

Date:

Registration number:

ST. JOSEPH’S COLLEGE (AUTONOMOUS), BENGALURU-27

B.Sc. PHYSICS - VI SEMESTER

SEMESTER EXAMINATION: APRIL 2022

(Examination conducted in July 2022)

**PH 6215 - Astronomy, Astrophysics and Nuclear Physics**

Time- 2 ½ hrs Max Marks-70

This question paper contains two printed pages and three parts

**Part - A**

**Answer any 4 questions**   **[4x10=40]**

1. a). Name any two windows of the electromagnetic spectrum to explore the universe.

 Mention their wavelength range and important observations made through them.

 b). Write the physical properties of a pulsar.

[6+4]

 2. a). Draw HR diagram and explain different stages of life of stars indicated in the diagram.

 b). Write a note on Milky way galaxy.

 [6+4]

 3. a). What are apparent and absolute magnitudes of a star. Obtain distance modulus

 relation for a star.

 b). Explain the structure of photosphere and chromosphere of the sun.

 [6+4]

 4. a). Obtain the condition for hydrostatic equilibrium in a the star.

 b). Explain energy generation mechanism by CNO cycle in the star.

 [6+4]

 5. a). Define ‘range’ of alpha particles. State and explain Geiger-Nuttall law. Mention

 Its importance.

 b). Define Q-value and threshold energy of a nuclear reaction. Obtain the relation

 between them.

 [4+6]

 6. a). With a neat diagram, Explain the working of a Geiger-Muller counter. Draw its

 characteristic curve.

 b). Write a note on nuclear binding energy.

 [7+3]

**Part – B**

 Data: $M\_{Θ}=2×10^{30} kg$, $ R\_{Θ}=7×10^{8} m$, $ L\_{Θ}=3.9×10^{26} W$, $1 ly=9.46×10^{15} m$.

 $G=6.67×10^{-11} Nm^{2}kg^{-2}$, $ 1pc=3.26 ly$, $ 1pc=3.08×10^{16 }m$

 $σ=5.67×10^{-8} Wm^{-2}K^{-4}$, Wien’s constant = 0.0029 mK

**Solve any four problems [4x5=10]**

$7. $The star Megrez emits light of maximum intensity at wavelength 336 nm. If its luminosity

$ $is 1.02x1027 W, calculate radius of the star. If distance of the star is 24.7 pc from the

 earth, find out its brightness.

 8. Calculate the photon travel time in the sun by photon diffusion.

 Core temperature and surface temperature of the sun is 15x 106 K and 6000K respectively.

9. The K-line of singly ionised calcium has a wavelength of 393.3nm as measured on the

 earth. The same line was observed at 401.8nm from a spectrum of one of the observed

 galaxies. If that galaxy is at distance of 298 million light years from the earth. Calculate

 the value of Hubble’s constant.

 10. Calculate the focal length of 8-inch f/10 telescope. Find out its

 (i) light gathering power compared to human eye of aperture 5mm

 (ii) theoretical resolving power in arcsec at wavelength 5000Å.

 11. Calculate the time required for 40% of a sample of K-40 to disintegrate. Half-life of

 the sample is 1.83 x109 years.

 12. In a cyclotron, alpha particles are accelerated by a RF oscillator of frequency10 MHz.

 The dee radius is 3.2 m. Calculate, (i) the applied magnetic field (ii) the maximum

 energy attained of the alpha particles. Mass of alpha particle $=6.64832×10^{-27}$ kg.

**Part – C**

**Answer any 5 questions:**   **[5x2=10]**

13. a). Even though photons travel with the speed of light, it takes nearly a

 million years to reach the surface of the sun. Explain.

 b). Modern telescopes are mostly reflective type. Give reasons.

 c). Massive stars have short life time. Why?

 d). How the existence of CMBR support the big bang event? Explain.

 e). Is beta spectrum discrete or continuous? Explain.

 f). Among leptons and hadrons, which one is fundamental? Explain.