

GROUP-C

Answer any **two** questions: $10 \times 2 = 20$

3. Discuss indirect method to find the stellar radii. Explain the *Eclipsing binary stars*. The luminosity of a star is 40 times that of the Sun and its temperature is twice as much. Determine the radius of the star.

4+3+3

4. What causes the tidal bulge of the Earth? Derive the tidal force of the Earth-Moon system. Explain Astrometric detection and Radial velocity detection of planet.

2+5+3

5. What are the assumptions made to understand the internal stellar structure theoretically? Derive the equation of hydrostatic equilibrium. What is *CNO cycle* and is it possible to begin *CNO cycle* without carbon?

- Explain it. Suppose that two nuclei have charges Z_1e and Z_2e and in order to interact, they must be separated by a distance $\sim 10^{-13}$ m. Calculate their mutual potential energy. If their relative kinetic energy is $3k_B T$, calculate the temperature required by two hydrogen nuclei to overcome this potential barrier.

2+3+2+3

U.G. 5th Semester Examination-2025

PHYSICS

[HONOURS]

Discipline Specific Elective (DSE)

Course Code : PHS-H-DSE-T-02

(Astronomy and Astrophysics)

[CBCS]

Full Marks : 60

Time : $2\frac{1}{2}$ Hours

The figures in the right-hand margin indicate marks.

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

GROUP-A

1. Answer any **ten** questions from the following:

$2 \times 10 = 20$

- What is the difference between the condensation and accretion processes?
- Write down the *Saha ionisation equation* and explain it.
- Draw the Horizon coordinate system and specify *azimuth angle, altitude, horizon*.
- What do you mean by *stellar parallax* - explain it.
- Explain the *Doppler Shift* phenomena.

- vi) State the *virial theorem* of a planet and explain its significance.
- vii) Write down the Friedmann equation. What are the possible value of 'k' and explain the significance of it.
- viii) Define absolute magnitude and write down the relation between Luminosity and absolute magnitude.
- ix) Define *parsec (pc)*. Convert this unit to S.I. unit.
- x) Define the *longitude* and *latitude*.
- xi) Define the *vernal equinox* and *autumnal equinox*.
- xii) State the *nebular hypothesis* and explain the reason behind this hypothesis.
- xiii) Explain the *stellar nucleosynthesis*.
- xiv) The apparent magnitude of the Sun is - 26.81 and that of the star Sirius is -1.47. Which one of them is brighter and by how much?
- xv) Define luminosity and radiant flux of a star.

GROUP-B

Answer any **four** questions: $5 \times 4 = 20$

2. a) What do you mean by the *apparent magnitude* of star? The apparent magnitude of the Sun is - 26.8. Find its absolute magnitude. Remember that

the distance between the Sun and the Earth is 1.5×10^{13} cm. 2+3

- b) List two evidences supporting the assumption that a disk shaped solar nebula existed during the evolution of the solar system. Why do terrestrial planets comprise mainly of materials having high melting points? How many planets are *terrestrial* and *Jovian* planets and name them? 2+2+1
- c) Derive diffusion equation of magnetohydrodynamics for solar system and show that the magnetic diffusivity is given by $\eta = (\mu\sigma)^{-1}$, where μ is magnetic permeability of the medium and σ is electrical conductivity. 5
- d) How did the planets form the solar nebula? Explain the three stages of the evolution of planets. 2+3
- e) Why are three α -particles needed to initiate helium reactions? Explain the importance of triple- α reaction in the formation of heavy nuclei. In what way is triple- α reaction related to the origin of life on the Earth? 2+2+1
- f) What is Universal Equatorial coordinate system? Calculate the zenith distance of a star whose latitude is 50°N and declination is 20°N when it is on the observer's meridian. 2+3