(b) Explain the transistor as a two-port network and define the four h-parameters used to characterise it. (5)

(c) Calculate the electron and hole concentrations for an intrinsic semiconductor given effective density of states $N_c = 2.8 \times 10^{19}$ cm^{-3}, 3 $N_v = 1.04 \times 10^{19}$ cm^{-3}, band gap Eg = 1.1eV, at 300 K. (5)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7005 **K**

Unique Paper Code : 2222513502

Name of the Paper : Physics of Devices (DSE Paper)

Name of the Course : **B.Sc. Prog. – (Physics)_NEP: UGCF-2022**

Semester : V

Duration : 2 Hours Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt a total of **four** questions, including Question No. **1,** which is compulsory.

1. Attempt any **five** (3×5=15)

(a) Define the effective mass of an electron in a semiconductor.

(b) What is the difference between direct and indirect band gap semiconductors?

(c) Explain why the Fermi level shifts in doped semiconductors.

(d) What is a varactor diode and give one of its application?

(e) Describe the frequency response of a transistor amplifier.

(f) Explain the concept of current gain and voltage gain in a transistor.

2. (a) Explain the characteristics, working principle and applications of the Unijunction Transistor (UJT). (5)

(b) Outline the structure and working of a Metal Oxide Semiconductor Field Effect Transistor (MOSFET). (5)

(c) Discuss the characteristics and working principle of a tunnel diode. (5)

3. (a) Discuss the basic idea and significance of CMOS technology in digital electronics. (5)

(b) Explain the construction and working of a Junction Field Effect Transistor (JFET). (5)

(c) Explain the effect of temperature on barrier height and contact resistance of metal-semiconductor junctions. (5)

4. (a) Describe the construction and working of a two-stage RC coupled amplifier. (5)

(b) Design a relaxation oscillator of 5 kHz frequency using UJT. (5)

(c) Find the position of the Fermi level in an n-type semiconductor doped with a donor concentration of 10^{16} cm^{-3} at 300 K. (5)

5. (a) Describe the formation and characteristics of Schottky barrier and Ohmic contact using energy band diagrams. (5)