P. Pages : 2

Time : Three Hours

GUG/W/18/1773

Max. Marks: 80

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Notes: 1. All questions carry equal marks.

- 2. Due credit will be given to neatness.
- 3. Assume suitable data wherever necessary.
- 4. Illustrate your answers wherever necessary with the help of neat sketches.
- 5. Use of non programmable calculator is permissible.
- **1.** a) Explain IGBT with reference to construction, characteristic, rating and applications.
 - b) In the fig. Q. 1 (b), the SCR has a holding current I_h of 5 mA and latching current I_L of **8** 15 mA. Calculate :
 - i) The minimum value of firing angle α and the conduction angle β with $R_L = 3K\Omega$.
 - ii) The maximum value of the load resistance R_L for the firing angle of 15°C.



- **2.** a) Explain MOSFET with reference to construction, characteristic, rating and applications.
 - b) A UJT is used to trigger the thyristor whose minimum gate triggering voltage is 6.2 V. The UJT ratings are : $\eta = 0.66$, $I_P = 0.5 \text{ mA}$, $I_V = 3\text{ mA}$, $R_{BB} = 5K\Omega$, leakage current = 3.2 mA, $V_P = 14V$, $V_V = 1V$, oscillator frequency = 2 KHz and $C = 0.04 \mu\text{F}$. Design the complete circuit.
- 3. a) Explain the working of a single phase full converter with inductive load. Illustrate your 8 answer with waveforms for source voltage, output voltage, output current, source current, current through and voltage across one thyristor. Assume continuous conduction. Neglect source inductance.
 - b) A single phase fully controlled thyristor bridge converter supplies an inductive load. 8 Assuming that the output current is virtually constant equal to I_0 , determine the following

if supply voltage is 220V and α is 60° :

- i) Average output voltage.
- ii) Supply rms current.
- iii) Supply fundamental current.
- iv) Displacement factor.
- v) Supply power factor.
- vi) Supply harmonic factor.

OR

- **4.** a) What is dual converters? Explain their operation in non circulating and circulating current modes of operation.
 - b) A three phase, six pulse, fully controlled converter is connected to 3 phase ac supply of 400 V, 50 Hz and the firing angle is maintained at 45°. If the load current is constant at 10A and the load voltage is 360V, determine the value of load resistance, source inductance and the overlap angle.

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5.	a)	Explain the operation of 3 – phase bridge inverter in 120° conduction mode. Draw output phase and line voltage waveforms.	8
	b)	A single phase half bridge inverter has a resistive load of $R = 3\Omega$ and the dc input voltage $E_{dc} = 50V$	8
		Calculate :	
		i) The RMS output voltage at the fundamental frequency E_1 .	
		ii) The output power P_0 .	
		iii) The average and peak current of each thyristor.iv) The peak reverse blocking voltage of each Thyristor.	
6		UK Write short note on reduction of hormonics in inverter output voltage	0
0.	a) L)	The single phase full bridge inverter has the resistive load of 2.4.0 and the de input	0
	D)	voltage of 48V. Determine :	9
		i) The RMS output voltage at the fundamental frequency E_1 .	
		ii) The output power P_0 .	
		iii) The peak reverse blocking voltage of each thyristor.iv) Average and peak currents of each thyristor.	
7.	a)	Draw the circuit diagram of Jones chopper. Explain its operation with the relevant waveforms of the voltages and currents. Also explain the process of commutation of the main thyristor. Assume the load as the dc series motor.	8
	b)	A first quadrant chopper is operated from 220V dc with switching frequency of 1 KHz. For a duty cycle of 0.7, find out the following : i) Average output voltage.	8
		ii) RMS output voltage.iii) Form Factor	
		iv) Ripple factor.	
		OR	
8.	a)	Explain the working of a four quadrant chopper with RL Load connected to it.	8
	b)	A dc battery is charged from a constant dc source of 220 V through a chopper. The dc battery is charged from its internal emf of 90 V to 122 V. The battery has internal resistance of 1 Ω . For a constant charging current of 10A, compute the range of duty cycle.	8
9.	a)	Draw complete protection scheme for a power semiconductor device and explain the use of each and every component.	8
	b)	Calculate the required parameters for a snubber circuit to provide reliable dv/dt protection to an SCR used in a single phase fully controlled bridge. The SCR has a maximum. dv/dt capability of $40V/\mu$ sec. The line voltage has a peak value of 325 V and source inductance	8
		of 0.1 mH.	
10	a)	Explain following phenomenon associated with SCR ·	8
10.	<i>u)</i>	i) Thermal runaway.ii) Radio frequency interference	U
	b)	A thyristor has with its heat sink thermal resistance of 0.2°C/watt and 0.05°C/watt for steady state and 100 milli – second respectively. Calculate the power loss which the thyristor can tolerate for 100 milli – second following a steady state power loss of 300 watt.	8

Assume $T_{jmax} = 125^{\circ}C$ and $T_{ambient} = 35^{\circ}C$.
