U.G. 5th Semester Examination-2021

PHYSICS

[HONOURS]
Discipline Specific Elective (DSE)
Course Code : PHS-H-DSE-T-02
(Astronomy and Astrophysics)

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:

$2\times10=20$

i)   Write down the Friedmann equation. What are the possible value of 'k' and explain the significance of it.

ii) 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?

iii) State the *virial theorem* of a planet and explain its significance.

iv) Define luminosity and radiant flux of a star.

v)   Define absolute magnitude and write down the relation between Luminosity and absolute magnitude.

vi) Explain the *Doppler Shift* phenomena.

vii) Define *parsec (pc)*. Convert this unit to S.I. unit.

viii) What do you mean by *stellar parallax* - explain it.

ix) Define the *longitude* and *latitude*.

x)   Draw the Horizon coordinate system and specify *azimuth angle, altitude, horizon.*

xi) Define the *vernal equinox* and *autumnal equinox.*

xii) Write down the *Saha ionisation equation* and explain it.

xiii) State the *nebular hypothesis* and explain the reason behind this hypothesis.

xiv) What is the difference between the condensation and accretion processes?

xv) Explain the *stellar nucleosynthesis.*

GROUP-B

Answer any **four** questions: $5\times4=20$

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) What is Universal Equitorial 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

c) Derive diffusion equation of magnetohydrodymanics 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) 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

e) How did the planets form the solar nebula? Explain the three stages of the evolution of planets. 2+3

f) 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

GROUP-C

Answer any **two** questions: 10×2=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 $3k_BT$, calculate the temperature required by two hydrogen nuclei to overcome this potential barrier. 2+3+2+3

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