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Question Paper Code : 83298

M.E. DEGREE EXAMINATION, JANUARY 2014.

First Semester

Power Electronics and Drives

PX 7104 — ADVANCED POWER SEMICONDUCTOR DEVICES

(Regulation 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Distinguish between Power and linear diodes.
2. Define 'Safe operating Area'.
3. How is the secondary breakdown avoided in a BJT?
4. What are current controlled devices? Mention its applications.
5. What are the limitations of MOSFET? How does single electron theory overcome this limitations?
6. Compare RCT and FCT.
7. Draw the gate driver circuit of a BJT.
8. What is the need of isolation for power semiconductor devices?
9. Mention any four types of heat sink, suitable for power semiconductor devices.
10. What are the parameters to be considered for proper mounting of the device with heat sink?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Discuss the device selection strategies of power semiconductor devices in detail. (8)
- (ii) Elucidate in detail the EMI impact due to switching of the power semiconductor devices. (8)

Or

(b) Two diodes are connected in series to share a total DC reverse voltage of $V_D=5KV$. The reverse leakage currents of two diodes are $I_{S1} = 30mA$ and $I_{S2} = 35mA$.

(i) Find the diode voltages if the voltage sharing resistances are $R_1=R_2=100k\Omega$. (8)

(ii) Find the voltage sharing resistances R_1 & R_2 if the diode voltages are equal i.e $V_{D1} = V_{D2} = V_{D/2}$. (8)

12. (a) (i) Discuss the two transistor analogy of thyristor with suitable diagrams. (8)

(ii) What are converter grade and inverter grade thyristors? Give two examples for each and discuss their applications. (8)

Or

(b) (i) With a neat circuit diagram explain the parallel operation of SCR devices. (8)

(ii) Discuss the operation of NPN transistor based darlington pair. List its advantages and disadvantages. (8)

13. (a) Describe the construction, static and switching characteristics of IGBT with neat diagrams.

Or

(b) With suitable illustrations and diagrams discuss the steady state and dynamic state models of a MOSFET device in detail.

14. (a) With a suitable diagram, explain the thyristor protection against

(i) Over voltages / currents (6)

(ii) di/dt (5)

(iii) dv/dt . (5)

Or

(b) (i) Draw and discuss the significance and applications of a snubber circuit. (6)

(ii) Discuss the design procedures and the operation of gate driver circuit for a SCR device. (10)

15. (a) (i) Obtain electrical equivalent circuit of thermal model of a semiconductor device. (10)

(ii) Write a technical note on liquid and vapour- phase cooling. (6)

Or

(b) (i) A power device has a thermal capacity of $0.2J/^\circ c$ and a thermal resistance of $0.7^\circ c/w$. Determine the maximum power dissipation the power devices withstand for 0.1sec for a temperature not exceeding $40^\circ C$. (8)

(ii) Discuss the various mounting techniques with suitable diagrams. (8)