Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2024

Subject Code:3151106 Date:28-11-2024

Subject Name:Power Electronics

Time:10:30 AM TO 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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define the following terms in connection with SCR: (1) Peak Inverse Voltage (2) Latching Current (3) Holding Current	**03**
	(b)	Describe dynamic Turn-ON switching characteristics of SCR.	**04**
	(c)	With the help of circuit diagram and relevant waveforms, explain the operation of continuous mode Flyback Converter. Also derive expression for voltage transfer ratio in terms of transformer turns ratio and duty cycle.	**07**
Q.2	**(a)**	The latching current of a thyristor circuit is 50mA. The duration of the firing pulse is 50µs. Will the thyristor get fired? Here R= 50 Ω, L= 0.5 H and V= 100V.	**03**
	(b)	Explain resistance firing circuit for SCR gate triggered.	**04**
	(c)	Discuss design consideration of Class- C commutation circuit with circuit diagram, operation and waveform.	**07**
		OR	
	(c)	For Class-D commutation circuit, compute the value of the commutation capacitor C and commutation inductor L for the following data: Edc= 50V, I_L (max)= 50A, t_{off} of SCR1= 30µs, chopping frequency f= 500 Hz and the load voltage variation required is 10 to 100%.	**07**
Q.3	**(a)**	Justify the statement: "Freewheeling diode improves the power factor of the system."	**03**
	(b)	Draw Circuit diagram and waveforms of single-phase half-controlled bridge rectifier for firing angle $\alpha = 90°$.	**04**
	(c)	Discuss Rectifying mode and Inverting mode of fully controlled bridge rectifier circuit with Inductive load.	**07**
		OR	
Q.3	**(a)**	Explain Semiconverter. Draw two Semiconverter circuits.	**03**
	(b)	The DC-DC converter has a resistive load of R= 10 Ω and the input voltage is Vs=220V. When the converter switch remains on, its voltage drop is Vch= 2V and the chopping frequency is f= 1 KHz. If the duty cycle is 50%, determine (a) the average output voltage Va, (b) the rms output voltage Vo, (c) the converter efficiency.	**04**
	(c)	The single-phase half-bridged inverter has a resistive load of R= 2.4 Ω and the dc input voltage is Vs= 48V. Determine (a) the rms output voltage at the fundamental frequency Vo1, (b) the output power Po, (c) the average	**07**

and peak currents of each transistors, (d) the peak reverse blocking voltage V_{BR} of each transistor, (e) the THD, (f) the DF and (g) the HF and DF of the LOH.

Q.4	**(a)**	List applications of DC-DC converter.	**03**
	(b)	Justify this statement for step-up operation: "The conditions for controllable power transfer are $0 < Vs < E$."	**04**
	(c)	Explain step-down converter with RL load in details.	**07**

OR

Q.4	**(a)**	Give comparison between Voltage source Inverter and Current source Inverter.	**03**
	(b)	Discuss following performance parameter of Inverters: (1) Harmonic Factor of n^{th} harmonics (2) Total harmonic distortion (3) Distortion Factor (4) Lowest order Harmonics	**04**
	(c)	Explain single phase full bridge Inverter in details.	**07**
Q.5	**(a)**	Discuss the selection criteria for switching transistor of flyback converter.	**03**
	(b)	List speed control methods of Induction motor. Explain closed-loop speed control.	**04**
	(c)	With the help of neat circuit diagram and associated waveform, explain the operation of Zero voltage switching resonant converters in half-wave mode.	**07**

OR

Q.5	**(a)**	List application of various Power conditioners.	**03**
	(b)	Discuss Power line disturbances.	**04**
	(c)	Describe the operation of on-line UPS system with the help of neat block diagram. Also list the important specifications of on-line UPS.	**07**

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