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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent Institution of MAHE, Manipal)

I SEMESTER M.TECH (POWER ELECTRONICS & DRIVES)

MAKE-UP EXAMINATIONS, DECEMBER 2017

SUBJECT: POWER ELECTRONICS DEVICES & CONVERTER TOPOLOGIES [ELE 5121]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 26 DECEMBER 2017** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Explain the safe operating area of a Power BJT in forward biased state with a neat graph. ***(02)***

1B. Briefly explain the problems associated with series connection of SCRs. Hence comment on the remedy for the same. ***(04)***

1C. Describe the switching characteristics of power MOSFET with the help of equivalent circuits. ***(04)***

2A. A Single phase full converter, connected to 230V, 50Hz source, is feeding a load R=10Ω in series with a large inductance that makes the load current ripple free. For a firing angle of 45°, calculate the power factor and efficiency. ***(05)***

2B. With the help of circuit diagram, and waveforms of load voltage and load current, explain the working of a single phase fully controlled full wave rectifier feeding an RL load with continuous current. And also derive the RMS output Voltage. ***(05)***

3A. Explain the operation of a three phase fully controlled converter feeding an RL load with continuous current. Draw the circuit diagram and waveforms of load voltage and load current at firing angle is 90°. Indicate the triggering instants of the devices on the waveform and also derive the output voltage. ***(05)***

3B. Explain the effect of source inductance on a three phase fully controlled ac-dc converter feeding an RL load. Draw the circuit diagram and waveforms of load voltage and load current. ***(05)***

4A. Consider the buck converter to produce an output voltage of 18V across a 10Ω load resistor the output voltage ripple is must not exceed 0.5%. The DC supply is 48V. Design for continuous inductor current, specify the duty ratio. The switching frequency is 40Khz. Find the value of inductor and capacitor. ***(05)***

4B. With the help of neat circuit diagram and relevant waveforms explain the working of cascaded multilevel inverter. What are its advantages and disadvantages? Explain its target applications. ***(05)***

5A. Give a technical comparison of square wave switching and Sinusoidal PWM switching of 1-ϕ full bridge voltage source inverters. Explain unipolar switching of 1-ϕ full bridge voltage source inverters with the help of suitable waveforms. Also draw and explain its harmonic spectrum. ***(04)***

5B. Write a technical note on SVPWM used in Inverter and ZCS resonant-switch dc-dc converter. ***(06)***