

Duration – 3 Hours

Total Marks - 80

Note:- 1. Question No. 1 is compulsory

2. Attempt any **three** questions out of remaining **five** questions

3. Assume suitable data if necessary &amp; justify the same

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Attempt **any four**.

- (A) With the help of two transistor analogy of SCR, briefly explain why gate loses its control once SCR is turned ON? 5
- (B) Mention any two applications of dc to dc converter. Draw the diagram of a Buck dc to dc converter and draw the inductor voltage, inductor current and derive the voltage ratio. 5
- (C) What are the advantages of PWM rectifier as compared to controlled rectifier using SCR? What are its applications? Illustrate the diagram of a single phase PWM rectifier. 5
- (D) Illustrate the diagram of a single-phase half bridge inverter and draw the output voltage waveform for square wave mode of operation. Such an inverter is connected to a resistive load of  $2.4 \Omega$  with d.c. input voltage of 24V each. Determine: (i) RMS output voltage (ii) Output power and (iii) Peak blocking voltage of each switch. 5
- (E) Compare Silicon Carbide and Gallium Nitride devices. 5
- 2 (A) Explain any two commutation methods of SCR. 10
- Describe any one application of Triac-Diac circuit. Derive the expression for RMS value of output voltage and draw the following waveforms: (i) Supply voltage; (ii) load voltage; (iii) Voltage across Triac. 10
- (B)
- 3 (A) Explain the operation of  $3\Phi$  bridge inverter feeding a resistive load for  $180^\circ$  conduction mode. Draw the pulse sequence for the switches & sketch all phase voltages and any one line to line voltage waveform. 10
- (B) What is the need for a Snubber circuit? Explain any one snubber circuit. 10
- 4 (A) Draw the diagram of a Boost converter and derive its voltage ratio. In Boost converter,  $V_d=12V$ ,  $R_L=24\Omega$ ,  $L=1mH$ ,  $f_s=10kHz$  and the output voltage required is twice than that of input. Find (i) duty cycle; (ii) the peak to peak inductor current ripple and (iii) average input current. Assume lossless converter. 10
- (B) Give a comparison between MOSFET and IGBT (any five points). Why driver circuit is needed to drive MOSFET & IGBT? Suggest any suitable driver circuit. 10
- 5 Draw a three phase half controlled rectifier (semi controlled) and the gating pulse sequence and explain briefly. (i) Draw the input and output voltage waveforms for a firing angle of  $\alpha=0^\circ$  and  $\alpha=30^\circ$ . (ii) Derive the average output voltage in terms of  $\alpha$  for a purely resistive load. (iii) Find the numerical value of output voltage and current for a firing angle of  $30^\circ$ , if this converter is fed from a 440V,  $3\Phi$ , 50Hz supply and is feeding a resistive load of 12 ohms. Graph sheet will be provided. 20
- 6(A) With neat diagrams explain the operation of AC voltage controller feeding R-L load. 10
- (B) Explain any two pulse width modulation technique of inverter. 10

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