Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2720709 **Date: 27/05/2016**

Subject Name: Advanced Power Converters

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.**

Q.1 **(a)** Explain the operation of PLR dc-dc resonant converter when operating with the $T_s > 2T_o$, where T_s and T_o represents switching period and resonant period, respectively. **07**

(b) What factors lead to deviation of neutral-point voltage? How can this deviation be minimized in a three level diode clamped inverter? **07**

Q.2 **(a)** For Y-Z1 phase-shifting transformer configuration, derive the equation of the input side line current in terms of secondary side line current. Consider N1 = 1 pu, primary to secondary side line voltage ratio = 1 and phase shift between secondary and primary side line voltage = 15°. **07**

(b) With suitable example and analysis show how is harmonic cancellation achieved in the multi-pulse converter. **07**

OR

(b) Show the schematic for a delta-polygon type of phase shifting transformer with appropriate dot-polarity to obtain 15° phase shift between secondary and primary side line voltages. Show the mathematical analysis resulting into equation that represents primary side line current in terms of secondary side line currents. **07**

Q.3 **(a)** For matrix converter, obtain the simplified equation representing the space vector for the following switch combinations: **07**

(i) bac and (ii) cca

where for 'bac' configuration, 'bac' indicates that output lines A, B and C are connected to input lines b, a and c, respectively.

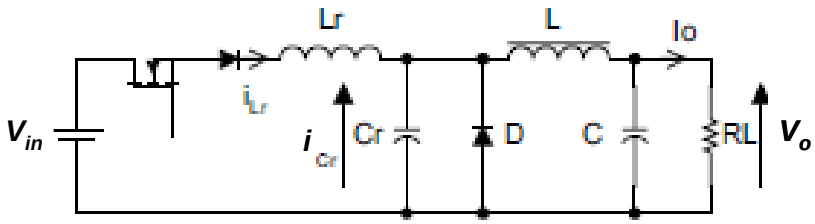
(b) Draw the circuit topology of a 3-level NPC multilevel inverter. List the possible switch combinations that can give the different levels. Also, list the levels in the output phase voltage. **07**

OR

Q.3 **(a)** Write a brief note on flying capacitor multilevel inverter. **07**

(b) Why does one require bi-directional switches for a matrix converter? How can such bi-directional switches be obtained? Also, critically evaluate/compare these bi-directional switches. **07**

Q.4 **(a)** With neat waveforms explain the operation of following resonant converter. Discuss the significance of L_r and C_r. **07**



	(b)	Draw the circuit configuration of SVC and STATCOM and compare them on various aspects.	**07**

OR

Q.4	**(a)**	The SLR dc-dc converter has the following parameters for its components: C_r =0.1μF and L_r =100μH, output capacitor C_o= 2000μF. The input source V_d =24V and the output voltage, V_o =5V. The switching frequency is 20 kHz. Identify the mode of operation for this converter. Determine (a) peak value of the resonant inductor current and (b) peak value of the voltage across the resonant capacitor.	**07**
	(b)	With relevant waveforms, explain IPD level-shifted carrier based modulation scheme for controlling 5-level cascaded H-bridge inverter.	**07**
Q.5	**(a)**	At what location one should place a shunt reactive-power compensator to improve the voltage profile of a line? Discuss with necessary waveforms and analysis.	**07**
	(b)	Write a brief note on power control in wind based energy generation system.	**07**

OR

Q.5	**(a)**	Comment on the following for 12-pulse HVDC transmission (i) Turns ratio of the two transformers Y-Y and Y-Δ (ii) Firing angle for the receiving and sending side terminals (iii) Harmonics on ac-dc side and filter requirements	**07**
	(b)	What is MPPT and why is it essential for PV systems? With suitable circuit configuration and any one MPPT technique explain how one can extract maximum power from PV system.	**07**

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