

DHANAMANJURI UNIVERSITY

JUNE – 2021

Name of Programme : M.Sc. Physics

Semester : Fourth

Paper Code : PHY-633

Paper Title : Astrophysics

Full Marks : 40

The figures in the margin indicate full marks for the questions.

Answer all questions.

1. Describe the classification schemes (spectral classification and luminosity class) of stars. 10

Or

Describe Hubble's classification scheme of galaxies. Distinguish between elliptical and spiral galaxies. 7+3=10

2. Explain the magnitude scale of stars. Define the distance modulus of a star. The apparent magnitude of the sun is -26.83 , find its absolute magnitude. Calculate the apparent magnitude of the sun if it were at the distance of α – Centauri (4.3 light years). 4+2+2+2=10

Or

Describe the parallax method for estimation of the distance to a star. α – Centauri is one of the closest stars to the earth with a distance of 4.3 light years. What is the parallax observed for α – Centauri by an observer on the earth's surface in arc-second? Express it in radian. 6+2+1+1=10

3. Describe the Equatorial co-ordinate system. Given that the latitude of Imphal is $\phi = 24.82^\circ$ N, find the declination range in which a star will be circumpolar, i.e., it will never set as seen from Imphal. Draw a suitable diagram. 6+4=10

Or

Describe the Altitude-Azimuth co-ordinate system. Using the geographical latitude of Imphal, $\phi = 24.82^\circ$ N, draw a suitable diagram and find
i) the height of the North Celestial pole above the horizon,
ii) the tilt of the celestial equator with respect to the horizon circle. 6+2+2=10

4. Deduce the equation of hydrostatic equilibrium of a star. Assuming polytropic equation of state obtain Lane-Emden equation from the hydrostatic equilibrium equation. Solve Lane-Emden equation for $n = 0$ (where $\gamma - 1 = 1/n$, γ being the polytropic index). Use the boundary condition $\Theta = 1$ and $\frac{d\Theta}{d\xi} = 0$ at $\xi = 0$. 3+3+4=10

Or

Using the equation of hydrostatic equilibrium and assuming ideal behaviour of a collapsing cloud deduce Virial theorem. Find the condition for collapse of a gas cloud using Virial theorem. Assuming constant density find the minimum mass of the gas cloud required for collapse of the cloud under isothermal conditions. 4+2+4=10
