B.Sc. Semester-VI (Honours) Examination, 2020 (CBCS)

Subject: Physics

Paper: DSE-4

(Astronomy and Astrophysics)

Time: 3 Hours   **Full Marks: 60**

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own word as far as practicable.

Group-A

Answer any *three* questions from the following: **10×3=30**

1. Define the astronomical unit, the light year and the parsec. Write *1* parsec in terms of astronomical unit and light year. If parallax of a star is measured to be 0.6 arc second then calculate the distance of the star in both astronomical unit and light year.   10

2. Draw a neat diagram of celestial sphere, showing Zenith, Nadir, the Celestial poles and equator, the horizon and the ecliptic. Write down the properties of a spherical triangle.   10

3. What do you mean by apparent and absolute magnitudes and distance modulus of a star? Write down the relation between distance modulus and distance of the star from the Earth. Apparent magnitude of the Sun is -26.8. Find its absolute magnitude. Distance between the Sun & the Earth is 1.5×10^{13} cm and *1* parsec=$.3 \times 10^{18}$ cm.   10

4. State the Virial Theorem for a closed, bounded and stable gravitational system. Prove the theorem for a system of a star and a planet orbiting around it. A globular cluster has *35* parsec diameter and contains one lakh stars. Each star has mass equal to one solar mass (10^{31}kg). Estimate the average velocity of stars in the cluster. Mention two limitations of the Newton's theory of gravitation.   10

5. What do you mean by main sequence stars? Write down the spectral classes of stars. In which class the Sun belongs to? Name the layers of solar atmosphere. Why is the temperature of the sunspots lower than their surroundings?   10

P.T.O.

Group-B

Answer any *six* questions from the following: 5×6=30

6. Define the astronomical coordinates of azimuth and altitude of a star. What are the altitude and azimuth of the pole star, as measured from Kolkata (23°N, 88°E)? 5

7. Distinguish between solar day and sidereal day. Calculate the length of one sidereal day. 5

8. Give two reasons of the variation of apparent solar day. How many solar days are there in a lunar calendar? 5

9. Write down the relation between luminosity and effective temperature of a star. Observed flux density and temperature of a star at distance *5* parsec is 10^{-8} Wm^{-2} and 10^4K respectively. Estimate the radius of that star. Value of Stefan Constant is 5.67×10^{-8}Wm^{-2}K^{-4}. 5

10. Calculate the diffraction limit of resolution of a telescope with *200* inch diameter for wavelength λ= *450* nm. Compare its light gathering power with a telescope of *200* mm diameter. 5

11. Name two types of reflecting telescopes. Mention one advantage and one disadvantage of the alt-azimuth mount over equatorial mount. 5

12. What are the four components of a galaxy? Distinguish between stars of population I and II. 5

13. What are cepheid variable stars? Why are they called standard candles? 5

OR

B. Sc. Semester VI (Honours) Examination, 2020 (CBCS)

Subject: Physics (Applied Dynamics)

Paper: DSE-4

Time: 2 Hours   **Full Marks: 40**

The figures in the margin indicate full marks. Candidates are required to give their answers in their own words as far as practicable.

Answer any eight of the following questions: **5×8=40**

1. Define streamlines, streaklines and pathlines. Under what conditions do they coincide? Explain.   5

2. For a dynamical system, how do you define fixed points? what is the significance of fixed points? How do you define attractors and repellers based on the stability of fixed points?

3. Define phase space. Construct the phase curve equation and plot them for a body falling under gravitational field, provided no other forces act on the body.   5

4. (i) Find all the fixed points of for $\dot{x}= f(x) = x^2-1$, and classify their stability.

   (ii) Can fixed point be both stable and unstable? Explain.   5

5. (i) How do you construct a Sierpinski gasket?

   (ii) Do streaklines intersect? Explain.   5

6. Construct a model for logistic population growth. Solve the logistic equation analytically to find the population P after a time t.   5

7. An influenza flu pandemic spreads through a population rapidly depending on two factors- the more people who have flu, the more rapidly it spreads and also the more the uninfected people there are, the more rapidly it spreads. Consider a community of 1000 people, where initially at t=0, one person has the flu. Researchers find that for this strain of flu the logistic growth constant is 0.630. Estimate the number of people in this community who will have had this flu after 10 days. What is the limiting value in this case?   5

8. What is iteration? How is cobweb plot used to investigate qualitative behaviour of one-dimensional iterated functions.   5

9. Define shear stress at a point. From the shear stress point of view, how do you define fluid?   5

10. What is fractal? Give two examples of fractals occurring in nature. What is Sinai billiard?   5