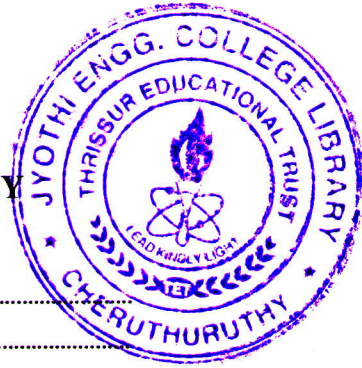


APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY
08 PALAKKAD CLUSTER



Q. P. Code : PE0820151A-I

(Pages: 2)

Name:

Reg. No:

FIRST SEMESTER M.TECH. DEGREE EXAMINATION MARCH 2021

Branch: Electrical and Electronics Engineering

Specialization: Power Electronics

08EE6251(A) POWER SEMICONDUCTOR DEVICES & MODELING

Time: 2 hour 15 minutes

Max. Marks: 60

Answer all six questions.

Modules 1 to 6: Part 'a' of each question is compulsory and answer either part 'b' or part 'c' of each question.

Q. No.	Module 1	Marks
1. a	Explain how safe operating areas (SOA) is summarizing the maximum values of current and voltage of a power semiconductor device.	3
Answer b or c		
b	Explain in detail about the desired characteristics non ideal controllable switches.	6
c	Explain the drift and diffusion mechanism of conduction in semiconductor.	6
Q. No.	Module 2	Marks
2. a	Explain the significance of n- layer in power diode.	3
Answer b or c		
b	Explain in detail why the breakdown voltage V_{CEO} is smaller than V_{CBO} in common emitter configuration of power BJT.	6
c	With the help of relevant figures explain in detail about the turn-on characteristics of power BJT.	6
Q. No.	Module 3	Marks
3. a	How converter grade thyristor differed from inverter grade thyristor?	3
Answer b or c		
b	Why SCR need to be connected in series? What care must be taken while series connecting SCRs.	6

- c i) How derating effecting series and parallel combination of SCR? 2
- ii) Determine the number of SCRs each with rating of 500Volt. 75Amps required in each branch of a series and parallel combination for a circuit with the total voltage and current rating of 7.5 kilovolt and 1000 Amps. Assume derating factor of 14%. 4

Q. No.	Module 4	Marks
4. a	Explain the vertically oriented four layer structure of power MOSFET.	3
Answer b or c		
b	Explain with the help of equivalent circuit how stray capacitance and depletion layer capacitance shaping the turn-on behaviour of MOSFET.	6
c	Illustrate how the latchup in IGBTs are greatly minimized.	6

Q. No.	Module 5	Marks
5. a	What is the significance of isolation in gate drive circuit? How can provide such isolation?	4
Answer b or c		
b	Explain how turn-on snubber improving switching trajectory of transistor with neat sketch.	8
c	What is the significance of turn-off snubber for thyristor? Discuss the design of thyristor snubber circuit assuming a worst-case conditions.	8

Q. No.	Module 6	Marks
6. a	Explain the different types of heat transfer mechanisms.	4
Answer b or c		
b	A MOSFET has an on-state loss of 50 Watt and a switching loss given by $10^{-3} f_s$ (in watts) where f_s is the switching frequency in hertz. The junction-to-case thermal resistance $R_{\theta jc}$ is $1^\circ\text{C}/\text{W}$ and the maximum junction temperature $T_{j,max}$ is 150°C . Assuming the case temperature is 50°C , estimate the maximum allowable switching frequency. If the MOSFET is mounted on a heat sink and the ambient temperature $T_a=35^\circ\text{C}$. If f_s 25kHz, what is the maximum allowable value of case to ambient thermal resistance $R_{\theta ca}$.	8
c	Explain different types of heat sinks.	8