SN – 332

V Semester B.Sc. Examination, November/December 2017
(2013 – 2014 and Onwards)
(CBCS – F+R/NS – Repeaters)
PHYSICS – VI
Astrophysics, Solid State Physics and Semiconductor Physics

Time : 3 Hours

Max. Marks : 70

Instruction : *Answer* ***five*** *questions from* ***each*** *Part.*

PART – A

Answer **any five** of the following questions. **Each** question carries **eight** marks. **(5×8=40)**

1. Derive an expression for gravitational potential energy of a star. 8

2. a) Write a note on H-R diagram.
   b) Derive an expression for the radius of a neutron star. Express it in terms of solar mass. (3+5)

3. Give the theory of compton effect. 8

4. Deduce an expression for the electrical conductivity of a metal based on free electron theory. Hence arrive at Ohm's law. 8

5. Give a detailed account of any four properties of superconductivity. 8

6. Derive an expression for the hoie concentration in the conduction band of intrinsic semiconductor. 8

7. a) Explain the principle and working of a solar cell.
   b) With a circuit diagram, explain the working of zener diode as a voltage regulator. (4+4)

8. With a neat circuit diagram, explain the working of a CE amplifier. Explain the method of drawing a.c. load line. 8

PART – B

Solve **any five** of the following problems. **Each** problem carries **four** marks. **(4×5=20)**

9. If the apparent and absolute magnitude of Aldebaran are + 0.87 and – 0.63 respectively, calculate its distance from the earth.
   Given : 1 Parsec = 3.2616 light years.

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10. Calculate the average pressure of the sun. Given : $R_\odot = 6.96 \times 10^8$m, $M_\odot = 1.989 \times 10^{30}$ kg and $G = 6.67 \times 10^{-11} Nm^2kg^{-2}$.

11. In the orion constellation the luminosity of the star is 10000 times that of sun and its surface temperature is about 3000K. How much larger is the radius of the star compared to that of the sun ? Given : Temperature of the sun is 6000K.

12. Find the interplanar spacing for the lattice planes of Miller indices (3 2 1), (2 1 0) and (1 1 1) for cubic lattice (a = 5.62Å).

13. Fermi energy for gold and silver are 5.54 eV and 5.51 eV respectively. Calculate their Fermi temperatures. Given : $K = 1.38 \times 10^{-23} JK^{-1}$.

14. A magnetic field of 0.7 T is applied on a germanium crystal of 0.5 mm thick. Calculate the Hall voltage developed, if the current density is 250 Am^{-2} and electron density $2 \times 10^{23}\ m^{-3}$

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15. Calculate the drift velocity of free electrons in a metal of area of cross section $2 \times 10^{-4}\ m^2$ in which a current of 100 A is flowing. The density of free electrons in a metal is $7.23 \times 10^{28}\ m^{-3}$.

16. For a transistor amplifier in CE – mode, $R_S = R_L = 1\ K\Omega$, $h_{ie} = 1.1K\Omega$, $h_{re} = 2.5 \times 10^{-4}$, $h_{fe} = 50$ and $h_{oe} = 25 \times 10^{-6}$ mhos. Calculate (i) Current gain and (ii) Voltage gain.

PART – C

Answer **any five** of the following questions. **Each** question carries **two** marks. **(5×2=10)**

17. a) The more massive a star, the shorter its life time. Justify.

    b) What is the order of the density of a neutron star ? What happens if it continues to contract further ?

    c) A hot star has radiations of shorter wavelength compared to that of a cooler star. Why ?

    d) Visible light is not preferred for crystal diffraction. Why ?

    e) In metals, as the temperature increases, the conductivity decreases. Explain.

    f) Why is $\beta > \alpha$ in a transistor ?

    g) Pure germanium and silicon at 0°K are insulators. Why ?

    h) Does the rate of generation of electron-hole pair is equal to the rate of recombination at a given temperature ? Explain.
