Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– V • EXAMINATION – WINTER 2016

Subject Code: 150903 Date: 19/11/2016
Subject Name: Power Electronics-I
Time: 10:30AM – 01:00PM 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)**	Draw static V–I characteristics of an SCR and explain its behaviour in forward conduction, forward blocking and reverse blocking modes.	**07**
	(b)	List the major differences between power MOSFET and SCR in terms of its operating principle, control, characteristics and applications.	**07**
Q.2	**(a)**	A thyristor V_g-I_g relation is $V_g = 1 + 10I_g$. In an application where the gating voltage is 20V rectangular pulse of 180° duration is used. Calculate the resistance R_g to be connected in series with the gate source voltage in order to limit the average gate power loss to 0.5W. Also calculate the value of V_g and I_g during gating.	**07**
	(b)	Explain two transistor analogy of SCR with relevant diagram.	**07**
		OR	
	(b)	Explain the working of UJT as a relaxation oscillator using its I-V characteristics.	**07**
Q.3	**(a)**	What is the need of a snubber circuit? Discuss the function of each component and hence, mention the steps involved in the design (selecting the values) of each component.	**07**
	(b)	Draw the circuit of a single-phase fully-controlled converter and write the conditions for it to operate in an inversion mode. Draw the relevant waveforms for the converter when it operates in an inversion mode.	**07**
		OR	
Q.3	**(a)**	Discuss the various methods through which isolation can be provided in the power electronic circuits.	**07**
	(b)	With relevant circuit diagram and waveforms show operation of the three-phase semi-converter bridge as a 3-pulse and 6-pulse ac-dc converter. Specify the sequence of operation of the devices along with the waveform. (Explanation not required).	**07**
Q.4	**(a)**	Explain how regenerative braking can be achieved for a separately excited DC motor using DC-DC converter.	**07**
	(b)	Write a brief note on the non-circulating current type dual converter.	**07**
		OR	
Q.4	**(a)**	Show how the speed-torque characteristics of a separately excited DC motor fed from a single-phase fully-controlled ac-dc converter varies with the change in the firing angle. Also, discuss the operation in brief.	**07**

(b) A single phase full converter bridge is connected to R L E load. The source voltage is 230V, 50 Hz. The average load current of 10 A is continuous over the working range. For R = 0.4Ω and L = 2 mH, compute, **07**

(i) firing angle delay for E = 120 V

(ii)(ii) firing angle delay for E = -120 V

(iii) the input power facto in each above case

Q.5 **(a)** Explain the working of a step-down chopper and derive the equation of average output voltage in terms of input voltage and duty cycle. **07**

(b) Critically evaluate various control strategies for regulating the output voltage of DC-DC converter. **07**

OR

Q.5 **(a)** Draw the circuit of voltage commutated chopper. Show the circuits and relevant waveforms for different modes of operation. **07**

(b) Explain the operation of Cuk converter and list its advantages over 2^{nd} order DC-DC converters. **07**

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