

DATE: 26-4-2018

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

B.Sc. Physics: VI SEMESTER

SEMESTER EXAMINATION: APRIL 2018

PH6212: Astronomy & Astrophysics, Nuclear Physics

Time: 3hrs Maximum Marks: 100

(For supplementary candidates)

Do not write the register number on the question paper

Please attach the question paper along with the answer script.

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

PART A

Answer any Five of the following: [5X12 = 60]

1. a) What are the benefits of studying space by infrared and gamma ray astronomy?

b) Explain the light gathering power, resolving power and magnifying power of a              telescope. [6+6]

1. a) Elaborate on the magnitude scale of brightness of a star. Derive distance       modulus equation.

b) Explain with the help of relevant equations, the energy generation in the core of sun by              proton-proton cycle. [6+6]

1. a) What is luminosity of a star? Explain how luminosity depends on the surface       temperature   of the star. Derive mass luminosity relation for a star.

b) Calculate life time of sun. [7+5]

1. a) Explain different stages in the life cycle of a star.
2. Indicate the positon of sun in the H-R diagram.
3. Explain cosmic microwave background radiation and how it throws light on Big-Bang theory. [6+2+4]

1. a) Explain decay constant of a radio-active element and range of α-particles. Explain the       law relating the two quantities.

b) With the help of Pauli’s neutrino hypothesis, explain β-ray spectra. [6+6]

1. a) Using the binding energy curve, explain  the energy release in the processes of           nuclear fission and fusion. Give one example for each of the processes.

b) With a neat diagram, explain the working of electron synchrotron. [7+5]

1. a) How does the velocity and gravitational mass of galaxies can be determined? Discuss      with details the observational evidence that makes cosmologists believe that  the      universe is constituted of dark matter. What does the red shift of galaxies indicate?

b) What are Leptons and baryons. Give one example each. [8+4]

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PART B

Solve any Four of the following: [4X6 = 24]

MΘ = 2X1030kg, RΘ =7X108m, G = 6.67X10-11Nm2/kg2 , 1pc = 3.08x1016m. LΘ= 3.8x1026W

1. If the parallax of a star is 0.772 arcsec, what is its distance from the earth? Find the distance     modulus of the star. If the luminosity of the star is 8.2x10-4 LΘ, Calculate the apparent     brightness of the star.
2. The absolute magnitude of a white dwarf is 10 and its surface temperature is 12,000K.  Compare its radius and luminosity with those of the Sun. Given: absolute magnitude of the  sun is 4.7 and its surface temperature is 6000K.
3. Calculate the kinetic energy of gas particles in a star of 3 solar radius and having 4.2 solar   mass.
4. The H-line of singly ionized sodium has a wavelength of 121.6nm as measured on earth. in  the spectrum of one of the observed galaxies which is at a distance of 4500MPc from us,  this spectral line is located at 212.8nm. Determine Hubble’s constant and corresponding age  of the universe.
5. Deuterons in a cyclotron describe a circle of radius 32cm just before emerging from the  dees. The frequency of the applied voltage is 10MHz. Find the flux density of magnetic  field and the velocity of deuterons. Also calculate the maximum energy imparted to  deuterons. Mass of deuterons = 3.32 x 10-27Kg.
6. Determine the radial electric field and life of a GM counter tube operating at 1900V with  radii of anode and cathode being 0.09mm and 1.5cm respectively. The GM tube has  guaranteed life counts of 1010 and operates 20hrs per day at 2500 counts per minute.

PART C

14. Answer any Eight of the following: [8X2 = 16]

a) What is the relationship between the life expectancy of a star and its mass?. Explain.

b) When ordinary star collapses to form a neutron star, its rotational speed increases. Explain      the reason.

c) A high energy photon produced at the core of star reaches the surface as optical photon.     Explain the process.

d) Hα filters are used to study chromospheres. Explain.

e) Which force is more predominant in the case of objects in space?. What is its role in the     energy production in stars?.

f) In recent years, reflection telescopes are much in use. Explain the advantages.

g) In the nuclear reaction, 6C12 + 6C12 → 10Ne20 + 2He4 + energy,

 both the proton and neutron numbers are conserved. How do you account for the release of     energy?

h) Mention the condition to achieve secular equilibrium. Give one example.

i) Photons are called massless bosons. Why?

j) Account for the discrete α-ray energy spectra.