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Your Roll No.....

7415

M.Sc./III Sem. F

PHYSICS

(Group A) Course XII (*h*)—Part I

(Astrophysics)

Time : 3 *Hours* *Maximum Marks* : 50

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

Attempt *All* questions.

1. Attempt any *five* :

(*a*) Describe the Horizon (*alt* – *az*) system of co-ordinates. Discuss its drawbacks.

(*b*) One of the four Galilean satellites of planet Jupiter is I_0. Its orbital period is 1.77 days. The semi-major axis of its orbit is 4.22×10^{10} cm. Calculate the mass of Jupiter under the assumption that Jupiter is too massive in comparison to I_0.

(*c*) Describe parallax method of measuring stellar distances. Show that the parallax becomes smaller as the distance to a star increases.

P.T.O.

(*d*) Discuss the salient spectral features of stars with spectral types O—M.

(*e*) In a sunspot, magnetic diffusivity, linear dimension and velocity of conducting fluid respectively are 10^3 m^2 s^{-1}, 10^4 km, and 10^3 ms^{-1}. Estimate the magnetic Reynolds number, R_m. Can one assume that the conductivity in the sunspot is virtually infinite ?

(*f*) Consider a pencil of radiation of intensity I_ν impinging upon a surface element $d\sigma$ at an angle θ to the normal to $d\sigma$. Derive an expression for the radiation pressure for the radiation field. 3×5

2. (*a*) What are apparent and absolute magnitudes of a star ? Show that :

$$m - M = 5 \log_{10} \left(\frac{d}{10\ pc} \right),$$

where m and M are the apparent and the absolute magnitudes of a star respectively and d is the distance to the star.

(b) The apparent magnitudes of the stars Arcturus and Aldebran are 0.06 and 0.86, respectively. Calculate the ratio of their brightness. 6,3

3. (a) What is HR diagram ? How is it important in the study of structure and evolution of stars ?

(b) Describe the Babcock model for the formation of sunspots. Discuss the formation and evolution of sunspots with the solar activity cycle. 4,4

4. Assuming coronal outflows to be steady, spherically symmetric and isothermal, derive Parker's equation for the solar wind velocity. Discuss all the plausible solutions. 9

5. (a) Derive the equation of radiative transfer.

(b) Solve the equation of transfer in the Eddington's first approximation to yield :

$$I(\theta, 0) = 2H + 3H \cos \theta .$$

The symbols have their usual meanings. 4,5

Or

Explain the phenomenon of limb darkening in the sun.

4. Derive Parker's equation for the speed of the solar wind by assuming steady, spherically symmetric and isothermal coronal outflows. Discuss the plausibility of different classes of solutions. 8

5. (a) Discuss the concept of local thermodynamic equilibrium in the interior of a star.

Or

Derive the equation of radiative transfer.

(b) Solve the equation of radiative transfer in the Eddington's first approximation and hence explain the phenomenon of limb darkening in the Sun. 3,6