Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– II(Old course) • EXAMINATION (Remedial) – WINTER- 2015

Subject Code: 1724502 **Date: 10/12/2015**

Subject Name: Power Electronics – II

Time: 02:30 PM – 05:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all the questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Notations and symbols used have usual technical meaning.**

Q.1 (a) In a 1-phase diode-bridge rectifier; a large capacitor is connected across the resistive load in order to minimize the ripple in the DC-link voltage. Assume utility voltage as sinusoidal. Draw the following waveforms and comment on distortion in supply current: **07**

(i) Waveform-1: Output voltage and output current

(ii) Waveform-2: Supply voltage, supply current, fundamental frequency component of supply current

(b) Neatly draw the output current (I_O) waveform of a 1-phase inverter from the description tabulated below. Calculate: (i) RMS output current $I_{O(RMS)}$ and (ii) Fundamental frequency component of output current $I_{O1(RMS)}$. **07**

Determine only %THD of the output current waveform using $I_{O(RMS)}$ and $I_{O1(RMS)}$.

Positive half-cycle of output current (I_O) waveform:

θ (degree)	0	0	45	45	135	135	180	180
I_O (A)	0	5	5	10	10	5	5	0

Negative half-cycle of output current (I_O) waveform:

θ (degree)	180	180	225	225	315	315	360	360
I_O (A)	0	-5	-5	-10	-10	-5	-5	0

Q.2 (a) (i) What are the features of multilevel inverter? **04**

(ii) Draw any one leg of an NPC 5-level inverter. Explain various alternatives (switching states) which are possible to generate each of the voltage levels: $V_{AO} = -V_{dc}/4$, $V_{AO} = V_{dc}/4$, $V_{AO} = -V_{dc}/2$, $V_{AO} = V_{dc}/2$ and $V_{AO} = 0$. Tabulate these alternatives for each voltage level by showing the states (either óONô or óOFFô) of all the switches of the Pole-A. **03**

(b) Explain SEPIC converter and its operating modes with neat diagrams. What are the applications and drawbacks of SEPIC? Comment on the factors affecting the reliability and efficiency of SEPIC. **07**

OR

(b) What is Displacement Power Factor (DPF)? Derive the relationship between PF, DPF and %THD of a distorted supply current produced due to 1-phase diode-bridge rectifier as front-end converter having shunt capacitor filter across the resistive load. **07**

Q.3 (a) Explain 1-phase boost converter based active PFC with neat diagram and waveforms. **07**

(b) Draw only the circuit diagram of a Class-E resonant inverter. It is having **07**

supply voltage = 48V, load = 40Ý, switching frequency = 20kHz and Q-factor = 6. Determine the optimum values of input inductor, input capacitor, resonance inductor and resonance capacitor.

OR

Q.3	**(a)**	Explain resonant DC-link inverter with neat diagram and waveforms.	**07**
	(b)	An L-type ZCS resonant converter delivers a maximum power of P_L = 1kW at Vo = 5V. Supply voltage Vs = 12V. Maximum operating frequency f_{max} = 50kHz. Determine the values of input inductor and input capacitor. Assume the intervals t_1 and t_3 are very small and x = Im/Io = 1.5.	**07**
Q.4	**(a)**	Explain all the possible switching states in 7-level H-bridge inverter.	**07**
	(b)	Explain the use of 1-phase PFCs for 3-phase applications.	**07**

OR

Q.4	**(a)**	Explain the principle of operation of a 5-level diode clamped multilevel inverter with neat circuit diagram.	**07**
	(b)	Explain ZVS resonant converter with neat diagram and waveforms.	**07**
Q.5	**(a)**	Explain 3-phase to 3-phase matrix converter.	**07**
	(b)	Explain 1-phase buck-boost converter based active PFC with neat diagram and waveforms.	**07**

OR

Q.5	**(a)**	Briefly explain the steps for designing a high frequency transformer.	**07**
	(b)	Explain 6-pulse converter with neat diagram and waveforms.	**07**

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