

**2022**  
**M.Sc.**  
**Third Semester**  
 DISCIPLINE SPECIFIC ELECTIVE – 02  
**PHYSICS**  
*Course Code: MPHD 3.21 (A)*  
 (Astronomy & Astrophysics)

*Total Mark: 70*  
*Time: 3 hours*

*Pass Mark: 28*

*Answer five questions, taking one from each unit.*

**UNIT-I**

1. (a) What are the different systems of coordinates employed to locate position of heavenly bodies? Discuss in brief equatorial coordinate system. 3+4=7
- (b) What are the various motions of earth? Explain them. 4
- (c) The standard meridian for India is  $82^{\circ}30'$  E. Find the local mean time for the following place corresponding to the standard time of 18h 35m 10s. 3
  - (i)  $110^{\circ}$  E
  - (ii)  $30^{\circ}$  W
2. (a) Find the declination ( $\delta$ ) of a star (using astronomical triangle) from the following data:
 

Latitude of the place =  $48^{\circ}30'$  N  
 Azimuth of the star =  $50^{\circ}$  W  
 Altitude of star =  $28^{\circ}24'$  4
- (b) Explain the formation of the seasons with proper diagram. 6
- (c) Draw with angles the astronomical triangles and explain the different terms. 4

**UNIT-II**

3. (a) What are apparent and absolute magnitude of star? Explain with examples. Obtain a relation for distance modulus of a star. 2+2+3=7

- (b) What is a colour-index of a star? Explain with example. 3
- (c) What do you mean by ‘atmospheric extinction’ and ‘scintillation’? 4
4. (a) Explain the different methods of measuring distances of stars. 8
- (b) Show that the apparent magnitude ( $m$ ) of a star depends on its intrinsic luminosity ( $L$ ) and its distance ( $d$ ). 3
- (c) Two telescopes have the following parameters:

Parameters	Type of Telescope	
	Reflector (A)	Refractor (B)
Diameter of main lens or mirror	2 m	1 m
Focal length of objective	7.6 m	14.6 m
Focal length of eyepiece	5 cm	1 cm

- Write which telescope described in the above table has: 3
- (i) greater light-gathering power
- (ii) greater resolving power      (iii) greater magnification

### UNIT-III

5. (a) Derive the Jean’s criterion for star formation. 4
- (b) Define specific intensity ( $I_\nu$ ) and radiation flux density ( $F_\nu$ ) and write the relation. 4
- (c) Write the formal solution of transport equation for homogenous medium and also write approximate solution for optically thick medium. 6
6. (a) What are variable stars? Write its classification and discuss each one of them in short. 7
- (b) What are nebulae? Discuss different types of nebulae. 5
- (c) Cepheid variable star in the Virgo cluster has an absolute magnitude of  $-5$  and an apparent magnitude of  $26.3$ . How far away is the Virgo cluster? 2

### UNIT-IV

7. (a) Derive the following equations for stellar structure:  $5 \times 2 = 10$

(i)  $\frac{dM(r)}{dr} = \rho(r)4\pi r^2$       (ii)  $\frac{dL(r)}{dr} = \epsilon \rho(r)4\pi r^2$

- (b) Find the expression for gravitational potential energy of a star. 4
8. (a) What is the linear density model of a star? Find the expressions for pressure and temperature for Sun. 10
- (b) Explain briefly the stellar evolution with H-R diagram. 4

### UNIT-V

9. (a) What is Chandrasekhar limit? Explain. 4
- (b) What is a Compton scattering? Derive an expression for Compton shift on the basis of quantum theory.  $2+8=10$
10. (a) What is thermal Bremsstrahlung? Obtain an expression for power radiated per unit frequency.  $2+6=8$
- (b) Derive an expression for power radiated by an electron in non-relativistic case (cyclotron radiation). 6
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