Combined First and Second Semester B.Tech. Degree
Examination, January 2019
(2013 Scheme)
13.109: SEMICONDUCTOR DEVICES (AT)

Time: 3 Hours
Max. Marks: 100

PART – A

Answer all questions. Each question carries 2 marks.

1. What is meant by doping?
2. What is diffusion current?
3. Draw the V-I characteristics of P-N junction diode.
4. Mention different type of Hetero-Junction devices.
5. What is junction breakdown?
6. Define threshold voltage of MOSFET.
7. Give the relation between output and input current for CB and CE configuration.
8. A JFET has a drain current of 5 mA. If \( I_{\text{DS}} = 10 \text{mA} \) and \( V_{\text{GS(off)}} = -6\text{V} \), find out \( V_{\text{GS}} \).
9. What is channel length modulation?
10. Draw the V-I characteristics of SCR.

(10×2=20 Marks)

PART – B

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

Module – I

11. a) Draw the energy band diagram of insulator, semiconductor and conductor and explain.
   b) Discuss the effect of temperature on semiconductors.

OR

P.T.O.
12. a) What do you understand by intrinsic and extrinsic semiconductor? Explain using their crystal structures.
   b) Derive the continuity equation for electrons and holes. Explain the physical meaning of each term.

Module – II

13. a) Explain the different current components in a p-n junction diode and hence derive the current equation.
   b) The voltage across a silicon diode at room temperature of 300 K is 0.71 V, when 2.5 mA current flows through it. If voltage increases to 0.8 V, calculate the new diode current.
   OR

14. a) What are the drawbacks of ohmic contacts? Using energy band diagrams, explain how the problem can be solved using low resistance ohmic contacts?
   b) Draw schematic diagram of alloyed ohmic contacts and derive the current equation.

Module – III

15. a) With neat sketches, explain principle operation of BJT (PNP/NPN) transistor.
   b) What is base width modulation? When it occurs? What is the impact of base width modulation?
   OR

16. a) Derive the equation for drain resistance $R_{ds}$ (DC and AC), Transconductance ($g_m$), amplification factor $\mu$ (JFET parameters).
   b) A JFET has $I_{dss} = 8.4\ mA$, $V_p = -3\ V$. What is the value of $I_d$ for $V_{gs} = -1.5\ V$? Find $g_m$ at this point.

Module – IV

17. a) Explain the operation of N-channel enhancement type MOSFET with the help of its $(I_d-V_{ds})$ and $(I_d-V_{gs})$ characteristics.
   b) Derive the equation for drain current using square law model.
   OR

18. a) Explain the principle and operation of Heterojunction LED.
   b) Write short notes on PNPN diode construction and its operation.