Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 714501N   **Date: 01-12-2014**
Subject Name: Power Electronics – I
Time: 10:30 am - 01:00 pm   **Total Marks: 70**
Instructions:
   1. **Attempt all questions.**
   2. **Make suitable assumptions wherever necessary.**
   3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain the õlatchingö phenomenon of SCR using its two-transistor equivalent model. Also derive the equation for the anode current.	**07**
	(b)	(i) Why isolation is provided between control circuit & power circuit? What are the drawbacks of providing isolation using electro-mechanical relay? Draw only the symbols of any two opto-isolators.	**04**
		(ii) Classify & briefly explain the types of power losses occurring in power electronic devices.	**03**
Q.2	**(a)**	Draw only the basic structure, symbol & V-I characteristic of a TRIAC. Briefly explain its various triggering modes.	**07**
	(b)	What are the causes for the unbalance in current sharing through SCRs connected in parallel? Explain static and dynamic current sharing for SCRs connected in parallel.	**07**

OR

	(b)	A thyristor string is formed by series & parallel connection of thyristors. The voltage and current ratings of the string are 5kV and 2kA respectively. Available thyristors have voltage and current ratings of 1kV and 800A respectively. The de-rating factor of 15% is to be kept for both series & parallel connections. Calculate the number of thyristors to be connected in series & parallel. If the maximum blocking current is 10mA and the maximum difference in their reverse recovery charge is 20 C; then calculate the value of resistance in static equalizing circuit and the value of capacitance in dynamic equalizing circuit.	**07**
Q.3	**(a)**	Explain Class-B commutation of SCR with necessary waveforms. Write only the expression for the turn ON time of the SCR with respect to the commutation circuit elements.	**07**
	(b)	Explain the operation of buck-boost converter with neat diagram and waveforms.	**07**

OR

Q.3	**(a)**	Explain the need of Heat-sink. Explain its selection process.	**07**
	(b)	Explain the operation of 3-phase bridge inverter with Y-connected resistive load in 180° conduction mode with neat diagram and waveforms.	**07**
Q.4	**(a)**	Explain bipolar switching scheme of a 1-phase sinusoidal PWM inverter with neat diagram and waveforms.	**07**
	(b)	An SCR has Vg-Ig characteristics given as $Vg = 1.2+4.5Ig$. In a certain application, the gate voltage consists of rectangular pulses of 15V and of	**07**

duration 50 s with 60% duty cycle. Determine the value of series resistor (Rg) in gate circuit to limit the peak power dissipation in the gate to 3W. Also calculate average power dissipation in the gate.

OR

Q.4	**(a)**	Explain the operation of fly-back converter with neat diagram and waveforms.	**07**
	(b)	For an inverter controlled by single pulse width modulation technique; prove that selective harmonic (n) can be eliminated from the inverter output voltage using this technique by adjusting firing angle (α) = 90°/n, using Fourier analysis.	**07**
Q.5	**(a)**	Explain the operation of a 12-pulse converter with neat circuit diagram and waveforms.	**07**
	(b)	Explain dual converter with circulating current control mode.	**07**

OR

Q.5	**(a)**	Explain the principle of operation of integral cycle control type 1-phase AC voltage controller with neat diagram and waveforms. Also derive the expression for RMS value of output voltage in terms of duty cycle.	**07**
	(b)	Explain center-tapped 1-phase to 1-phase cycloconverter with neat circuit diagram and waveforms.	**07**

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