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Unique Paper Code : 2223510019
Name of Course : B.Sc. Prog.-(Physics)_NEP: UGCF-2022
Semester : V- Semester
Name of the Paper: : Foundation of Astrophysics (DSE paper)
Semester : V
Duration : 3 Hours
Maximum Marks : 90

Instructions for Candidates

Write your Roll No. on the top immediately on receipt of this question paper.

Attempt five questions in all.

Question No. 1 is compulsory.

1. (a) Define the astronomical unit, the light year and the parsec. (6X3=18)
(b) Explain the atomic origin of emission and absorption spectra
(c) What do you mean by apparent and absolute magnitudes of a star?
(d) Given that the solar constant is 1370 Wm^{-2} , calculate the luminosity of the sun.
(e) Why is it necessary to propose the existence of dark matter?
(f) Why is Balmer lines of Hydrogen weak in both hottest and the coolest star?
(g) How are Sunspots groups divided according to the nature of their magnetic polarity?
2. (a) Draw a neat diagram of celestial sphere, showing Zenith, Nadir, the Celestial poles and equator, the horizon and the ecliptic. Explain in detail the Horizontal system, the Equatorial system and the Ecliptic system of Celestial coordinates. 10
(b) Define proper motion of a star. Establish relation between the transverse velocity, parallax and proper motion of the star. 8
3. (a) Define Luminosity of a star. Derive its relationship with the temperature and the radius of the star? 4
(b) Draw an H-R diagram showing quantities represented on its x-and y-axes. Mark the position of supergiant, red giants, white dwarfs and subdwarfs. Place the following stars on the H.R. Diagram : B and K 10
(c) Explain why are strong lines of neutral metals and band of molecules present in M stars? 4

4. (a) Explain how energy travels from the core of the sun to its surface. Mention any phenomenon which is caused by the manner in which energy is transferred in the surface layers of the sun. 8
 (b) Compute the time taken by a photon to travel from the centre of the sun to its surface if the mean free path of the photons is 0.5 cm and the radius of the sun is 6.8×10^8 m. 5
 (c) Describe briefly the solar corona. Explain why its temperature is so high compared with that of the photosphere. 5

5. (a) What are cepheid variable stars? Why are they called standard candles? 6
 (b) Write the period luminosity relation for Cepheid variable stars. Explain how this relation has been used for finding distances of external galaxies. 6
 (c) State Hubble's law. Given that $H = 70 \text{ km s}^{-1} \text{ Mpc}^{-1}$, estimate the age of the universe. 6

6. (a) Make a sketch of the Milky - way Galaxy. Show the position of the sun in it. 4
 (b) Enumerate the characteristics of the terrestrial and Jovian planets and highlight their major differences? 6
 (c) State the Oparin-Haldane hypothesis of origination of life on earth. How could building blocks like amino acids or nucleotides have assembled into actual biological macromolecules on early Earth? 8

CONSTANTS

$$G = 6.67 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$$

$$k_B = 1.38 \times 10^{-23} \text{ J/K}$$

$$\sigma = 5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$$

$$M_{\text{sun}} = 1.99 \times 10^{30} \text{ kg}$$

$$R_{\text{sun}} = 6.96 \times 10^8 \text{ m}$$

$$L_{\text{sun}} = 3.86 \times 10^{26} \text{ W}$$

$$1 \text{ A. U.} = 1.5 \times 10^{11} \text{ m}$$