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Reg. No. | | | | | | | | | |

V Semester B.Sc. Degree Examination, March - 2021

PHYSICS

Astro Physics, Solid State Physics and Semiconductor Physics

(CBCS) (Freshers) (2018-19) and Onwards

Paper : VI

Time : 3 Hours **Maximum Marks : 70**

***Instructions to Candidates*:**

1) Answer any **Five** questions from each part.
2) Non-programmable scientific calculators is allowed.

PART - A

Answer any **Five** questions. Each question carries **Eight** marks. **(5×8=40)**

1. a) Define apparent magnitude and absolute magnitude of a star. Hence derive the expression for distance modulus.
b) Write the HR diagram and mark the positions of main sequence stars, red giants and white dwarf stars.

2. a) Derive an expression for average temperature of a star.
b) Write any four general characteristics of main sequence stars.

3. a) Explain photon diffusion time.
b) Write a note on
i) Neutron Stars,
ii) Pulsars and
iii) Black holes.

4. a) State Moseley's law
b) What is Compton effect? Obtain an expression for 'Compton Shift'.

5. a) Derive an expression for thermal conductivity on the basis of free electron theory of metals.
b) State Wiedemann - Franz law.

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6. a) Derive an expression for average kinetic energy of electrons at absolute zero in terms of Fermi energy.
   b) Explain Type-I superconductor.

7. a) Distinguish between conductors, semiconductors and insulators on the basis of energy bands.
   b) Explain depletion region in PN junction.

8. a) Explain the working of a voltage regulator with variable load resistance using a Zener diode.
   b) Derive an Expression for input impedance of a transistor in CE mode using h-parameter.

PART - B

Solve any **Five** problems. Each problem carries **Four** marks. **(5×4=20)**

9. The luminosity of a star is 5250 $L_\odot$. If it is 144 light years away from the earth, calculate its brightness. 1 light year = 9.4605×10^{18}m.

10. Calculate the life time of a star of mass $5M_\odot$, Given lifetime of the sun = 12 billion years.

11. A beam of x - rays of λ=0.842 A° is incident on a crystal at a grazing angle of 8° when the first order Bragg's reflection occurs. Calculate the grazing angle for 3rd order reflection.

12. The Fermi energy for silver is 5.5 eV. calculate the Fermi temperature and Fermi velocity, Given Boltzmann constant = 1.38×10^{-23}J K^{-1} and mass of electron = 9.1×10^{-31}kg.

13. Calculate the Hall voltage developed in a silicon crystal of thickness 2mm, when a magnetic field of 2T is applied. Given : the current density is 500 Am^{-2} and concentration of electrons=$3\times10^{22}m^{-3}$, e=1.6×10^{-19}C.

14. For silicon semiconductor with band gap 1.12eV, determine the position of Fermi level at 300K if $m_e^* = 0.12m_0$ and $m_h^* = 0.28m_0$. Given, Boltzmann constant = $1.38\times10^{-23}JK^{-1}$.

15. The reverse saturation current flowing through a p-n junction at 300K is 80μA. Calculate the current flowing when a forward bias of 0.2V is applied. Also calculate the static resistance. Given Boltzmann constant = $1.38\times10^{-23}JK^{-1}$, e=$1.6\times10^{-19}$C.

16. A transistor is connected in CE mode in which the collector supply is 15V and the voltage drop across resistance R_C connected in the collector circuit is 1V. The value of R_C = 1kΩ, calculate the collector emitter voltage.

PART - C

Answer any **Five** questions. Each questions carries **Two** marks. **(5×2=10)**

17. a) Does the surface temperature of a star related to its colour? Justify.

b) Do all stars become supernova? Justify.

c) Can Compton shift be observed for zero scattering angles? Explain.

d) What is the sign of Hall coefficient for p-type semiconductor? Justify.

e) Superconductor is an ideal diamagnetic material. Justify.

f) Is n-type semiconductor electrically negative? Justify.

g) In a solar cell will the top semiconducting layer be thin or thick? Explain.

h) Why are h-parameters called so?