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Register Number:

DATE: **26** **-04-2018 (1PM)**

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

B.Sc. PHYSICS – VI SEMESTER

SEMESTER EXAMINATION: APRIL 2018

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

**Time: 2½ hours. Max. Marks: 70**

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

**PART- A**

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

1 a). Explain the terms (i) luminosity (ii) apparent brightness and (iii) apparent magnitude of a         star with the relevant equations.

b). Write a note on (i) photosphere and (ii) chromosphere of the sun.               [6+4]

2 a). Derive an expression for the gravitational potential energy of a star based on constant        density model.

b). Deduce an expression for the kinetic energy of a star using virial theorem. [7+3]

3 a). Explain the formation of a white dwarf after red giant stage. Obtain its mass- radius relation

b). What is Chandrasekhar’s limit? Under what physical condition, a white dwarf will attain this         limit? [7+3]

4 a). What is red shift of galaxies? Explain how Hubble’s law can be used to make an estimation        of age of the universe.

b). Write a note on cosmic microwave background radiation and its detection.    [6+4]

5 a). Give the theory of successive disintegration. Obtain an expression for the number of         daughter nuclei present as a function of time.

b). Arrive at the conditions for (i) secular and (ii) transient equilibrium. [6+4]

6 a). Explain the following properties of a nucleus

(i) charge (ii) mass defect and (iii) binding energy.

b). Explain briefly the working principle of a GM counter. Mention one important merit and          demerit of it. [5+5]

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**PART- B**

Data Given: MΘ =2x1030 kg, RΘ=7x108 m, LΘ=2.9x1026 W, G=6.673x10-11Nm2kg-2, k=1.38x10-23JK-1, mH=1.67x10-27kg, MΘ=+4.8 , 1 pc = 3.08 x 1016 m.

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

7. An f/15 reflecting telescope can just resolve two closely lying stars at an angle 0.02097 arc          second at 550 nm. Find out (i) diameter of the mirror (ii) focal length of the mirror     (iii) light gathering power with respect to 8 inch reflecting telescope in our college.

8.  Calculate the mean temperature and mean pressure of a star whose mass is 5MΘ and      radius 1.5RΘ, assuming the star to be completely ionized.

9.  The apparent magnitudes of the star Fomalhaut is +1.17 and its parallax is 0.13″. Find out      the absolute magnitude of the star. Compare its luminosity with that of sun.

10. The event horizon of a black hole is found to be 12 km. An object is orbiting around it in a       circle of diameter 6 pc. Calculate mass of the black hole and orbiting velocity of the object.

11. Calculate Q-value and threshold energy of the nuclear reaction 8O18 (p, n) 9F18

Given mass of 8O18 =17.99910u, 9F18 =18.00095u, p=1.00782u and n=1.00866u.

12. A cyclotron with dees of radius 2m is used to accelerate α-particles with a transverse      magnetic field of 2T. Calculate the maximum energy to which α-particles can be accelerated.      What would be the frequency of the electric field applied to the dees? mα= 6.6465x10-27kg.

**PART- C**

Answer any **FIVE** of the following [5x2=10]

13 a). Chandra telescope is put in space rather than on the earth. Give reasons

b). Why are IR telescopes placed at high altitudes? Which astronomical objects are            prominently observed through it?

c). Why reflecting telescopes are preferred than the refracting telescopes?

d). A massive star has shorter life time than the lighter stars. Explain

e). How are protons and neutrons formed out of quarks?

f).Electrons are detected from an unknown element. How one can differentiate whether         the electrons are β particles or ionized electrons? Explain.