

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 86
(For candidates admitted from the academic year 2023– 2024 and thereafter)

B.Sc. DEGREE EXAMINATION, APRIL 2026
BRANCH I - MATHEMATICS
FOURTH SEMESTER

COURSE : MAJOR ELECTIVE
PAPER : ELEMENTS OF SPACE SCIENCE
SUBJECT CODE : 23MT/ME/ES45
TIME : 3 HOURS **MAX. MARKS: 100**

Q. No.	SECTION A (5 × 2 = 10) Answer ANY FIVE questions	CO	KL
1.	Define a great circle and a small circle.	1	1
2.	What do you mean by First point of Aries and First point of Libra?	1	1
3.	Give the expression to obtain the dip of horizon.	1	1
4.	When does the penumbral eclipse of the moon occur?	1	1
5.	Give an expression for the mass of a planet using the correct form of Kepler's third law.	1	1
6.	What is a sidereal year and what is its duration?	1	1
Q. No.	SECTION B (10 × 1 = 10) Answer ALL questions	CO	KL
7.	Any great circle passing through the poles of a circle is called a _____ to the given circle. (a) prime (b) vertical (c) tangent (d) secondary	2	2
8.	The sum of three sides of a spherical triangle is _____. (a) equal to 360° (b) greater than 360° (c) less than 360° (d) None of these	2	2
9.	The path of the apparent annual motion of the sun is called the _____. (a) equinox (b) ecliptic (c) obliquity (d) solstice	2	2
10.	The axis of diurnal rotation of the celestial sphere is called the _____. (a) celestial axis (b) diurnal axis (c) polar axis (d) none of these	2	2
11.	The angle between the directions of ordinary horizon and the visible horizon is called the _____. (a) dip of horizon (b) end of horizon (c) origin of horizon (d) none of these	2	2
12.	The time when the centre of the sun is 6° below the horizon is called _____. (a) nautical twilight (b) civil twilight (c) astronomical twilight (d) all of these	2	2
13.	When the moon becomes the full moon from the new moon, it is said to be _____. (a) waning (b) syzygy (c) waxing (d) glowing	2	2
14.	If the moon obscures a planet in the course of its sidereal revolution, it is said to be _____. (a) solar eclipse (b) lunar eclipse (c) total lunar eclipse (d) planetary occultation	2	2

15.	_____ is the interval between two successive passages of the sun through the first point of Aries. (a) Tropical year (b) Anomalistic year (c) Sidereal year (d) none of these	2	2
16.	_____ meridian is considered as the zero meridian or prime meridian from which the longitudes of other places are measured east or west. (a) Atlantic (b) Greenwich (c) Central (d) Eastern	2	2
Q. No.	SECTION C (2 × 15 = 30) Answer ANY TWO questions	CO	KL
17.	Explain the Napier's Rules in detail.	3	3
18.	Discuss in detail about the horizontal and equatorial systems of celestial coordinates.	3	3
19.	Discuss the variations in the durations of day and night on the equator and the Arctic circle.	3	3
20.	Elaborate on the seasons in the northern hemisphere obtain the expressions for finding the actual length of each season.	3	3
Q. No.	SECTION D (2 × 15 = 30) Answer ANY TWO questions	CO	KL
21.	Derive the cosine formula for a spherical triangle.	4	4
22.	(a) If the right ascension of the sun increases by $\Delta\alpha$ while its longitude increases by $\Delta\vartheta$, show that $\Delta\alpha = \Delta\vartheta \cos \omega \sec^2 \delta$ where ω is the obliquity of the ecliptic, ϑ the longitude and δ the declination of the sun. (b) Brief about the circumpolar stars and obtain the condition for a star to be circumpolar. (7 + 8)	4	4
23.	Discuss the direct and retrograde motion of planets.	4	4
24.	Obtain Newton's deductions from Kepler's laws.	4	4
Q. No.	SECTION E (2 × 10 = 20) Answer ANY TWO questions	CO	KL
25.	In the spherical triangle ABC , if the elements b, c and A undergo small changes $\Delta b, \Delta c$ and ΔA prove that $\Delta a = \Delta b \cos C + \Delta c \cos B + \Delta A \sin b \sin c \cdot H$ where $H = \frac{\sin A}{\sin a} = \frac{\sin B}{\sin b} = \frac{\sin C}{\sin c}$.	5	5
26.	Prove that the latitude of a place is equal to the sum of the declination and meridian zenith distance of a body.	5	5
27.	Derive the conditions for occurrence of a solar eclipse.	5	5
28.	Find the sidereal time at Greenwich corresponding to mean time 10h 13m 40s am on a given date, given that the sidereal time of mean midnight was 5h 15m 42s.	5	5
