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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 : $1 \times 10 = 10$

206 265 (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 \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?

$L \propto M^4$
 $\frac{L_1}{L_2} \propto \left(\frac{M_1}{M_2}\right)^4$
 $\frac{L_1}{L_2} = \frac{2}{1} \propto \left(\frac{M_1}{M_2}\right)^4$
 $\frac{L_1}{L_2} = 2 \propto \left(\frac{M_1}{M_2}\right)^4$
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$m - M = 5 \log \left(\frac{d}{10}\right)$

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. $1+6=7$

$\frac{dP}{dr} = -\frac{Gm}{r^2}$

(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: 5×2=10

(i) Hertzsprung-Russell (H-R) diagram

(ii) Black holes

(iii) Cosmic Microwave Background

(iv) Galactic centre and its property
