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

**Date:26-04-2019**

**B.Sc. PHYSICS – VI SEMESTER**

**SEMESTER EXAMINATION: APRIL 2019**

**PH 6215 – Astronomy, Astrophysics & Nuclear Physics**

**SUPPLEMENTARY CANDIDATES ONLY**

**aTTACH**

**Time-2 ½ hrs Max. Marks-70**

***This question paper contains 2 printed pages and 3 parts***

**PART-A**

Answer any **FOUR** questions. Each carries 10 marks [4x10=40]

1. a) Mention any two electromagnetic radiations that are blocked by the earth’s atmosphere.          Specify their wavelength range. [4]

b) With a schematic diagram, describe the focal arrangement of a cassegrain telescope.          Mention its advantages over refracting telescopes. [6]

2. a) What is apparent and absolute magnitude of a star? Obtain the distance modulus

        relation for a star. [6]

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

3. What is photon diffusion time? Obtain an expression for the photon diffusion time

     in a star. [10]

4. a) Draw HR diagram. How does it help to understand different stages in the life time

        of stars.  [6]

b) Write a note on dark matter emphasizing its evidence [4]

5. a) Explain the characteristics of nuclear forces. [5]

b) Give Pauli’s neutrino hypothesis to account for the β-decay. [5]

6. a) With a diagram, describe the construction and working of a cyclotron. [5]

b) Obtain an expression for the maximum energy of a particle attained in a cyclotron. [5]

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**PART-B**

MΘ=2x1030kg, RΘ=7x108 m, G=6.675x10-11 Nm2kg-2, 1u=931.48 MeV, 1pc=3.08x1016 m, ᵋ0=8.854x10-12 Fm-1 & σ=5.67x10-8 Wm-2K-4

Solve any **FOUR** problems. Each carries 5 marks [4x5=20]

7. Radius and surface temperature of the star Regulus are 9x108m and 22,000K      respectively. The apparent brightness of the star is found to be 7x10-9 Wm-2. Calculate      luminosity and distance of the star.

8.  Calculate the gravitational binding energy of a star whose mass is 2MΘ and radius is 1.5RΘ

      based on both constant density model as well as linear density model. Also find out total       kinetic energy of the star.

9. Astronomers have observed that a cloud of hot gas material orbiting a super massive black       hole with a radius 3pc with an orbital velocity 200 kms-1. Calculate the mass (in terms of       solar mass) and event horizon of the black hole.

10. The k-line of calcium from a galaxy measured at wavelength 3933Å showed a red shift of            196Å. Apparent and absolute magnitudes of the galaxy are found to be +14.49 and -22       respectively. Find out the distance and velocity with which the galaxy recedes from us.

      Also find out the Hubble constant.

11. Calculate the α-particle potential barrier in the case of thorium nucleus (Z=90 & A=228).

      Take Ro=1.3fm.

12. Calculate the Q-value and threshold energy for the nuclear reaction 14N(n,α)11B.

Given masses of N14=14.007550u, B11=11.012811u, n=1.008987u & α=4.003879u.

**PART-C**

Answer any **FIVE** questions. Each carries 2 marks [5x2=10]

13. a) CNO cycle is the source of energy in the massive stars whereas proton-proton chain in            the less massive stars. Explain.

b) Chromosphere of the sun appears coloured. Give reasons.

c) No white dwarf is found to have a mass greater than Chandrasekhar’s limit? Explain

d) Observations from a satellite showed a line peak at 0.96mm. What could be the source            of emission? Comment on the observations.

e) Why γ-emission is always accompanied by α-emission in a radioactive material?

f) Explain how a proton and a neutron can be constructed using quarks?

**PH 6215-19-A**