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3 (Sem-6/CBCS) PHY HE 4

2024

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) Convert 1 per sec into astronomical unit.

(b) Write the value of mass of a neutron star.

(c) For the absolute magnitude, the distance of objects from the observer is

(A) 1AU (B) 10AU (C) 1PC (D) 10PC

Contd.

- (d) Write the Chandrasekhar limit for white dwarf mass.
- (e) What is solar corona ?
- (f) What are Lenticular galaxies ?
- (g) Distinguish between sidereal and solar time.
- (h) State the cosmological principle.
- (i) How the lifetime of a star on the main sequence varies with mass ?
- (j) Define an asteroid.

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

- (a) A particular star has apparent and absolute magnitudes as -0.3 and $+4.1$. Calculate the distance in Astronomical unit.
- (b) A $100m$ radio dish is used for detection of $18cm$ radiation of OH molecule. Calculate the resolving power of radio telescope.

- (c) What is the declination of celestial equator and the celestial pole. What is right ascension ?

(d) Draw a schematic ray diagram of a Newtonian reflecting telescope.

(e) What are radio galaxies ? What do radio galaxies do ?

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

(a) Define Luminosity and Radiant flux of a star. Calculate the ratio of the radiant fluxes received from two stars whose apparent magnitudes differ by 2.5 .

$$1 + 1 + 3 = 5$$

(b) What is H-R diagram ? Sketch H-R diagram showing all groups of stars. What information about the star, the H-R diagram provides ? $1 + 2 + 2 = 5$

- (c) What is Milky Way ? What are the components of Milky Way ? Draw a schematic drawing of the Milky Way showing all the components. $1+2+2=5$
- (d) Describe briefly how a black hole can be formed in Galaxy.
- (e) Distinguish between refracting and reflecting telescopes. What are the advantages of reflecting telescope over the refracting telescope ? $3+2=5$
- (f) How does a supernova explosion lead to the production of a neutron star ?
4. Answer **any four** questions from the following : $10 \times 4 = 40$
- (a) (i) Establish the virial theorem and find the relationship between pressure and gravitational binding energy. 7

- (ii) Show that the mass of a white dwarf increases as its radius decreases. 3
- (b) (i) Draw the Hubble tuning fork diagram and describe the classification scheme of the galaxies. 7
- (ii) Explain why lifetime of a massive star is shorter. 3
- (c) (i) What are apparent and absolute magnitudes of a star ? Derive the relation between them. $1+1+4=6$
- (ii) Explain how the distance of a nearby star can be determined using trigonometric parallax method. 4
- (d) (i) Explain how the objects in the solar system are classified. 7

(ii) Distinguish between meteorites and asteroids. 3

(e) How does sun produce energy ? Explain how the process can take place in two different reaction sequences.

1+4+5=10

(f) (i) What are the principal region of solar atmosphere ? Explain their properties. 2+5=7

(ii) What is Kuiper belt ? What is the shape of Kuiper belt ? 2+1=3

(g) Obtain the fundamental equation of cosmology based on Newtonian mechanics and discuss fundamental weakness of this equation. 8+2=10

(h) Write short notes on : **(any two)**

5+5=10

(i) Oort Cloud

(ii) SIMBAD

(iii) Active Galaxies

(iv) Big Bang Theory
