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Question Paper Code: 52153

M.E. DEGREE EXAMINATION, DECEMBER 2015

First Semester

Power Electronics and Drives

15PPE103 - MODERN POWER SEMI CONDUCTOR DEVICES

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- Reverse recovery current in a diode depends upon
 - PIV
 - Temperature
 - Storage charge
 - Forward field current
- The reverse recovery time of diode is $t_{rr} = 3\mu s$ and the rate of fall of the diode current is $di/dt = 30 A/\mu s$. The storage charge Q_{RR} is
 - $130 \mu s$
 - $140 \mu s$
 - $135 \mu s$
 - $145 \mu s$
- The number of PN junctions in a SCR is
 - 1
 - 2
 - 3
 - 4
- The SCR can be termed as
 - DC switch
 - AC switch
 - Square-wave switch
 - Either a or b
- Which one is most suitable power device for high frequency ($>100kHz$) switching application?
 - BJT
 - Power MOSFET
 - Schottky diode
 - Microwave transistor

6. The controlling parameter in MOSFET is
 (a) V_{ds} (b) I_g (c) V_{gs} (d) I_s
7. Opto couplers combine
 (a) IGBTs and MOSFETs
 (b) Power transistor and silicon transistor
 (c) SITs and BJTs
 (d) Infrared light emitting diode and a silicon photo transistor
8. Snubber circuit is used to limit the rate of
 (a) Rise of current (b) Conduction period
 (c) Rise of voltage across SCR (d) none of the above
9. Thermal resistance in SCRs has the units of
 (a) $^{\circ}C/W$ and heat sinks (HS) are made from aluminum
 (b) $W/^{\circ}C$ and HS are made from steel
 (c) $^{\circ}C / W$ and HS are made from copper
 (d) $^{\circ}C / W$ and HS are made from copper alloy
10. A semiconductor device of thermal resistance $0.6^{\circ}C/W$ has its heat sink at $90^{\circ}C$. In case the junction drop is $1.5 V$ for a load current of $30 A$ dc, the junction temperature would be
 (a) $63^{\circ} C$ (b) $107^{\circ} C$ (c) $117^{\circ} C$ (d) $127^{\circ} C$

PART - B (5 x 2 = 10 Marks)

11. Distinguish between power diode and linear diode.
12. What are the differences between converter grade and inverter grade thyristors?
13. Compare RCT and FCT.
14. State the necessity of isolation.
15. Write the important guideline for heat sink design.

PART - C (5 x 16 = 80 Marks)

16. (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) (i) Discuss the on-state and switching losses of power devices. (8)
- (ii) Draw the symbols of four power switching devices and mention few applications of each device. (8)
17. (a) (i) How BJT and thyristor act as current controlled devices? Prove this concept by its switching characteristics. (8)
- (ii) With neat sketch, explain the Darlington pair of thyristors and its characteristics. (8)

Or

- (b) (i) Discuss the need of connecting devices in series/parallel. Also explain the drawback of the same. (8)
- (ii) Obtain the steady state and dynamic model of BJT. (8)
18. (a) Explain the features of the following (16)
- (i) GTO
- (ii) MCT
- (iii) FCT
- (iv) RCT

Or

- (b) (i) Draw and explain the static and switching characteristics of power MOSFET. (8)
- (ii) Describe the basic structure of IGBT. (8)
19. (a) (i) Explain over voltage and over current protection of SCR. (8)
- (ii) Draw and explain the base drive circuit of power BJT. (8)

Or

- (b) (i) Write the importance of pulse transformer and Opto coupler. (8)
- (ii) Write short notes about Snubber circuits. (8)

20. (a) Explain the transient thermal impedance for power semiconductor devices. (16)

Or

(b) (i) Describe the method of designing the heat sinks for thyristors. (8)

(ii) Write short notes on liquid cooling and vapour phase cooling. (8)
