(Pages : 2) **A – 6619**

Reg. No. : .....

Name : .....

Combined First and Second Semester B.Tech. Degree Examination, December 2016

13.109 : SEMICONDUCTOR DEVICES (AT)

(2013 Scheme)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **2** marks.

1. Explain Einstein relation.
2. What is meant by electron-hole pair ?
3. The voltage across a silicon diode at room temperature of 300k is 0.71V, when 2.5 mA current flows through it. Calculate reverse saturation current.
4. Explain about ohmic contacts.
5. Explain Zener breakdown.
6. What is punch through in a BJT ?
7. Explain how the MOSFET can be used as capacitor.
8. A JFET has I_{DSS}= 8.4 mA, V_P = –3V. What is the value of I_D for V_{GS} = – 1.5V ?
9. Draw the V-I characteristics of UJT.
10. Draw symbol for P-channel and N-channel depletion type MOSFET.

(10×2=20 Marks)

PART – B

Answer **any one full** question from **each** Module. **Each** question carries **20** marks.

Module – I

11. a) Draw energy band structure of insulator, semi-conductor and metal. Explain the difference in their electrical conductivities.

    b) Derive the equation for charge densities in intrinsic and extrinsic semiconductors.

OR

12. a) Describe the Hall Effect. What properties of a semiconductor are determined from Hall Effect ?

    b) The resistivity of doped silicon material is $9\times10^{-3}\ \Omega-m$. The Hall coefficient is $3.6\times10^{-4}\ m^3/C$. Assuming carrier conduction, find the mobility and density of charge carriers.

Module – II

13. a) Discuss the forward and reverse biasing behaviour of a diode.

    b) What are the two types of capacitances across a P-N junction ? Which of these is more important in case of forward bias ?

OR

14. a) What is Hetero-Junction ? Explain energy band diagram of any Hetero-Junction device.

    b) Mention different type of Hetero-Junction devices with their applications.

Module – III

15. a) Draw and explain the input and output characteristics of a transistor in CE configuration.

    b) In a transistor circuit $I_E = 5$ mA, I_C=4.95 mA, I_{CEO}=200 μA. Calculate β and leakage current I_{CBO}.

OR

16. a) With neat sketches explain the principle of operation of JFET.

    b) A JFET has I_{DSS}=15 mA and $V_{GS(off)}$= –5V. Find the drain current for V_{GS}=0V, –1V and – 4V.

Module – IV

17. a) Write short notes on :
        i) Channel length modulation
        ii) Velocity saturation
        iii) Body effect.

    b) Explain the principle of operation of LASER.

OR

18. a) Write short notes on UJT construction and operation.

    b) Explain principle of operation of SCR.