বিদ্যাসাগর বিশ্ববিদ্যালয়

VIDYASAGAR UNIVERSITY

Question Paper

B.Sc. Honours Examinations 2021

(Under CBCS Pattern)

Semester - III

Subject : ELECTRONICS

Paper : C 5-T & P

(Semiconductor Devices)

Full Marks : 60 (Theory-40 + Practical-20)

Time : 3 Hours

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.

(Theory)

Group-A

A. Answer any ***three*** of the following questions : 12×3=36

1. (a) Does the mass of an electron vary with the velocity? If so, how?

   (b) What is Hall effect? For an intrinsic semiconductor show that the Hall coefficient is given by

   $R_H = -[1/(n_i e)][(\mu_n - \mu_p)/(\mu_n + \mu_p)]$, where μ_n and μ_p are the mobilities of the electrons and holes, and n_i is the intrinsic carrier concentration.

   (1+3)+(2+6)

2. (a) How does a barrier field appear across a p-n junction?

(b) For an unbiased p-n junction, sketch the variation of the space charge, electric field, electrostatic potential and electron energy as a function of distance across the junction. 4+(2+2+2+2)

3. (a) Discuss how a transistor can be used as current amplifier?

(b) Draw and explain the minority concentration profile of a p-n-p transistor operating normally. 5+(3+4)

4. (a) Illustrate the different modes of operation by drawing the circuit diagrams for : (i) p-n-p transistor and (ii) n-p-n transistor.

(b) Draw the output characteristics of a transistor operating in CE mode and explain active, saturation and cut-off regions. (3+3)+(2+4)

5. (a) Define the pinch-off voltage. Establish the expression for pinch-off voltage of a JFET.

(b) An n-channel silicon JFET has a donor concentration of 2×10^{21} m^{-3} and a channel width of 4 μm. If the dielectric constant of silicon is 12, find the pinch-off voltage. If the FET operates with a gate-source voltage –2V, what is the saturation voltage V_{Dsat}? (2+5)+(3+2)

6. (a) Show the structure and circuit representation of a semiconductor controlled rectifier. Expalin its principle of operation.

(b) Mention some uses of triacs and diacs. (2+2+5)+(1½+1½)

Group-B

B. Answer any ***two*** of the following questions : 2×2=4

7. What do you understand by direct and indirect bandgap semiconductors? 2

8. What is a Schottky junction? 2

9. How does a Zener diode differ from an ordinary semiconductor diode? 2

10. Why is the MOS transistor commercially more important than a JFET? 2

(Practical)

Paper - C5-P

(Semiconductor Device Lab)

Marks : 20

Group-A

A. Answer any ***one*** of the following questions : 15×1=15

1. Draw the circuit diagram to study the I–V characteristics of a P–N junction diode. Draw the ideal diode I–V curve. How can you determine cut-in voltage, dc resistance, dynamic resistance, material constant and reverse saturation current from the I–V data of an ideal diode? 3+2+10

2. Explain the experimental arrangement and procedure to study the out put characteristics of a BJT under CE mode of operation. 15

3. Expalin the experimental arrangement and procedure to study the I–V characteristics of a SCR. 15

Group-B

B. Answer any ***one*** of the following questions : 5×1=5

4. Explain how a Zener diode can be used as a voltage regulator. Discuss with a neat circuit diagram. 5

5. How can you determine r_1, r_0 and β from the characteristics curve of a BJT? 5

6. Explain how can you obtain I–V characteristics of a JFET. 5