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

V Semester B.Sc. Degree Examination, March/April - 2022

PHYSICS

Astrophysics, Solid State Physics and Semiconductor Physics

(CBCS-Freshers+Repeaters 2018-19 & Onwards Scheme)

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. Obtain the expression for core pressure of a star on the basis of Linear density model. **(8)**

2. Obtain an expression for gravitational potential energy of a star on the basis of Linear density model. **(8)**

3. a) What is Chandrasekhar's mass limit?

   b) Obtain an expression for core temperature of a star. **(2+6)**

4. Derive the expression for electrical conductivity of a metal based on free electron theory. Hence arrive at ohms law. **(8)**

5. a) What is Hall effect? Arrive at the expression for Hall co-efficient.

   b) Distinguish between continuous and characteristic X-ray spectra. **(4+4)**

6. With relevant circuit diagram, explain the characteristics of n-p-n transistor in common emitter mode. **(8)**

7. a) What is a solar cell?

   b) Obtain an expression for the concentration of free electrons in an intrinsic semiconductor. **(1+7)**

8. a) What are hybrid parameters?

   b) Using hybrid equivalent circuit, derive the expression for current gain and voltage gain of CE amplifier. **(2+6)**

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PART - B

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

9. The apparent and absolute magnitude of a star are +0.87 and -0.63 respectively. Calculate its distance from the earth.

10. If the luminosity and surface temperature of a star are 26 L_{sun} and 1.12×10^{4} K respectively, calculate its radius. Given $L_{sun}=4\times10^{26}$W, $R_{sun}=7\times10^{8}$m. T_{sun}=6000K.

11. Find the interplanar spacing for the lattice planes of Miller indices (3 2 1), (2 1 0) for cubic lattice with a = 5.26 Å.

12. In an experiment on Compton scattering X - rays of wavelength 1.5×10^{-10}m are used. Calculate the wavelength of X-rays scattered at an angle 60°. Given h = 6.625×10^{-34}Js, m_o=9.1×10^{-31}kg and c = 3×10^{8}ms^{-1}.

13. Assuming one free electron per atom, estimate the Fermi energy for copper. Given the density of copper = 8.95×10^{3} kg m^{-3} and atomic mass = 0.0635 kg mol^{-1}.

14. Calculate the conductivity of silicon material if mobility of electrons and holes are $0.32m^2V^{-1}s^{-1}$ and $0.18m^2V^{-1}s^{-1}$ respectively and intrinsic carrier concentration n_i is $18\times10^{22}m^{-3}$. Given $e=1.6\times10^{-19}C$.

15. A 24 V - 600 mW Zener diode is to be used for providing 24V stabilized supply to a variable load. If the input voltage is 32V calculate the value of series resistance.

16. Calculate the values of β_{dc}, I_C and I_E for transistor that has $\alpha_{dc}=0.96$ and $I_B=120\mu A$.

PART - C

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

17. a) Is the brightness of star a good indicator of its distance? Explain.
    b) Can Black holes be seen? Explain.
    c) Do white dwarfs attain stability? Explain.
    d) Is an unit cell of fcc structure a primitive cell? Explain.
    e) Why ordinary light cannot be used for crystal diffraction? Explain.
    f) Is p-type semiconductor electrically neutral? Explain.
    g) Can emitter and collector regions of transistor be inter changed? Justify.
    h) Superconductor is an ideal diamagnetic material. Justify.