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Reg. No. :

Question Paper Code : 41057

M.E./M.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

First Semester

Power Electronics and Drives

PX 5101 — POWER SEMICONDUCTOR DEVICES

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the requirements of an ideal switch?
2. Compare ON state and switching losses.
3. What are converter grade and inverter grade thyristors?
4. Define secondary breakdown.
5. State the limitations of MOSFET.
6. What are the special features of IGBT?
7. Draw the gate driver circuit for BJT.
8. How is over current protection achieved in IGBT?
9. What are the parameters to be considered or proper mounting of the device with heat sink?
10. What is thermal impedance?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain the occurrence of electromagnetic interference due to switching. (7)
(ii) Draw and explain the switching characteristics of power diode. (6)

Or

- (b) (i) Explain the Safe operating Area of the power device with a neat diagram. (7)
(ii) Describe the device selection strategies of power semiconductor devices. (6)
12. (a) Analyze the operating principle of thyristor and compare its switching characteristics with BJT. (13)

Or

- (b) How can the BJT and thyristor be acted as current controlled devices? Validate this concept by their switching characteristics. (13)
13. (a) Describe the construction, static and switching characteristics of IGBT with neat diagrams. (13)

Or

- (b) Describe the steady state and dynamic state model of MOSFET. (13)
14. (a) (i) Draw and explain the functioning of gate drive circuit of a power MOSFET. (7)
(ii) Explain the protection of power BJT against over voltage and over current. (6)

Or

- (b) Explain in detail about pulse transformer and opto-coupler in the context of their importance. (13)
15. (a) (i) Deduce the electrical equivalent circuit of thermal model of a semiconductor device. (7)
(ii) Brief about liquid and vapour-phase cooling. (6)

Or

- (b) (i) Explain about various mounting techniques with suitable diagrams. (7)
(ii) Describe the guidelines for the selection of heat sink. (6)

PART C — (1 × 15 = 15 marks)

16. (a) Two diodes are connected in series to share a total DC reverse voltage of $V_D = 10$ KV. The reverse leakage currents of two diodes are $I_{s1} = 40$ mA, and $I_{s2} = 50$ mA.
(i) Find the diode voltages if the voltage sharing resistance are $R_1 = R_2 = 100$ K Ω
(ii) Find the voltage sharing resistances R_1 and R_2 if the diode voltages are equal i.e. $V_{D1} = V_{D2} = V_D/2$. (15)

Or

- (b) Calculate the maximum power dissipation of a power device which can with stand for 0.2 seconds for a temperature not exceeding 45°C, if the device has a thermal capacity of 0.3 J/°C and the thermal resistance of 0.8°C/w. (15)