

2007

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(1)

Your Roll No.....

2858

M.Sc./III Sem.

G

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 four :

- (a) 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 .
- (b) Assume you are stargazing at 50°N latitude. Declinations of the bright stars Capella, Vega and Canopus are, respectively, $+ 46^\circ 00'$, $+ 38^\circ 47'$, $- 52^\circ 42'$. Which of these stars will be above your horizon :
- (i) always ?

P.T.O.

- (ii) sometimes ?
- (iii) never ?
- (c) Of the seven spectral types (O, B, A, F, G, K, M) which have the following given characteristics :
- (i) Identical with our Sun;
 - (ii) Effective temperature of $50,000^{\circ}\text{K}$;
 - (iii) Molecules present;
 - (iv) Neutral Helium lines;
 - (v) Strongest hydrogen lines.
- (d) In a sun-spot, magnetic diffusivity, linear dimension and velocity of conducting fluid respectively is $10^3 \text{ m}^2\text{s}^{-1}$, 10^4 km , and 10^3 ms^{-1} . Estimate the magnetic Reynold number, R_m . Is it fair to assume that the conductivity in the sun-spot is virtually infinite ?
- (e) Show that in free space, the specific intensity along any ray path is constant. 4×4=16

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

$$m - M = 5 \log_{10} \left[\frac{d}{10 \text{ pc}} \right]$$

where m and M are the apparent and the absolute magnitudes of a star respectively and d is the distance to the star in parsec (pc).

- (b) Describe colour index for a main sequence star. Star A has a colour index of $- 2.5$ and star B has a colour index of $+ 4.0$. Which one is cooler and why ?

5,3

3. (a) The satellite Hipparcos measured the parallax of 120000 stars to better than $0.002''$. Deduce a limit on the distance to which Hipparcos was able to measure.

- (b) How can one find the masses of the components of a visual binary system using orbital information and Newton's form of Kepler's third law ?

- (c) What does the butterfly diagram tell us regarding the formation and evolution of sun-spots and the solar activity cycle ?

2,4,3

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