two places on the earth such that the latitude of *A* exceeds that of *B* by 18° and *A* lies in the frigid zone. Show that if on any day *A* has the sun continuously for 24 hours above the horizon, *B* has twilight throughout the night and vice versa.

13. (a) Show that at any place the sun stays as long above the horizon as the he stays below it in the course of a year.

Or

(b) If *K* be the coefficient of refraction show that the sine of the zenith distance of an object is reduced by refraction $\pm 0(1 - K)$ of its true value.

14. (a) If the moon's horizontal parallax is 57′ and its angular diameter be 32′, find its radius and its distance from the earth (earth's radius = 4000 miles).

Or

(b) The distance of a star *S* is 4 times as much as the distance of another star S_1. If the parallax of S_1 is 0.0005″, find the parallax of *S*.

15. (a) Find the mass of a planet by using Kepler's third law.

Or

(b) If l, l_1 be the latera recta of the orbits of the earth and a planet, show that the area traced out by the planet in a given time is equal to $\sqrt{\dfrac{l_1}{l}}$ finites the area traced out by the earth in the same period.

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b)
Each answer should not exceeding 600 words.

16. (a) In the spherical triangle ABC, prove that $\cos b \cos C = \sin b \cot a - \sin C \cot A$.

Or

(b) In the spherical triangle ABC, if b and c remain constant and the other elements have small variations prove that

(i) $\Delta B \tan C = \Delta C \tan B$

(ii) $\Delta a = \Delta A \sin c \sin B$

(iii) $\Delta a \cot c = -\Delta B \sin a$.

17. (a) If the altitude of a star is equal to the latitude of the place of observation, show that the hour angle and azimuth are respectively.

$$\cos^{-1}\left[\tan\phi\tan\left(\frac{\pi}{4}-\frac{\delta}{2}\right)\right] \text{ and }$$

$$2\sin^{-1}\left[\sec\phi\sin\left(\frac{\pi}{4}-\frac{\delta}{2}\right)\right].$$

Or

(b) If the declination of the sun changes from 8° to $\delta°+s''$ between sun rise and sun set, show that the afternoon will be longer than the forenoon by $\dfrac{\sec\delta\sin\phi}{\sqrt{\cos^2\phi-\sin^2\delta}}\cdot\dfrac{s}{15}$ seconds, ϕ being the latitude of the place.

18. (a) Find the effect of refraction on the R.A. and declination of a star.

Or

(b) Derive the Cassini's formula for refraction

19. (a) Define angular diameter and angular radius. Show that the angular radius of a body varies inversely as its distance from the observer. Also find the relation between horizontal parallax and angular radius of a body.

Or

(b) If X_1 and X_2 be the positions of a star X as displayed by parallax at two instants separated by 3 months, show that XX_1 and XX_2 are conjugate semi diameters of the parallactic ellipse.

20. (a) State Newton's law of gravitation and explain how the third law of Kepler may be derived from it.

Or

(b) If $e = \sin \theta$, show that when powers of e are neglected the value of u satisfying Kepler's equation is given by $\tan u = \sec \phi \tan 2x$, where $\tan x = \tan\left(45° + \dfrac{\theta}{2}\right) \tan\left(\dfrac{m}{2}\right)$.

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