PG/IIIS/PHS-304/18(CBCS)

M.Sc. 3rd Semester Examination, 2018

PHYSICS

PAPER —PHS-304

Full Marks : 40

Time : 2 hours

Answer **Q.Nos. 1 & 2** and any **two** form the rest

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

(*Science of Universe*)

1. Answer any *four* questions : 2 × 4

(*a*) What is/are the most important physical mechanism(s) that supports a main sequence star and a white dwarf against a collapse due to self-gravity ?

(*b*) Give the definition of 'parsec'.

1 pc = ? ly.

(*c*) What is Dajan scale ?

(*d*) Mention all the stellar classification along with the temperature range.

(*e*) What are the basic difference between open cluster and globuler cluster ?

(*f*) What is Schwarzschild radius in a black hole ?

(*g*) Why does an X-ray observatory need to be in space ?

2. Answer any *four* questions : 3 × 4

(*a*) What constellations are most visible to the naked eye in the Northern hemisphere ? Write the name of star in the summer triangle.

(*b*) If the Sun is located at the centre of an imaginary sphere of radius 1.5×10^{11} m.

Calculate the energy received per second by the inner surface of the sphere. Given the solar constant = 1.36 kW/m^2.

(*c*) Write the difference between the fast and how solar winds.

(*d*) Draw an HR diagram, properly label the axes and indicate the position of the main sequence.

(*e*) What are meant by optical astronomy, X-ray astronomy and radio astronomy ?

(*f*) Differentiate red giant star and dwarf star.

(*g*) Outline three differences between spiral and elliptical galaxies, other than the obvious difference between their shapes.

3. (*a*) Explain the concept of the celestial sphere and the conventions of angular measurement that enable us to locate objects in the sky. 2 + 3

(*b*) Considering the motions of earth, solar system and galaxy, calculate how fast are we moving while lying in bed sleep ? 4

(*c*) What do you mean by solar cycle ? 1

4. (*a*) Based on the current hydrogen reserve in the sun and energy output, if the efficiency of generating radiation from the p-p chain is 90%, how many years can the sun keep burning ? 4

(*b*) Betelgeuse is a red giant star in the constellation Orion. It has a radius 1000 R_{sun} and luminosity 100,000 L_{sun}.

(*i*) What is its temperature assuming it emits as a perfect blackbody ?

(*ii*) From the above, can you justify why is called a red giant, i.e., why is it called "red" and "giant". 2 + 2

(*c*) How does neutron star balance the gravitational pull ? 2

5. (*a*) If a star is 2 times higher in diameter than sun and 2 times warmer than sun then what will be luminosity of that star ? 3

(*b*) Sun like star ends in white dwarf. True of false ? Justify. What will be the main content of the Sun like star after the "end" ? 3

(*c*) Give the evolution of a masive ($M = 30\ M_{SUN}$) star with proper sketch. 4

6. (*a*) Explain what is meant by wave-particle duality of light. 3

(*b*) What is Hubble's law ? 1

(*c*) Does the electron behave like a wave ? Justify. Calculate the de Broglie wavelength of an electron travelling at a speed of 2.5% of the speed of light in vacuum. 1 + 3

(*d*) Write the properties of thermal radiation. 2