

Total number of printed pages-7

3 (Sem-6/CBCS) PHY HE 4

2025

**PHYSICS**

(Honours Elective)

Paper : PHY-HE-6046

*(Astronomy and Astrophysics)*

Full Marks : 80

Time : Three hours

*The figures in the margin indicate full marks for the questions.*

1. Answer the following questions :  $1 \times 10 = 10$ 
  - (a) Write Parse in terms of Astronomical unit.
  - (b) What is distance ladder in cosmology ?
  - (c) Which coordinate does not change with time ?
    - (i) Declination
    - (ii) Hour angle

- (iii) Altitude
- (iv) Azimuth
- (d) For a group of stars, the luminosity is found to vary as the fourth power of the mass of star. When the ratio of masses of two stars is  $\sqrt{2}$ , the ratio of their Luminosities is
- (i) 2
- (ii) 4
- (iii) 8
- (iv) 16
- (e) Write the sequence of classification of stars.
- (f) What is Aladin ?
- (g) Define f-number of a Telescope.
- (h) What are lenticular galaxies ?
- (i) How does Sun produce energy ?

(j) What is Asteroid belt? What is its shape?

2. Answer the following questions :  $2 \times 5 = 10$

- (a) The absolute magnitude of a star is +1. Calculate its distance so that the apparent magnitude of the star is -1.
- (b) Calculate the resolving power of a telescope having a diameter of 2.34 m, when a radiation of wavelength  $5500 \text{ \AA}$  is detected.
- (c) What are the major regions in the solar interior? Draw a schematic view of the sun showing the regions.
- (d) Write the difference between asteroids and meteoroids.
- (e) What is white dwarf stars? How the mass of the white dwarf varies with radius?

3. Answer *any four* questions from the following :  $5 \times 4 = 20$

(a) Define the astronomical unit, the light year and the parsec. If parallax of a star is measured to be 0.6 arc-second then calculate the distance of the star in astronomical unit.  $1+1+1+2=5$

(b) Calculate the ratio of the radiant fluxes received from two stars whose apparent magnitude differ by 2.5.

(c) Write the relation between Luminosity and Mass of a main sequence star. Using this relation explain why lifetime of a massive star is shorter.  $1+4=5$

(d) Describe the sequence of reactions in the Carbon-Nitrogen-Oxygen (CNO) cycle for production of energy of a star.

(e) Explain Hubble's scheme of galaxy classification. What class has been assigned to the milky way of Galaxy?

$3+2=5$

(f) State Hubble's law of expanding universe and explain how Hubble's constant indicates the age of the universe.  $2+3=5$

4. Answer **any four** questions from the following :  $10 \times 4 = 40$

(a) (i) Write the equation of hydrostatic equilibrium of a star. From this equation obtain the relation between potential and kinetic energy of a star.  $1+6=7$

(ii) Explain how neutron stars are formed due to Supernova explosion.  $3$

(b) (i) What do you mean by main sequence stars? Write down the spectral class of stars. In which class the Sun belongs to?

$1+1+1=3$

(ii) Name the three layers of solar atmosphere. Explain the layers briefly.  $7$

- (c) (i) What is a celestial sphere? For a celestial sphere define celestial poles, celestial equator and celestial meridian. Draw a diagram showing these. 5
- (ii) Describe the altazimuth coordinate system used in positional astronomy. 5
- (d) (i) What is light gathering power of a telescope? Compare the light gathering powers of the 8m telescope and 0.8m telescope. 2+3=5
- (ii) Draw a schematic ray diagram of a Hubble Space Telescope. Explain how this telescope overcome the drawback of Land-based Telescope. 2+3=5
- (e) (i) What are cepheid variable stars? Why are they called standard candles. 5
- (ii) Write the major differences between the elliptical and spiral galaxies. 5

- (f) What are active galaxies? Explain how active galaxies are classified. What is the source of its activity?  $1+7+2=10$
- (g) Discuss qualitatively the different stages in the evolution of a star.
- (h) Write short notes on *any two* of the following:  $5 \times 2 = 10$
- (i) Hertzsprung–Russell (H-R) diagram
  - (ii) Black holes
  - (iii) Cosmic Microwave Background
  - (iv) Galactic centre and its property
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