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

DATE: **12-04-2017 (1pm)**

**B.Sc. PHYSICS – VI SEMESTER**

**SEMESTER EXAMINATION: APRIL 2017**

**PH 6212: Astronomy, Astrophysics & Nuclear Physics**

Time: 3Hours Max Marks: 100

**(*For supplementary candidates only)***

***Attach this question paper with the answer script***

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

**PART A**

Answer any **five** of the following (5X12 = 60)

1 a) Name the electromagnetic radiations that can be used as windows to the universe and their

Wave length range. (7)

b) Obtain an equation to determine the distance of a star using trigonometric parallax method. (5)

2 a) Describe the different regions of the solar atmosphere and mention their temperature range. (6)

b) What is meant by the magnitude scale and obtain an expression relating apparent magnitude

and apparent brightness of two stars. (6)

3 a) Obtain the ideal gas equation of the state of a star, considering the stellar matter to be an ideal gas

b) State virial theorem and show that the total energy of a star is negative.

c) Derive an expression for the hydrostatic equilibrium. (3+4+5)

4 a) Obtain the mass-radius relation of a white dwarf and explain the Chandrasekhar limit. (6)

b) What is dark matter and give evidence for its presence in the galaxies? (6)

5) Describe the construction and working of a cyclotron with theory. What are the limitations? (12)

6 a) What is meant by the range of an alpha particle? Name the parameters on which the range

depends. Also write Geiger-Nuttal law and explain its significance. b) With the help of binding energy curve explain nuclear fission & nuclear fusion. (6+6)

7 a) Explain Edwin Hubble’s tuning fork classification of galaxies with an appropriate diagram.

Also elaborate on the different features of the galaxies. (8)

b) Write a note on elementary particles. (4)

**PART B**

Answer any **four** of the following (4X6 = 24)

8) How much greater is the light-gathering power of the 5 meter Hale telescope than that of the 2.4 meter

Hubble Space Telescope? Also calculate the theoretical resolving power of Hubble Space Telescope

in arc-sec at visual wavelengths (λ=5000). If the primary mirror of Hubble Space Telescope has

an f-ratio of 24, calculate its focal length.

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9) The maximum apparent magnitude of the SN 1987A supernova that occurred in the LMC galaxy was

+2.9. It was at adistance of 51.4Kpc. Calculate its absolute magnitude. Also find its luminosity

in terms of the Sun [Mѳ = +4.8].

10) The surface temperature and core temperature of Sun are 5800K and107 K respectively. Calculate

the photon diffusion time in Sun. Also calculate its gravitational binding energy as per linear star

model. Radius of Sun=7x108m.Mass of Sun=2x1030.G=6.67x10-11Nm2kg-2.

11) The H-line of calcium detected in the light from a galaxy has a wavelength λ = 4018Å.

The laboratory wavelength of H-line = 3968.84Å. What is the galaxy’s distance from us if

Hubble’s constant =76kms-1Mpc-1? Also calculate the age of the universe.

12) Calculate the Q-value and hence the threshold energy of the reaction 7N14 (n, d) 6C13.

(Given the mass of N14=14.003074u, mass of n=1.008665u, mass of d=2.014102u.and

Mass of C13=13.003354u).

13) The activity of a radioactive sample drops to 1/16th of its initial value in 1 hour

20 minutes. What is the half-life?

**PART C**

Answer any **Eight** of the following (8X2 = 16)

14) a) Rotational velocities of neutron stars are very high. Explain.

b) A hot star peaks at a shorter wave length compared to that of a relatively cooler star.Why?

c) All modern optical telescopes are reflective telescopes. Why?

d) Why the stars are stable,even though nuclear fusion is happening continuously

at the core?

e) Explain how the CMBR support Big Bang theorem.

f) Massive stars have very short life time. Why?

g) The daughter element of a radioactive element has an atomic number greater than

its parent element. How will you explain this?

h) Why do stable nuclei never have more protons than neutrons?

i) G.M.counter is quenched after every event. Why?

j) Is beta spectrum discrete or continuous? Explain.