2021

M.Sc.

Third Semester

DISCIPLINE SPECIFIC ELECTIVE – 02

PHYSICS

Course Code: MPHD 3.21 (A)

(Astronomy & Astrophysics)

Total Mark: 70 *Pass Mark: 28*

Time: 3 hours

Answer five *questions, taking* one *from each unit.*

UNIT–I

1. (a) Describe the horizon system of coordinates with proper diagram. Discuss its drawbacks. 6

   (b) Find the zenith distance and altitude at the upper culmination of the stars from the following data:

   (i) Declination of star = 42°15' N
   Latitude of the observer = 26°40' N

   (ii) Declination of star = 23°20' N
   Latitude of the observer = 26°40' N 4

   (c) Explain the formation of the seasons with proper diagram. 4

2. (a) Draw the celestial sphere and write celestial sphere's features on it. 6

   (b) What are the various motions of earth? Explain them. 4

   (c) How high is Sun at noon in Kohima on equinox and solstice (latitude of Kohima is 25.6° N)? 4

UNIT–II

3. (a) The parallax angles of the Sun's neighbouring star, Alpha Centauri, is 0.7453". Calculate its distance. 3

   (b) The distance modulus of Vega is –0.5. At what distance is it from earth? 3

   (c) The apparent magnitude of the Sun is –26.81 and that of the star Sirius is –1.47. Which one of them is brighter and by how much amount? 4

(d) Define the following termS for telescope
(i) resolving power and diffraction limit
(ii) magnifying power
(iii) light gathering power 2+1+1=4

4. (a) Show that the apparent magnitude (m) of a star depends on its intrinsic luminosity (L) and its distance (d). 4
(b) Calculate the diffraction limit of resolution of a telescope of 200 *inch* diameter for $\lambda = 457$ *nm*. Compare its light gathering power with a telescope of 200 *mm* diameter. 4
(c) Write short notes on
(i) CCD
(ii) Atmospheric scintillation 3+3

UNIT–III

5. (a) What are nebulae? Write the classification and distribution of galactic nebulae. 4
(b) What are variable stars? Discuss the various types of intrinsic variable stars in detail. 7
(c) Phobos (one of the moon of Mars) orbits Mars with an average distance of about 9380 km from the centre of the planet and a rotational period of about 7hr 39 min. Use this information to estimate the total mass of the system. 3

6. (a) Discuss the period luminosity relation of Cepheid variables. 4
(b) The period of a Cepheid is 25.3 days in M100 and its apparent magnitude is 25.3. Find its distance. 4
(c) Define specific intensity(I_ν), mean intensity (J_ν) and radiation flux density (F_ν) and write its relations. 6

UNIT–IV

7. (a) What is the polytrope model of a star? Derive the Lane-Emden equation and find its solution for $n = 0$. 8
(b) The life time of a star (τ) on main sequence is related to its mass (M) as $\tau \propto M^{-2.5}$. The estimated life time of the Sun on the main sequence is approximately 10^{10} years. Calculate the main sequence life time of a star of mass
(i) $10\ M_s$

(ii) $0.5\ M_s$ 4

(c) Explain Hayashi line on H-R diagram. 2

8. (a) Derive the following equations for stellar structure

(i) $\frac{dM(r)}{dr} = \rho(r) 4\pi r^2$

(ii) $\frac{dL(r)}{dr} = \epsilon \rho(r) 4\pi r^2$ 7

(b) What is a H-R diagram? Explain briefly the stellar evolution with H-R diagram. 3+4=7

UNIT–V

9. (a) What is thermal Bremsstrahlung? Show that power radiated per unit frequency is independent of distance. 8

(b) Derive an expression for power radiated by a relativistic electron moving in a magnetic field. 6

10. (a) Discuss the Thomson scattering and show that $\sigma_T = \frac{8\pi}{3} r_0^2$; where r_0 is the classical electron radius. 8

(b) Explain the stellar evolution using H-R diagram and discuss the possible end stages of a star. 6
