Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
B. E. - SEMESTER – VII • EXAMINATION – WINTER 2012

Subject code: 171002   **Date: 31/12/2012**
Subject Name: Power Electronics
Time: 10.30 am - 01.00 pm   **Total Marks: 70**
Instructions:
   1. **Attempt any five questions.**
   2. **Make suitable assumptions wherever necessary.**
   3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Define the following terms with respect to SCR 1 Latching current 2. The holding current 3.On state Voltage 4.Forward dv/dt rating 5.Minimum gate current I_{gmin}	**05**
	(b)	List the ideal characteristics of a power switching device.	**03**
	(c)	Explain the function of the following: (i) free wheeling diode (ii) UPS and (iii) heat sink	**06**
Q.2	**(a)**	Explain the operation of the SCR using the Two transistor analogy. Obtain the condition for the breakdown of the device.	**05**
	(b)	Discuss the various turn on methods of a thyristor.	**05**
		(OR)	
	(b)	Explain the Triggering modes of TRIAC with the aid of the structure diagram and characteristics.	**05**
	(c)	Explain the control characteristics of GTO and IGBT	**04**
Q.3	**(a)**	Explain the series operation of 'n' thyristors in the string with appropriate derivation for string voltage. Define String efficiency and derating factor.	**06**
	(b)	Draw the structure and explain the principles of operation of the following power devices: (i)SCR (ii) Power MOSFET	**08**
		OR	
Q.3	**(a)**	What do you understand by phase control of SCR?.	**03**
	(b)	Derive the expressions for the average load voltage, average load current, RMS load voltage of a single phase half-wave controlled rectifier with resistive load .Show the necessary waveforms.	**05**
	(c)	Explain the classification of DC converters with the help of circuit diagram and the quadrant of operation.	**06**
Q.4	**(a)**	Explain the working of the following converters with the help of circuit diagrams and waveforms : (i) Single Phase Full converter (ii) Three Phase Half Wave converter.	**08**
	(b)	A chopper circuit is operating on Time Ratio Control(TRC) principle at a frequency of 1KHz.on a 220V dc supply. If the load voltage is 180 V, calculate the conducting and the blocking period of the power device in each cycle .	**03**
	(c)	State the advantages & disadvantages of buck-boost converter	**03**
		OR	

Q.4	**(a)**	Explain the principle of operation of step down Chopper with resistive load. Differentiate between constant frequency and variable frequency operation of this chopper.	**04**
	(b)	Explain the principle of operation of step up Chopper , Discuss the modes of operation with equivalent circuits and mathematical relations..Sketch the current and voltage waveforms. Obtain the condition for controllable power transfer.	**07**
	(c)	List the applications of dc to dc converter.	**03**
Q.5	**(a)**	Explain the principle of operation of the buck converter discussing the modes .Sketch the equivalent circuits and the waveforms for the voltage and the current for a continuous flow. Obtain Expressions for (i) peak to peak ripple current ii) peak to peak ripple voltage. Show that peak to peak ripple voltage is inversely proportional to square of the switching frequency.	**08**
	(b)	Explain dv/dt and di/dt protection for thyristor.	**06**

OR

Q.5	**(a)**	How do you classify the inverters?	**03**
	(b)	Explain the principle of working of a single phase half bridge inverter with the help of the circuit and waveforms for both resistive and inductive loads. Calculate rms output voltage at the fundamental frequency and the output power for a dc input voltage of 48 V and resistive load of 2.4 Ω.	**07**
	(c)	Distinguish between natural and forced commutation of SCR. Explain any one commutation method for DC circuits .	**04**

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