[4858] - 1063

T.E. (Electrical)

Power Electronics

(2012 Pattern) (End Sem.)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*

Q1) a) Describe the gate triggering of a thyristor. Does the gate current have any effect on the forward break over voltage. Discuss. **[5]**

b) Define latching and holding current as applicable to an SCR. Show these currents on its static IV characteristics. **[5]**

OR

Q2) a) Sketch switching (or dynamic) characteristics of a thyristor during its turn on and turn off processes. Show the variation of voltage across the thyristor and current through it with respect to time during these two dynamic processes. Write expressions for turn on time and turn off time. **[8]**

b) Discuss the conditions which must be satisfied for turning on an SCR with a gate signal. **[2]**

Q3) A single phase half wave SCR circuit feeds power to a resistive load. Draw waveforms for source voltage, load voltage, load current, and voltage across the SCR for a given firing angle α. Hence obtain expressions for average and rms load voltages in terms of source voltage and firing angle. **[10]**

OR

P.T.O.

Q4) a) For a 3 phase full converter, explain how output voltage wave, for firing angle 60° is obtained by using **[5]**

   i)   phase voltages and

   ii) line voltages.

   b) Discuss the effect of source inductance on the performance of a single-phase full converter indicating clearly the conduction of various thyristors during one cycle. **[5]**

Q5) a) Describe the principle of step-up chopper. Derive an expression for the average output voltage in terms of input voltage and duty cycle. State the assumptions made. **[10]**

   b) A step up chopper has input voltage of 220V and output voltage of 660V. If the conducting time of thyristor chopper is $100\mu s$, compute the pulse width of output voltage. Draw circuit diagram. **[6]**

OR

Q6) a) Explain switching characteristics of an IGBT. **[8]**

   b) Compare power of MOSFETs with BJTs. **[8]**

Q7) a) Draw neat circuit and describe the working of a single phase full bridge inverter feeding Inductive load with square wave output. Draw output voltage and current waveforms to show conduction intervals of devices. Comment on drawback of square output voltage. **[8]**

   b) The single phase half-bridge inverter has a resistive load of $R = 2.4\Omega$ and the dc input voltage is $V_s = 48V$. Determine **[8]**

   i)   the rms output voltage.

   ii) the output power P_o,

   iii) the average and peak currents of each transistor,

   iv) the peak reverse blocking voltage V_{BR} of each transistor,

OR

Q8) a) What are the main differences between voltage source and current source inverters. Explain current source inverter in detail with neat circuit diagram. **[8]**

b) Explain sinusoidal - pulse width modulation as used in PWM inverter. What are modulation indices? How they affect output voltage? Discuss the effect of number of pulses generated per half cycle on harmonics in output voltage. **[8]**

Q9) a) Draw and explain working of 3ph inverter bridge to feed 3ph resistive load (star connected) using 120º mode of conduction. Draw control signals for devices used and output phase and line voltage. **[10]**

b) Draw a single phase CSI is fitted with ideal SCRs. Describe its working when its load is a inductive. Show output current and voltage waveforms. **[8]**

OR

Q10) a) What are the types of Multilevel Inverter. Explain diode clamped multilevel inverter. **[10]**

b) What is a cascaded multilevel inverter? What are the advantages of a cascaded multilevel inverter. **[8]**

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