

6 SEM TDC PHY M 4 (Op)

2016

(May)

PHYSICS

(Major)

Course : 604

(Optional Course)

Full Marks : 60

Pass Marks : 24

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) The Nadir is a point in a celestial coordinate system which is

- (i) directly overhead
- (ii) directly underneath
- (iii) on a great circle
- (iv) None of the above

- (b) The apparent brightness of a star is the
- (i) total amount of power it radiates into space
 - (ii) total amount of light it radiates into space per unit time
 - (iii) amount of light reaching us per unit area from the star
 - (iv) None of the above
- (c) The apparent magnitude of a faint star in comparison to a bright star is
- (i) positive and high
 - (ii) negative and high
 - (iii) negative and low
 - (iv) imaginary
- (d) The source of energy of a star is
- (i) chemical in nature
 - (ii) mechanical in nature
 - (iii) thermonuclear in nature
 - (iv) gravitational in nature
- (e) Our Milky Way galaxy is a/an
- (i) elliptical galaxy
 - (ii) circular galaxy
 - (iii) irregular galaxy
 - (iv) spiral galaxy

(f) Which of the following particles is not a fermion?

(i) Electron

(ii) Pi-meson

(iii) Proton

(iv) Neutron

2. (a) What do you understand by the terms astronomy and astrophysics? What is celestial sphere? Discuss briefly about the spherical coordinates of such sphere. 2+1+2=5

(b) Mention the basic differences among optical, radio, X-ray and gamma-ray astronomies. 2

3. (a) Show that the apparent magnitude (m), absolute magnitude (M) and the distance (d) of a star are related by a relation

$$m - M = 5 \log d - 5$$

What are the units of m , M and d ? 3+1=4

(b) If the measured parallax angle of a star is $0.379''$, how far is the star in light year and in km? 3

(c) What is H-R diagram? Draw this diagram and discuss the basic features of it. 1+3=4

4. (a) Describe how a star remains in equilibrium in its configuration. Show that its equilibrium configuration is governed by the fundamental equation

$$\frac{1}{r^2} \frac{d}{dr} \left(\frac{r^2}{\rho} \frac{dP}{dr} \right) = -4\pi G\rho$$

where symbols have their usual meanings. 2+3=5

(b) Explain the p - p chain and CNO cycle as a source of nuclear energy in a star. 4

5. (a) What do you mean by a galaxy? Classify galaxies on the basis of Hubble's classification and briefly mention their properties. 1+4=5

(b) State Hubble's law. On the basis of this law, explain the phenomenon of expanding Universe. 1+3=4

6. (a) Define spin and isospin of elementary particles. Classify particles on the basis of spin. Write down the isospin multiplets of nucleons, pions and kaons. 2+1+3=6

(b) What is the name of the anti-particle of electron? How was it discovered? $1+2=3$

7. (a) What are fundamental interactions? Give a brief idea about all fundamental interactions. $1+4=5$

(b) What are quarks and gluons? Write down the quark structures of proton and neutron and show that charges of proton and neutron are sum of the charges of their respective quark constituents. $2+2=4$

Or

Write short notes on any *two* from the following : $2 \times 2 = 4$

(i) Variable stars

(ii) Newtonian cosmology

(iii) Hypercharge