[This question paper contains 4 printed pages.]

Your Roll No. .....

5134 **B**

B.Sc. Prog./II

EL-202–SEMICONDUCTOR DEVICES AND FABRICATION

(Admissions of 2005 and onwards)

Time : 3 *Hours* *Maximum Marks* : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any *Five* questions.

1. (*a*) What are drift velocity and mobility of a charge carrier? 2

(*b*) What are direct and indirect band gap semiconductors? Give example of each. 3

(*c*) What is Fermi Energy? Show that fermi level of an intrinsic semiconductor lies in the middle of conduction band and valence band. How does its position change for an extrinsic semiconductor with doping concentration? Also discuss the effect of temperature on the position of Fermi level. 10

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2. (*a*) Derive an expression for the density of electrons in conduction band. 10

(*b*) What is Hall's effect? A sample of Si is doped with 10^{22} Boron atoms/m^3. If the mobility of hole is 0.04 m^2/Vs, find the resistivity of the sample. If the thickness of the sample is 125 μm and current I_x = 1.2 mA and magnetic field B_z = 0.1 Tesla, find the Hall voltage. 5

3. (*a*) Draw the energy band diagram of an open circuited P-N junction. 3

(*b*) Derive an expression for the depletion region width of a P-N junction. 7

(*c*) Explain the principle behind varactor diode. Mention some of its applications. 5

4. (*a*) Write the volt-ampere equation for a P-N diode. What is reverse saturation current in a P-N diode? Discuss the effect of temperature on reverse saturation current. 5

(*b*) Differentiate between Zener and Avalanche breakdown mechanism. 5

(*c*) Explain the working of a PNP transistor. Draw the energy band diagram of a bipolar junction transistor in thermal equilibrium. 5

5. (*a*) Discuss the construction and working of a *n*-channel JFET in details. Why is it called a 'voltage-controlled device'? 9

(*b*) Explain, what is transconductance, drain resistance and amplification factor of a JFET? 6

6. (*a*) What is difference between JFET and MOSFET? What are enhancement and depletion type MOSFET? 5

(*b*) What is Schottky Effect? Explain, how potential barrier arises in a metal-semiconductor (*n*-type) rectifying contact? Also draw its energy band diagram. 10

7. (*a*) What are the advantages of IC over discrete components? 5

(*b*) Explain the process of fabricating an integrated Resistor. 5

(*c*) Discuss Moore's Law. 5

8. Write short notes on any *two* : 7½+7½

(*i*) Ion Implantation;

(*ii*) Molecular Beam Epitaxy;

(*iii*) Thermal Oxidation.