2023

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) Write the different systems of co-ordinates employed to locate position of heavenly bodies. Explain horizon co-ordinate system. 5+3=8

   (b) Find the zenith distance and altitude at the upper culmination of the stars from the following data: 6

   (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

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

   (b) Show that altitude of the pole is equal to latitude of the place 4

   (c) Write short notes on following: 2×2=4

   (i) Equation of time

   (ii) Ecliptic and equinoctial points

UNIT–II

3. (a) What do you understand by apparent and absolute magnitude of a star? Obtain a relation for distance modulus of a star. 2+2+4=8

   (b) Explain the photomultiplier tube and discuss the detection limit of telescopes. 4+2=6

4. (a) If the measured parallax of Sirius is 0.38". What is its distance from Earth in parsecs (pc) and in light-years (ly)? 4

(b) The distance modulus of the star Vega is –0.5. At what distance is it from Earth? 4

(c) What do you mean by 'atmospheric extinction' and 'scintillation'? 6

UNIT–III

5. (a) Derive the Jean's criterion for star formation. 6

   (b) Define the term emission and absorption coefficient of radiation field passing through matter and obtain the radiation transfer equation. 4+4=8

6. (a) What are binary stars? Write and discuss the different types of binary stars. 10

   (b) What are Cepheid variable stars? Discuss the period-time relation of Cepheid variables. 4

UNIT–IV

7. Derive the following equation for stellar structure: 7×2=14

   (a) $\frac{dL(r)}{dr} = \in p(r)4\pi r^2$

   (b) $\frac{dT(r)}{dr} = -\frac{L}{4\pi r^2 k}$

8. What is the polytrope model of a star? Derive the Lane-Emden equation and find its solution for $n = 0$? 14

UNIT–V

9. (a) Explain the stellar evolution with H-R diagram. 7

   (b) Explain Thomson scattering and derive an expression for Thomson cross-section. 7

10. (a) What is thermal radiation? Show that $E = \sigma T^4$. 7

    (b) Write short note on the following: 3½×2=7

    (i) Chandrasekhar limit

    (ii) Neutron star