

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 6218 - 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). With a neat diagram, explain the working of Cassegrain reflecting telescope.

 Mention its advantages over refracting telescope.

 b). Mention the wavelength range and important findings from the radio astronomy. [7+3]

1. a). What is dark matter? Give two evidences to confirm the existence of the dark

 matter in the universe.

 b). Describe the Hubble’s classification of galaxies.

 c). Mention the physical properties of pulsars. [3+4+3]

1. a). What is stellar parallax? Explain the trigonometric parallax method to find the

 distance of stars.

 b). Mention different parts of the inner structure and explain the mechanism occurring

 in the sun. [6+4]

1. a). What is an ideal star? Obtain the expressions for the mean particle energy and mean

 temperature of a star based on the ideal gas equation of the state of the star.

 b). Write a note on photon random walk in the sun. [7+3]

 5. a). Give the theory of successive disintegration of a radioactive substance.

 b). Explain the conditions of equilibrium during successive disintegration.

 [6+4]

 6. a). Define Q-value of a nuclear reaction. Obtain an expression for the threshold

 energy of a nuclear reaction.

 b). Explain the characteristics of nuclear forces. [6+4]

**Part - B**

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

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

 $σ=5.67×10^{-8} Wm^{-2}K^{-4}$, $1 ly=9.46×10^{15} m$

**Solve any 4 problems** [4x5=20]

7. A quasar has an emission line identified as LY- 𝛼 of hydrogen is observed at 212.8nm.

 The same line is observed in the lab at 121.6nm. Calculate the distance of the quasar.

 Given: Hubble constant is 72 km/s/Mpc.

8. Astronomers have observed a ring of hot gas material orbiting a supermassive object at the

 centre of our Milky way galaxy. This ring has a diameter of about 4 parsecs and an orbital

 speed of 200km/s. Determine the mass of this massive object in solar mass units. If that

 massive object is a black hole, what would be its Schwarzschild radius?

9. The black body spectrum of a star is found to peak at 2900Å. The star is 300 light years away.

 Its luminosity reaching earth over an area 10-6 m2 is found to be 3X10-16 W. Calculate the

 temperature and intrinsic luminosity of the star.

 10. Calculate the gravitational binding energy of the Sun based on the linear density model

 of the star from the data given above. What would be the total energy of the Sun?

11. A cyclotron is used to accelerate deuterons. It has a magnetic field of 1.5 Wbm-2 and extraction

 radius 0.5m. Calculate the frequency of the RF oscillator and maximum energy attained by the

 deuterons. Mass of deuteron= $3.34×10^{-27}$ kg.

 12. Calculate the activity of 10 gram of U-238. Half-life of U-238 is 4.5x109 years.

**Part - C**

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

 13. a). Which part of the electromagnetic spectrum is suitable to observe very hot regions

 of the universe? What is its wavelength range?

 b). No white dwarf is found to have a mass greater than Chandrashekar’s limit.

 Give reasons

 c). Massive star has a much shorter life-span than the sun. Why?

 d). What is hydrostatic equilibrium in stars? Why it is necessary in stars?

 e). Is a Geiger-Muller counter suitable for energy measurement of incoming particles? Give

 reasons

 f). How charge is conserved when proton and a neutron are built by quarks? Explain.