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**M.E. / M.TECH. DEGREE EXAMINATIONS, DEC 2019**

First Semester

**PD18101 – POWER SEMICONDUCTOR DEVICES***(Power Electronics and Drives)***(Regulation 2018)****Time: Three Hours****Maximum : 100 Marks**

Answer ALL questions

**PART A - (10 X 2 = 20 Marks)**

	CO	RBT
1. Define reverse recovery time in the switching characteristics of power diode.	1	U
2. Give four main applications of power diodes.	1	AP
3. What triggers secondary breakdown?	1	AN
4. Distinguish between converter and inverter grade thyristors.	2	AN
5. Draw the MOSFET circuit models for transient analysis.	2	AN
6. Mention the special features of IGBT.	2	U
7. What are the merits of opto-isolator?	3	U
8. Classify snubber circuits based on circuit topologies.	3	AN
9. Distinguish between thermal resistance and thermal impedance.	4	AN
10. Give the electrical analogy of a thermal component.	4	AN

**PART B - (5 X16 = 80 Marks)**

11. (a) (i) How do you choose a power device for an application? Explain with examples.	(8)	1	AN
(ii) How is the rating of a power diode increased as compared to a signal diode?	(8)	1	AN
<b>(OR)</b>			
(b) (i) Write short notes on electro-magnetic interference during switching.	(8)	1	U
(ii) Write short notes on safe operating area of power device.	(8)	1	U
12. (a) (i) Discuss the turn-on and turn-off transients of Power BJT.	(8)	2	U

- (ii) A power BJT has a minimum current gain of 8. The load resistance is  $11\Omega$ . The supply voltage is 200V and the input voltage to the base circuit is 10V. If  $V_{CE(sat)}$  is 1V and  $V_{BE(sat)}$  is 1.5V, find (a) the value of resistance to be added in the base circuit, for an over drive factor of 5  
(b) the forced current gain and (c) the power loss in the transistor.

**(OR)**

- (b) (i) Describe the structure and characteristics of GTO. (8) 2 AN  
(ii) Write a short note on MCT (8) 2 AN
13. (a) Describe the construction, static and switching characteristics of IGBT with diagrams. (16) 2 AN

**(OR)**

- (b) (i) Develop the dynamic model of a power MOSFET (10) 2 AN  
(ii) Write short notes on a specific Intelligent power module. (6) 2 AP
14. (a) (i) With suitable diagram, explain the thyristor protection against over voltages / currents (6) 3 AN  
(ii) Explain the thyristor protection against  $di/dt$  and  $dv/dt$  (10) 3 AN

**(OR)**

- (b) (i) Design and explain a gate driver circuit for MOSFET. (8) 3 E  
(ii) Explain the effect of snubbers on switching characteristics. (8) 3 E
15. (a) (i) Describe the different methods of cooling semiconductor devices. (8) 4 AP  
(ii) Explain the steps involved in heat sink design. (8) 4 AP

**(OR)**

- (b) (i) Explain the different types of heat sinks. (8) 4 AP  
(ii) A fast-recovery diode switches 60 A rectangular current pulses at 10 kHz. The off-state bias is 400 V and the external circuit inductance limits the reverse  $dI_F/dt$  to 100 A/ $\mu$ s. If the device junction-to-case thermal resistance is 0.7 K/W, calculate the minimum heat-sink requirement with a 50 per cent duty cycle, if the maximum ambient temperature is 40°C. (8) 4 AP