Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013

Subject code: 714501N Date: 23-12-2013

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 in detail the operation of 3-phase bridge inverter for 120° conduction mode.	**07**
	(b)	Explain 'Single Pulse PWM' technique in detail with relevant waveforms and analysis.	**07**
Q.2	**(a)**	Explain advantages and disadvantages of PWM technique.	**07**
	(b)	Write a note on 'Isolation of Gate and Base Drives' and highlight the role of optocouplers and pulse transformers.	**07**
		OR	
	(b)	For a 1-phase full bridge inverter with dc input voltage of 42V and feeding load of 5Ω, find (i) the RMS output voltage at fundamental frequency, (ii) the output power Po, (iii) the average, RMS and Peak current through each transistor and (iv) THD.	**07**
Q.3	**(a)**	Explain the operation of 1-ph phase-controlled full converter with necessary circuit diagram, waveforms and analysis.	**07**
	(b)	Explain the operation of 12-pulse converter.	**07**
		OR	
Q.3	**(a)**	Derive the equation of input power factor of three phase full converter.	**07**
	(b)	Explain the operation of 1-ph dual converter with necessary circuit diagram, waveforms and analysis.	**07**
Q.4	**(a)**	Explain with necessary circuit diagram and waveforms: ON-OFF control based operation of single phase full wave AC voltage controller feeding Resistive Load. Derive the equations of output RMS voltage and input power factor.	**07**
	(b)	An ON-OFF control based 1-phase full wave AC voltage controller is feeding 50Ω load from supply mains of 230V, 50Hz. The thyristor switches are on for 60cycles and off for 40cycles. Find (a) rms output voltage, (b) input power factor and (c) rms current of thyristors.	**07**
		OR	
Q.4	**(a)**	Explain with necessary circuit diagram, waveforms and analysis, the operation of 1-phase phase-controlled full wave AC voltage controller feeding R-load.	**07**
	(b)	A phase-control based 1-phase full wave AC voltage controller is feeding 50Ω load from supply mains of 230V, 50Hz. The firing angle delays of both thyristors are 60°. Find (a) rms output voltage, (b) input power factor and (c) rms current of thyristors.	**07**
Q.5	**(a)**	Draw and explain the construction of power BJT. Explain static characteristics of power BJT. How power BJTs are different from signal BJTs.	**07**

(b) A Cuk regulator has input voltage of 15V, duty cycle of 40% and switching frequency of 25KHz. The filter inductance is L_2=350μH and filter capacitance is C_2=220μF. The energy transfer capacitance is C_1=400μF and inductance is L_1=250μH. The average load current is 1.25A. Determine (i) average output voltage, (ii) average input current, (iii) peak-to-peak ripple voltage of capacitor C_1, and (iv) ripple current of Inductor L_2. **07**

OR

Q.5 **(a)** Draw buck converter topology. With relevant waveforms, explain its operation in continuous mode. Derive expression of its output voltage in terms of duty ratio. **07**

(b) Explain operation of fly-back converter in brief with necessary circuit diagram and equations. **07**

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