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PG CBCS
M.SC. Semester-III Examination, 2021
PHYSICS
PAPER: PHS 303D (SPL PAPER)
(ASTRONOMICAL METHODS &
STELLER STRUCTURE AND EVOLUTION)

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

<u>**Write the answer for each unit in separate sheet**</u>

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

PHS 303D.1(**ASTRONOMICAL METHODS**)
Marks: 20

Answer any <u>TWO</u> questions of the following: **2X10=20**

1. What is the relationship between brightness and apparent magnitude of a star? Compare the brightness of the Sun and Sirius A if aparent magnitude of Sun and Sirius A are -26.81 and -1.47 respectively. If a star at 40 pc is brought closer to 10 pc, i.e., 4 times closer, how bright will it appear in terms of the magnitude? Describe how you can measure distance of a nearby star using method of stellar parallax.   2+2+3+3

2. Define *parsec*. What is the relation between light year and parsec? A satellite measures the parallax angle of a star as 0.005 arc-second. What is the distance of the star?   Describe how you can measure radius of a star using Stefan-Boltzmann law.   2+1+4+3

3. How you can measure masses of eclipsing binary stars. After about 5 billion years the Sun is expected to swell to 200 times its present size. If its temperature becomes half of what it is today, find the change in its absolute magnitude. The mass of star Sirius is thrice that of the Sun. Find the ratio of their luminosities and the difference in their absolute magnitudes. Taking the absolute magnitude of the Sun as 5, find the absolute magnitude of Sirius.   3+4+3

4. Describe Kepler's laws of planetary motion. How you can measure surface tempereture of a star. The surface temperatures of Sirius A and Sirius B are found to be equal. The absolute magnitude of Sirius B is larger than that of Sirius A by 10. How big will be the radius of Sirius A, in comparison to that of Sirius B?   3+3+4

5. What is *distance modulus*? The apparent magnitude of the Sun is -26.8. Find its absolute magnitude. Remember that the distance between the Sun & the Earth is 1.5×10^{13} cm. The mass of star Sirius is thrice that of the Sun. Find the ratio of their luminosities and the difference in their absolute magnitudes. Taking the absolute magnitude of the Sun as 5, find the absolute magnitude of Sirius.   2+3+5

(P.T.O.)

PHS 302D.2 (STELLER STRUCTURE AND EVOLUTION)
Marks: 20

Answer any __TWO__ questions of the following: 2X10=20

1. What is the Virial theorem related to the interior of a star? From the Virial theorem, show the relationship between average temperature, mass and density of a star.   3+7

2. Suppose that the energy transport due to radiation process is analogous to the random walk. Compute the time taken by a photon, generated in the core of the Sun, to reach the solar surface. Given that for the Sun, the mean free path is $l \sim 0.5$ cm for photon at an average density and temperature of 1.4 g cm^{-3} and 4.5×10^6 K, respectively. How does the radiative transport of energy give rise to temperature gradient in stars? Derive the related temperature gradient relation inside a star with observed luminosity.   4+6

3. Calculate the radius of a star which has the same effective temperature as the Sun but luminosity 1000 times larger. What do you mean by Helioseismology? A pressure of 1200 Pa (Pascal) prevails in the solar atmosphere. What should be the strength of the magnetic field required to balance such a pressure?   4+2+4

4. What is HR diagram? Show the location of Sun, Super giants, red giants and white dwarfs in HR diagram. The temperature inside a sunspot is 4000 K and that of its surface is 6000 K. Calculate the strength of the magnetic field inside the sunspot which will balance the pressure inside and outside.   3+2+5

5. Describe different layers of solar atmosphere. What is the chemical composition of the photosphere of Sun? What do you mean by butterfly diagram? Describe with figure.   4+2+4

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