Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code: 2720709 **Date: 10/12/2015**

Subject Name: Advanced Power Converters

Time:2:30 pm to 5:00 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)** With relevant waveforms explain the operation of Half Bridge PLR dc-dc converter when operating with $\gamma_s < \gamma_o/2$. **07**

(b) State the advantages of multi-level inverter. Draw the space vector diagram for three-level NPC inverter. Show the analysis for the orientation and magnitude of the space vectors representing óPOPô and óPNOô combinations. **07**

Q.2 **(a)** The SLR dc-dc converter has the following parameters for its components: Cr = 0.1µF and Lr = 100µH, output capacitor Co = 2000µF. The input source Vd is 24V and the output voltage, Vo is 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) For Y-Z1 phase-shift 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**

OR

(b) Discuss the significance of a phase shifting transformer for a multi-pulse converter application. With detailed mathematical analysis for any one appropriate phase shifting transformer configuration explain how a phase shift of -15° can be obtained. **07**

Q.3 **(a)** What factors lead to deviation of neutral-point voltage? How can this deviation be minimized in a three level diode clamped inverter? **07**

(b) With neat waveforms discuss the operation of ZCS switched dc-dc Buck converter. **07**

OR

Q.3 **(a)** With neat waveforms discuss the operation of ZVS-CV (Zero Voltage Switching-Clamped Voltage) dc-dc converter. **07**

(b) State the two basic rules to be observed for operating the switches of a Matrix converter and hence, group the possible switching state combinations of a 3-phase Matrix converter. Also, discuss the significance of LC filter in context to the converter. **07**

Q.4 **(a)** Critically evaluate the various popular level-shifted carrier based PWM techniques used for multi-level inverter. **07**

	(b)	Explain the control and operation of FC-TCR for reactive power compensation with neat circuit diagram and waveforms.	**07**

OR

Q.4	**(a)**	How can one get more than 5 levels from two H-bridge connected in cascade? Show the maximum possible levels that one can get with this arrangement and also list the switch combinations and corresponding level of output voltage.	**07**
	(b)	Write a brief note on instantaneous reactive power compensation using FACTS devices.	**07**
Q.5	**(a)**	Draw a one line diagram of an HVDC transmission system for interconnecting two ac systems. Also explain the functions of each component involved in it.	**07**
	(b)	With the help of relevant characteristics, discuss in brief the need of MPPT control of a Wind Energy Conversion System.	**07**

OR

Q.5	**(a)**	Write a brief note on any one control strategy for matrix converter.	**07**
	(b)	PV module with following rating is available	**07**

V_{oc} = 21V and I_{sc} = 3.8A.

Two such modules are connected in series and are feeding a resistive load of 10q through a dc-dc converter. Out of Buck and Boost converter which converter one should select to extract maximum power from PV array. Give detailed justification.

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