WEST BENGAL STATE UNIVERSITY
B.Sc. Honours 6th Semester Examination, 2023

PHSADSE05T-PHYSICS (DSE3/4)

Full Marks: 50

Time Allotted: 2 Hours

The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.

Answer Question No. 1 and any *two* questions from the rest

$2 \times 15 = 30$

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

   (a) Luminosity of a star is 10 times that of the Sun. Calculate the difference in their absolute magnitude.

   (b) What are Cepheid variable stars? Explain their role in distance measurement in Astronomy.

   (c) Define 'Hour angle' and Right Ascension.

   (d) Given that the solar constant is 1370 Wm^{-2}, calculate the luminosity of Sun.

   (e) Write four characteristics of the terrestrial and jovian planets.

   (f) Why is it necessary to propose the existence of Dark matter?

   (g) What causes granulation of photosphere?

   (h) What is meant by "Differential Rotation" of Milky Way?

   (i) Why the elliptical Galaxies are said to be just the residue of the merger between two or more spiral Galaxies?

   (j) Why does 'Limb Darkening' happen?

   (k) The estimated lifetime of Sun on Main Sequence is $\sim 10^{10}$ years. Determine the Main Sequence lifetime of a star of mass $0.5 M_\odot$, where $M_\odot$ is Sun's mass.

   (l) A galaxy of absolute magnitude, $M = -20$, is at a distance of 700 kpc. Would it be visible to the unaided eye?

   (m) Two stars are 1.5 arc-second apart. Examine if they would be resolved by a 25 cm telescope working at wavelength 550 nm.

   (n) Explain why stars towards the centre of our galaxy appear fainter and redder.

   (o) List the types of binary star system.

   (p) On the celestial sphere, show the diurnal circles of stars seen from the North pole.

   (q) What are the two immense forces required to maintain the star in its main-sequence phase?

   (r) The star Sirius has a temperature of about 9200 K and Luminosity of about $23 L_0$, where L_0 is the solar Luminosity. Find the Ratio of radii of the Sirius and the Sun.

(s) Draw the H-R diagram in Temperature-Luminosity scale and locate the different types of stars in different positions on the graph.

(t) State Hubble's law and explain its significance.

2. (a) Draw the celestial sphere showing the ecliptic, vernal equinox and automnal equinox. Determine the deactivation (δ) of ecliptic north pole. 　　　　7

(b) The distance modulus of a star is -2.5. At what distance (in pc) is it from us? 　　　　3

3. (a) What are the several criteria of forming the Hubble sequence from Sa (early) towards Sc (late) Galaxies? 　　　　3

(b) State de Vaucouleur's law. Define effective radius of an elliptic galaxy and derive an expression for it. 　　　　1+1+3

(c) Explain the importance of Accretion disk and Asteroid belt in connection with the formation of Solar system. 　　　　2

4. (a) Describe the physical environment and processes to obtain the emission line spectra and absorption line spectra from the different types of stars. 　　　　3

(b) Calculate the strength of the magnetic field inside the Sunspot required to balance the pressure inside and outside of the solar Atmosphere, where the temperature is $= 6500$ K. Given : the particle density $N_s = 10^{23}$, $\mu = 4\pi \times 10^{-7} \, NA^{-2}$ and $K_B = 1.38 \times 10^{-23} \, JK^{-1}$. 　　　　3

(c) What is helioseismology? How the astronomers have been able to gain new insights into the structure of the Sun with the help of it? 　　　　1+3

5. (a) What do you understand by a White Dwarf Star? 　　　　3

(b) Explain the existence of an upper limit on the mass of a White Dwarf Star. What is this limiting value called? 　　　　4

(c) What is Corona? Why it is not seen in normal time? 　　　　1+2

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