2 0 1 7

(May)

PHYSICS

(Major)

Course : 604

(Optional Course)

Full Marks : 60

Pass Marks : 24/18

Time : 3 hours

The figures in the margin indicate full marks
for the questions

OPTION—A

Paper : 60410

(ASTROPHYSICS AND PARTICLE PHYSICS)

1. Choose the correct answer from the following : 1×6=6

   (a) Which of the following quantities are related in Hertzsprung-Russell diagram?

       (i) Surface gravity and effective temprature

       (ii) Effective temperature and turbulent velocity

       (iii) Stellar temperature and luminosity

       (iv) Chemical composition and luminosity

(b) 1 parsec is a distance measured, if a star makes a parallax angle of 1 arc second, which is equal to

(i) 2.99×10^8 km

(ii) 3.08×10^{13} km

(iii) 3×10^5 km

(iv) 2.06×10^5 km

(c) A binary system whose two stars periodically eclipse one another leading to a periodic changes in the apparent brightness of the system is known as

(i) visual binary

(ii) eclipsing binary

(iii) optical binary

(iv) spectroscopic binary

(d) The luminosity of the sun is obtained as

(i) 3.09×10^{33} erg sec^{-1}

(ii) 3.90×10^{30} erg sec^{-1}

(iii) 3.827×10^{33} erg sec^{-1}

(iv) 2.90×10^{33} erg sec^{-1}

(e) The end point of evolution of a star of 1 solar mass is known as

(i) red giant

(ii) pulsar

(iii) white dwarf

(iv) neutron star

(f) Particles, which do not respond to strong interaction but only to weak and electromagnetic interactions, are referred to as

 (i) protons

 (ii) leptons

 (iii) hyperons

 (iv) neutrons

2. (a) What are the various branches of astronomy on the basis of observational point of view? What do you understand by astronomy and astrophysics? Give a brief idea of the difference of optical and radio telescopes. 2+2+2=6

 (b) Explain why an X-ray telescope is superior to other telescopes. 2

3. (a) Define the absolute magnitude of a star. Obtain the relation connecting the absolute magnitude with apparent magnitude and the distance of the star in parsec 2+3=5

 (b) Star A has colour index 0·0, star B has colour index 1·0. Which one of them has a higher surface temperature? 2

 (c) What is spectral classification of stars? What are the various spectral classes? What is H-R diagram? 2+1+2=5

4. (a) What are the various processes of energy transport in stellar interior? Show that the variations of the luminous flux within the stellar interior is

$$\frac{dL(r)}{dr} = 4\pi r^2 \rho \varepsilon$$

where ε is the energy generated due to thermonuclear reactions. 3+3=6

(b) Give an account of the PP chain and CNO cycle as a source of nuclear energy in a star. 4

5. (a) What do you understand by cosmology? Give a brief idea of Newtonian cosmology. 2+2=4

(b) State Hubble's law. Discuss the phenomenon of expanding universe on the basis of this law. 1+3=4

6. (a) What are elementary particles? Explain clearly the meaning of isotopic spin and strangeness. In what respect are they important in classifying elementary particles? 1+2+2=5

(b) Compare the properties of leptons and baryons. Which is the mediator in strong interactions? 3

7. *(a)* State and explain with examples the conservation laws, which govern the elementary particle reactions and decay.

1+2=3

(b) What are quarks? Depict the quark models of *(i)* mesons and *(ii)* protons and antiprotons.

1+2+2=5

Or

Write short notes on any *two* of the following :

2½×2=5

(i) Red giant

(ii) Fermions

(iii) Gluons