ஸ்ரீ-ல-ஸ்ரீ காசிவாசி சுவாமிநாத சுவாமிகள் கலைக் கல்லூரி

திருப்பனந்தாள் – 612504

S.K.S.S ARTS COLLEGE, THIRUPPANANDAL - 612504

QUESTION BANK

Title of the Paper

ASTRONOMY

COURSE – III MATHS

Prepared by

A.NIRAIMATHI M.Sc.,

Assistant Professor

Department of Mathematics

MAJOR BASED ELECTIVE III (A)

ASTRONOMY

Objectives :

1. To introduce the exciting world of astronomy to the students.
2. To help the students to study spherical trigonometry in the field of astronomy.
3. To understand the movements of the celestial objects.

UNIT I :

Relevant properties of sphere and formulae in spherical trigonometry (no proof, no problems) - Celestial sphere and diurnal motion -Celestial coordinates-sidereal time.

UNIT II :

Morning and evening stars -circumpolar stars- diagram of the celestial sphere -zones of earth -perpetual day-dip of horizon-twilight.

UNIT III :

Refraction - laws of refraction -tangent formula-Cassini's formula - horizontal refraction- geocentric parallax -horizontal parallax.

UNIT IV :

Kepler's laws - verification of 1st and 2nd laws in the case of earth - Anomalies -Kepler's equation - Seasons -causes -kinds of years.

UNIT V :

Moon-sidereal and synodic months - elongation - phase of moon - eclipses-umbra and penumbra - lunar and solar eclipses - ecliptic limits - maximum and minimum number of eclipses near a node and in a year - Saros.

Book for Study :

1. Kumaravel, S. and Susheela Kumaravel, *Astronomy*, 8th Edition, SKV Publications, 2004.

Unit 1: Sec: 39-79
Unit 2: Sec: 80-90,106-116
Unit3: Sec: 117-144
Unit 4: Sec: 146-162,173-178
Unit 5: Sec: 229-241,256-275

Book for Reference :

1. G V Ramachandran, Text Book of Astronomy, Mission Press, Palayamkottai, 1965.

UNIT- I

Choose the correct Answer :

1) The fixed point is the …….. of the sphere.

   a) Radius

   b) Intersection

   c) Center

   d) Plane

2) The equal distance is the ……. of the sphere.

   a) Plane

   b) Radius

   c) Center

   d) Intersection

3) The section of a sphere by a plane through its center is called a ……

   a) Radius

   b) Great circle

   c) Small circle

   d) Intersection

4) Cotangent formula is……

   a) $cos\ b\ cos\ C\ =\ sin\ b\ cot\ A - sin\ c\ cot\ a$

   b) $sin\ b\ sin\ c\ =\ cos\ b\ cot\ a - cos\ c\ cot\ A$

   c) $cos\ b\ cos\ c\ =\ sin\ b\ cot\ a - sin\ c\ cot\ A$

   d) $cos\ A\ =\ -cos\ B\ cos\ c\ +\ sin\ B\ sin\ c\ cos\ a$

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5) The portion on the surface of a sphere bounded by …….. is a spherical quadrilateral.

   a) Three great circle

   b) Great circle

   c) Small circle

   d) Four great circle

6) The points where the celestial axis meet the celestial sphere are called the ……

   a) Celestial pole

   b) Celestial axis

   c) Celestial meridian

   d) Celestial equator

7) The plane of the ecliptic is include at an angle of about ……. To the plane of the equator is called the obliquity.

   a) $27^0\ 23^1$

   b) $23^0\ 27^1$

   c) $23^1\ 27^0$

   d) $27^1\ 23^0$

8) The sun moves along a great circle of the celestial sphere eastward describing about ……. Per day.

   a) 1

   b) 1^0

   c) 1^1

   d) 0.0124

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9) The sun comes to the position mid way between $\simeq$ and γ on the ecliptic on …… it is the beginning of winter season.

a) Mar 21st

b) June 21st

c) Sep 23rd

d) Dec 22nd

10) The path of the apparent annual motion of the sun is called ……

a) Ecliptic

b) Obliquity

c) Meridian

d) Equator

Answers :

1) c 2) b 3) b 4) c 5) d 6) a 7) b 8) b 9) d 10) a

2 Marks :

11) Define Sphere.
12) Define Great and Small circle.
13) Define angle between two circles.
14) Define Spherical radius.
15) Define Lune
16) Define Celestial horizon
17) Define Celestial points.
18) Define Cardinal point.
19) Define Rising and Setting.
20) Define annual motion of the Sun.

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5 Marks :

21) The section of a sphere by a plane is a circle.
22) Explain spherical triangle.
23) Properties of spherical triangle.
24) Explain Napier's Rule.
25) Define Equinoxes and Solstices.
26) Define Equatorial system.
27) To find longitude of the sun on any day.
28) To define First point of Aries and First point of Libra.
29) Define Due North and Due South.
30) Define Eastern and Western hemisphere.

10 Marks :

31) Explain Celestial co. ordinate.
32) Relation between right ascension and longitude of the sun.
33) Show that the right ascension α and declination δ of the sun will always the connected by the equation.
    tan δ = sin α tan ω
34) At any instant the sidereal time is give by the right ascension. Plus west hour angle of the any celestial body expressed in time units at that instant.
35) The latitude of a plane is equal ti the altitude of the celestial pole.
36) Describe the uses of unit one in your own method.
37) Find the hour angle of a body at rising and setting.
38) Find the azimuth of the star at rising.
39) Three stars S_1, S_2, S_3 have the same right ascension and their declination are – $\delta, 0, \delta$ respectively show that the interval between the rising of S_1 and S_2 is the same as the interval between the risings of S_2 and S_3 .
40) Prove that the latitude of a place is equal to the sum of the declination and meridian zenith distance of a body.

UNIT - II

Choose the correct Answer :

1) The region bounded by the tropic of cancer and the arctic circle is called the ……
   a) North temperate zone
   b) South temperate zone
   c) North torrid zone
   d) South torrid zone
2) Duration of perpetual day is ……
   a) $364(1/4)/90^0 cos^{-1}\ (\ cos\ \emptyset\ cosec\ \omega)\ days$
   b) $365(1/4)/180^0 sin^{-1}\ (\ cosec\ \emptyset\ cos\ \omega)\ days$
   c) $365(1/4)/180^0 cos^{-1}\ (\ cos\ \emptyset\ cosec\ \omega)\ days$
   d) $364(1/4)/180^0 sin^{-1}\ (\ cosec\ \emptyset\ cos\ \omega)\ days$
3) There is a dim light for short time every day before sunrise and after sunset is called ……..
   a) North Frigid zone
   b) Twilight
   c) Dawn
   d) Plane
4) Evening twilight is called ……..
   a) Radius
   b) Dawn
   c) Twilight
   d) Dusk
5) The time when the sun is at a depth of ……. the horizon is called Astronomical Twilight.
   a) 18^0 below
   b) 9^0 above
   c) 9^0 below
   d) 18^0 above
6) Which is circumpolar star.
   a) North, South

b) North, West

c) South, West

d) South, East

7) The spherical cap bounded by the ……. is called the North Frigid Zone.

a) Antarctic circle

b) Tropic of Capricorn

c) Arctic circle

d) Tropic of cancer

8) The curve passing through the point to contact of these tangents is called the ……

a) Visible horizon

b) Invisible horizon

c) Tropic of Capricorn

d) Tropic of cancer

9) On the tropic of cancer ∅ is …….

a) ω

b) $\emptyset$

c) γ

d) δ

10) The angle between the direction of ordinary horizon and the visible horizon is called …….

a) Plane

b) Dip of horizon

c) Visible horizon

d) Invisible horizon

Answers :

1) a 2) c 3) b 4) d 5) a 6) a 7) c 8) a 9) a 10) b

2 Marks :

11) Define Invisible circum polar star.

12) Draw the celestial sphere.

13) Define Morning stars.

14) Define Tropic of Capricorn.

15) Define North Torrid zone.
16) Define Perpetual day.
17) Draw the Dip of horizon.
18) Define Twilight.
19) Define Nautical twilight.
20) Define Dawn and Dusk.

5 Marks :

21) Explain Morning and Evening star.
22) Explain North circum polar star.
23) Find the condition that a star is circum polar star.
24) Explain perpetual day and perpetual night.
25) Define effects of Dip
26) Draw the Celestial meridian. Note the point.
27) Show that the latitude of a place is equal to be arithmetic mean of the meridian and altitude of circum polar star.
28) Define Dip of Horizon
29) Explain Twilight.
30) Expression for Dip.

10 Marks :

31) Explain circumpolar star.
32) To find the time taken by a star to rise from a small vertical distance X^{II} below the horizon.
33) Show that the latitude of a place is equal to be arithmetic mean of the meridian and altitude of a circum polar star.
34) Describe the zones of earth.
35) To find the duration of perpetual day in a place of latitude$\emptyset > 90^0 - \omega$.
36) Find the condition that twilight may last throughout night.
37) Find the duration of twilight.
38) If the evening twilight ends when the sun is 18^0 below the horizon show that at the equator the duration of evening twilight is give by $12/\pi \ sin^{-1}(sin\, 18^0 \ sec\, \delta)$.
39) Find the number of consecutive night having twilight throughout night.

40) Find the duration of twilight when it is shortest.

UNIT - III

Choose the correct Answer :

1) Tangent formula for refraction r is ……...
   a) $k\ tanz$
   b) $tanz$
   c) $tanz\ tanx$
   d) $tanz\ sinx$
2) It is found that k is ……. nearly.
   a) 56.2^{II}
   b) 54.2^{II}
   c) 58.2^{II}
   d) 60
3) That earth is surrounded by a number of layers of atmosphere extending to a height of about ……..
   a) 150 miles
   b) 100 miles
   c) 52 miles
   d) 132 miles
4) When $z = 90^0$ the body is on the horizon and the parallax is called the …….
   a) Horizontal parallax
   b) Horizontal arc
   c) Geocentric parallax
   d) Angular diameter
5) The angle subtended at the i of the observer by the diameter of a body is called its ……...
   a) Angular radius
   b) Angular diameter
   c) Horizontal parallax
   d) Geocentric parallax

6) The angle subtended by the radius of the body at the $\hat{\imath}$ of the observer is called its ……..…

a) Horizontal arc

b) Angular diameter

c) Angular semi diameter

d) Horizontal parallax

7) Horizontal parallax p is ……

a) $(d + 1/a)$

b) (d/a)

c) $(a + 1/d)$

d) (a/d)

8) $\mu \sin \emptyset = sin\ (\emptyset + r)$. Since r is small put $sin\, r\ =\ r\ ;\ cos\, r\ =\ 1$. Find r is……

a) $(\mu -\ 1)\ sin\ \emptyset$

b) $(\mu -\ 1)\ tan\ \emptyset$

c) $(\mu -\ 1)\ cosec\ \emptyset$

d) $(\mu -\ 1)\ sec\ \emptyset$

9) It gets refracted in the successive layers and reaches the observer in a direction in which t started. This deviation of light is called ……

a) Refraction

b) Horizontal parallax

c) Angular diameter

d) Astronomical refraction

10) Cassini's formula r is …….

a) $A\ tanz\ +\ B\ tan^3\ z$

b) $tan^3\ z$

c) $A\ tan^3\ z +\ B\ tan^3\ z$

d) $tan\ z$

Answers :

1) a 2) c 3) b 4) a 5) b 6) c 7) d 8) b 9) d 10) a

2 Marks :

11) Define Refraction.

12) Define laws of refraction.
13) Define Astronomical refraction.
14) Let $\mu = \frac{\sin\ (\emptyset + r)}{\sin\ \emptyset}$ To find r, when r is small.
15) Define Parallax.
16) Define Geocentric parallax.
17) Define Horizontal parallax.
18) To draw the horizontal parallax of moon by meridian observer.
19) Define Angular diameter.
20) Define Angular radius.

5 Marks :

21) Explain Refraction.
22) Explain the laws of refraction.
23) Co. efficient of refraction.
24) To find Cassini's constants A and B.
25) Tangent formula for refraction.
26) Explain Geocentric parallax.
27) Effect of Geocentric parallax on the rising and setting of a celestial body.
28) Show that the angular radius of the body varies inversely has its distance from the observer.
29) Find the relation between horizontal parallax and angular radius of the body.
30) Show that due to the horizontal parallax P the moons angular radius is increased in the ratio $1 : cos\ p$.

10 Marks :

31) Find Tangent formula for refraction
32) Find the effects of refraction on the right ascension and declination of a star.
33) Find the effect of refraction on a small horizontal arc.
34) Cassini's formula.
35) Explanation of Geocentric parallax.
36) Effect of Geocentric parallax.
37) Changes in RA and declination of body due to Geocentric parallax.
38) To find the horizontal parallax of moon by meridian observation.

39) If the moons horizontal parallax is 57^1 and here angular diameter be 32^1, Find here radius and here distance from the earth (earth's radius = 4000 miles).

40) Describe refraction and law of refraction.

UNIT - IV

Choose the correct Answer :

1) The position E_0 of the earth in its actual orbit around the sun is when it is nearest to the sun is called……
   a) Perihelion
   b) Aphelion
   c) Apses
   d) Apse line
2) Every planet describes an elliptic orbit around the sun, the sun being situated at focus. It is ……. Kepler's law.
   a) None of this
   b) Ist law
   c) IInd law
   d) IIIrd law
3) The equation of ellipse is …….
   a) $l/r = 1 + e$
   b) $l/r = 1 + cos\theta$
   c) $l/r = 1 + e\,cos\theta$
   d) $l/r = 1 + e\,sin\theta$
4) The Areal velocity of planet is …….
   a) $½\, r^2\, d\theta/dt$
   b) $½\, r\, d\theta/dt$
   c) $½\, r^2\, dt/d\theta$
   d) $r/2\, dr/dt$
5) Perihelion and aphelion (or perigee and apogee) are together called the……..
   a) Perihelion
   b) Aphelion

c) Apses

d) Apse line

6) Perigee falls on ….. and apogee falls on ……..

a) Jan 3rd,July 3rd

b) July 3rd,Jan 3rd

c) Jan 30th,July 30th

d) July 30th,Jan 30th

7) The longitude of the perigee is found to be about……..

a) 83^0

b) 280^0

c) 28^0

d) 283^0

8) Mean Anomaly is …….

a) $\frac{2\pi}{T}.t$

b) $\frac{\pi}{T}.t$

c) $\frac{4\pi}{T}$

d) 2π

9) 89 days 0.5 hours length of …… season time.

a) Spring

b) Summer

c) Winter

d) Autumn

10) The ……. year is the interval between two successive passages of the sun through the first point of Aries (γ).

a) Sidereal year

b) Tropical year

c) Anomalistic year

d) Leap year

Answers :

1) a 2) b 3) c 4) a 5) c 6) a 7) d 8) a 9) c 10) b

2 Marks :

11) Define Kepler's IInd law.
12) Define Perihelion and Aphelion.
13) Define Perigee and Apogee.
14) Define Apses and Apse line.
15) Draw the true anomaly and eccentric anomaly of the planet.
16) Define Mean solar time.
17) Define Seasons.
18) Define Sidereal year.
19) Define Tropical year.
20) Define Leap year.

5 Marks :

21) Write the Kepler's law.
22) Explain True anomaly and Eccentric anomaly of the planet.
23) Define Mean Anomaly.
24) To express u as a series in "m".
25) To express v in terms of "m".
26) To express "m" in terms of "v".
27) Effect of equation of time on the lengths of morning and evening.
28) Explain Seasons.
29) Explain causes of season.
30) Explain Different kind of years.

10 Marks :

31) Newton's deduction from Kepler's law.
32) To find the relation between u and v.
33) To find $V = u + e\,sin\,u + \frac{e2}{4} sin\,2u + \cdots$
34) To prove that $m = u - e\,sin\,u$
35) Describe Lengths of seasons.
36) If P be the number of days in the year and if summer is longer than spring by Q days and longer that autumn by R days find the eccentricity of the earth's orbit and the longitude of perigee.

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37) Describe different kind of years.

38) Describe causes of season.

39) Prove that than equation of vanishes four times a year.

40) Analytical expression for the equation of time.

UNIT - V

Choose the correct Answer :

1) The moon is at a distance of about ….. miles from the earth.
   a) 40.000
   b) 2,40,000
   c) 2,00,000
   d) 2,35,040
2) The Lunar orbit is at an angle of $5^0\ 8^1$ to the ecliptic and it eccentricity is……..
   a) 1/18
   b) 1/180
   c) 1/90
   d) 1/240
3) The two points of intersection of lunar orbit and the ecliptic are called the …….
   a) Lunar orbit
   b) Sidereal Month
   c) Nodes
   d) Synodic Month
4) The line joining the nodes of the …… is called the nodal line.
   a) Sidereal Month
   b) Nodes
   c) Lunar orbit
   d) Moon
5) Sidereal month is above …… days.
   a) $26\frac{1}{23}$

b) $27\frac{1}{3}$

c) $25\frac{1}{13}$

d) 27

6) The elongation of moon at any instant is the difference between the …… of the sun and moon.

a) Longitudes

b) Latitude

c) Synodic

d) Lunar

7) When the moon $\theta > 90^0$ is called ……

a) Hunters moon

b) Eclipses

c) Winter

d) Gibbous

8) Eclipses are two types. They are……

a) Harvest and Hunters moon

b) Synodic and Solar

c) Solar and Lunar

d) None of this

9) The moon when $\theta = 180^0$ is ……..

a) Full

b) Gibbous

c) Crescent

d) Dichotomized

10) Synodic month is about ……. Days.

a) $29\frac{1}{2}$

b) $27\frac{1}{3}$

c) 29

d) 27

Answers :

1) b 2) a 3) c 4) c 5) b 6) a 7) d 8) c 9) a 10) a

2 Marks :

11) Define Moon.
12) Define Nodes.
13) Define types of nodes.
14) Define sidereal month.
15) Define synodic month.
16) Draw the phase of moon.
17) Define Solar eclipse.
18) Define Lunar eclipse.
19) Draw the lunar eclipse.
20) Comparison of solar and lunar eclipse.

5 Marks :

21) To find the relation between sidereal and synodic months.
22) Explain Elongation.
23) Draw the different phases of moon.
24) Explain the types of eclipses.
25) Draw the shadow cone cost by the earth.
26) Draw the Lunar eclipse.
27) To find the angle between a direct common tangent and the line of center of two circles.
28) To find the angle between a transverse common tangent and the line of center of two circles.
29) Comparison of solar and lunar eclipse.
30) Explain moon and nodes.

10 marks :

31) Describe phases of moon.
32) Discuss the different Phases of moon using of formula.
33) To find the relations between sidereal and synodic period of a planet.
    $ie) \; 1/S \; = \; 1/T \frown 1/Y$

34) If P and Q are the period of two planet moving in circular orbit and if their elongation has seen from each other. When the planet are stationary are given by ∅ and θ. Then show that $P\ tan\emptyset\ =\ Q\ tan\theta\ =\ 0$.

35) Explain the shadow cone cost by the earth.

36) Explain Lunar eclipse.

37) Show that how to calculate the light of lunar mountain.

38) To find the condition for the occurrence of a lunar eclipse.

39) Find the condition for occurrence of solar eclipse.

40) If θ and ∅ are the semi vertical angles of the shadow and the cone of pennumber cost by the earth and if S be the semi diameter of the sun. show that $2sin\ S\ =\ sin\ \theta\ +\ sin\ \emptyset$

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