Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–VII • EXAMINATION – SUMMER • 2015

Subject Code: X71102 **Date: 12/05/2015**

Subject Name: Power Electronics

Time:02:30 pm - 05:00 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)**	Define following terms: (i)Holding current (ii) Turn off time (iii) Reverse recovery charge(iv)Minimum gate current	**08**
	(b)	Explain the operation of the SCR using the two transistor analogy. Obtain the condition for the breakdown of the device.	**06**
Q.2	**(a)**	Draw the structure and explain the working principle of the following power devices: (i)Power MOSFET (ii) IGBT	**08**
	(b)	What is the purpose of dv/dt protection? Explain the common method of dv/dt protection.	**06**
		OR	
	(b)	The thyristors are used in a string to withstand a dc voltage of V_s= 15 kV. The maximum leakage current and recovery charge differences of thyristors are 10mA and 150µC, respectively. Each thyristor has a voltage-sharing resistance of R = 56kΩ and capacitance of C_1 = 0.5µF. Determine (a) the maximum steady state voltage sharing $V_{DS(max)}$, (b) the steady-state voltage derating factor, (c) the maximum transient voltage sharing $V_{DT(max)}$, and (d) the transient voltage derating factor.	**06**
Q.3	**(a)**	Explain three-phase half-wave controlled rectifier with resistive load.	**07**
	(b)	Describe any two forced commutation methods.	**07**
		OR	
Q.3	**(a)**	Describe the operation of single phase dual converters with necessary waveforms.	**07**
	(b)	A single phase full converter with RL load uses a delay angle control and is supplied by a 230V-50 Hz input. If α =π/3, E= 10 V, R= 10Ω and L = 20 mH, determine the average output voltage, output current, and load impedance.	**07**
Q.4	**(a)**	Explain the principle of operation of step-up chopper. Sketch the current and voltage waveform. Also discuss the modes of operation with equivalent circuit.	**07**
	(b)	Explain the working principle of Boost regulator with the help of circuit diagram and waveforms. Draw equivalent circuit for different modes of operation.	**07**
		OR	
Q.4	**(a)**	Show chopper classification. Explain Class C and Class D chopper with necessary diagram.	**07**
	(b)	Describe switched mode power supply with necessary diagrams in detail.	**07**
Q.5	**(a)**	What is PWM inverter? Explain its principle and any one method of PWM inverter to control output voltage.	**07**
	(b)	Explain battery charger with necessary diagrams.	**07**
		OR	

Q.5	**(a)**	Describe the working of single phase bridge inverter with diagram and waveforms.	**07**
	(b)	List types of Heating mechanism available and explain any one in detail.	**07**

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