

Reg. No.

Question Paper Code

21324

M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

First Semester

M.E. - Power Electronics and Drives

20PPEPC101 - ADVANCED POWER SEMICONDUCTOR DEVICES

(Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

- | | <i>Marks,
K-Level,CO</i> |
|---|------------------------------|
| 1. Define SOA. | 2,K1,CO1 |
| 2. What is the ideal switch? | 2,K1,CO1 |
| 3. Explain why does the collector current of a BJT in the active region increases with increasing collector voltage for a given base current? | 2,K2,CO2 |
| 4. Draw the circuit symbol of RCT. | 2,K1,CO2 |
| 5. Explain why E-MOSFET is called sometimes normally-off MOSFET. | 2,K2,CO3 |
| 6. List out some applications of IGBT. | 2,K1,CO3 |
| 7. Give some reasons for preferring exponentially decaying pulse in pulse transformer. | 2,K1,CO4 |
| 8. What are the requirements of generation of gating signal for thyristors? | 2,K2,CO4 |
| 9. Describe how heat transfer in heat sinks is achieved through convection? | 2,K2,CO5 |
| 10. What is thermal Impedance? | 2,K1,CO5 |

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) Examine the EMI impact due to switching of the power semiconductor devices. 13,K3,CO1

OR

- b) Explain the characteristics of following diodes:
- (i) General purpose diodes, 5,K2,CO1
 - (ii) Fast recovery diodes and 4,K2,CO1
 - (iii) Schottky diodes. 4,K2,CO1

12. a) Draw the two transistor analogy of a thyristor and explain the regenerative switching action and derive expression for IG. 13,K4,CO2

OR

- b) Explain secondary breakdown and importance of SOA in power BJT. 13,K2,CO2

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create

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13. a) Outline the problems associated with series and parallel operation of IGBTs. 13,K4,CO3

OR

- b) With suitable illustrations and diagrams discuss the steady state and the dynamic models of MOSFET in detail. 13,K4,CO2

14. a) (i) Explain the protection circuits of SCR. 6,K2,CO4
(ii) Describe electronic crowbar protection scheme employed for the over voltage protection of Thyristor. 7,K2,CO4

OR

- b) Summarize the design procedure of a snubber circuit. 13,K5,CO4

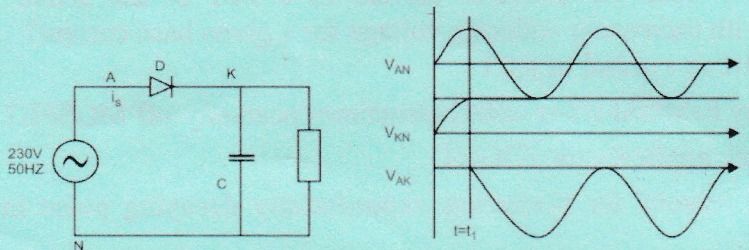
15. a) Categorize the various mounting techniques for SCRs. 13,K4,CO5

OR

- b) Explain the different types of heat transfer techniques and electrical analogy of thermal components. 13,K2,CO5

PART - C (1 × 15 = 15 Marks)

16. a)



15,K5,CO1

- (a) For the single phase half wave rectifier shown evaluate the V_{RRM} rating of D. (b) Will the required V_{RRM} rating change if an inductor is placed between the diode and a capacitor. (c) What will be the required V_{RRM} rating if the capacitor is removed? Assume a resistive load. (d) The source of the single phase rectifier circuit has an internal resistance of 2Ω . Find out the required Non repetitive peak surge current rating of the diode. Also find the $i^2 t$ rating of the protective fuse to be connected in series with the diode.

OR

- b) (i) A thyristor is rated to carry full load current with an allowable case temperature of 100°C , for maximum allowable junction temperature of 125°C and thermal resistance between case and ambient as $0.5^\circ\text{C}/\text{w}$. Find the sink temperature for an ambient temperature of 40°C . Take thermal resistance between sink and ambient as $0.4^\circ\text{C}/\text{w}$. 8,K5,CO5

- (ii) Calculate the maximum power dissipation of a power device which can withstand for 0.2seconds for a temperature not exceeding 45°C , if the device has a thermal capacity of $0.3 \text{ J}/^\circ\text{C}$ and the thermal resistance of $0.8^\circ\text{C}/\text{W}$. 7,K5,CO5