2023

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 :   1×10=10

    (a) What is Stellar Parallax ?

    (b) Write the sequence of classification of
         stars.

    (c) What is the most basic property of a
         star that determines its location on the
         main sequence ?

(d) Define an asteroid.

(e) Will solar time and sidereal time differ if the difference in the longitudes of two places is equal to the difference in time ?

(f) Where does the star formation take place in our galaxy ?

(g) What is cosmic microwave background radiation ?

(h) What is the shape of Kuiper belt ?

(i) What does f-number represent in a telescope ?

(j) What is Zenith point ?

2. Answer the following questions : 2×5=10

(a) Solar corona is observed only during total solar eclipse. Why ?

(b) Express 1 January, 2023 in Julian Date.

(c) Write declination δ of

(i) Celestial North pole

(ii) Celestial South pole

(iii) Zenith

(d) State the cosmological principle.

(e) The apparent magnitude of full Moon is −12·5 and that of Venus is −4. Which one is brighter and how much ?

3. Answer **any four** questions from the following : 5×4=20

(a) Parallax of Barnard's star is 0.522. Calculate its distance in parsec, light year, astronomical unit, mile and kilometre. 1+1+1+1+1=5

(b) Sketch the Sun, and identify the corona, chromosphere, photosphere, convection zone, radiation zone and core. Explain why the temperature of the chromosphere increases with height. 3+2=5

(c) The mass of Sirius B is thrice that of the Sun. Find the ratio of luminosity and difference in their absolute magnitude. Taking the absolute magnitude of the Sun as 5, find the absolute magnitude of Sirius B. 1+2+2=5

(d) Explain *one* method used for determination of distance of nearby celestial bodies.

(e) Define luminosity and radiant flux. Using Stefan-Boltzmann law of radiation, obtain the ratio of radii R_1 and R_2 of two stars with surface temperatures T_1 and T_2 and absolute magnitudes M_1 and M_2 respectively. 2+3=5

(f) Explain the concept of distance ladder.

4. Answer *any four* questions from the following : 10×4=40

(a) Sketch the H–R diagram showing all groups of stars. Show the location of the Sun on the diagram. What information does the H–R diagram provide about stars ? 6+1+3=10

(b) What are galaxies ? Explain the origin and evolution of galaxies. How are they classified ? Draw a schematic view of the Hubble galaxy classification. What are the main differences between lenticulars and spirals ? 1+2+1+3+3=10

(c) Explain the terms ecliptic, North and South celestial pole, horizon, celestial equator, latitude, longitude, declination, right ascension and hour angle. Draw a celestial sphere and show the positions of above mentioned terms in the celestial sphere. 5+5=10

(d) Derive Virial theorem and find the internal energy of a Star.   6+4=10

(e) (i) Discuss various parts of Milky Way, Stellar populations and motions of Stars in the Milky Way.

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(ii) Define active galaxies. Mention the characteristics of active galaxies.

2+3=5

(f) Discuss different stages of the evolution of a star.

(g) What is meant by resolving power of a telescope ? Explain the Rayleigh criterion for resolution. Calculate the diffraction limit of resolution of a $3m$ telescope for wavelength $600nm$.

2+5+3=10

(h) Write short notes on **any two** of the following :   5×2=10

(i) Carbon-nitrogen cycle

(ii) White dwarf

(iii) Oort's cloud

(iv) Neutron star

(v) Oscillating universe

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