

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – II • EXAMINATION – WINTER • 2014****Subject code: 1720709****Date: 05-12-2014****Subject Name: Advance Power Converters****Time: 02:30 pm - 05:00 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 the help of a neat phasor diagram, derive the necessary equations for a Y/Z-1 configuration that can help to decide the number of turns to achieve a desired phase shift. **07**
- (b) Compare the operation of SLR half bridge DC-DC converter for the following two cases (i) $N_s < N_o/2$ and (ii) (i) $N_s > N_o$. **07**
- Q.2** (a) With relevant analysis explain how the cancellation of harmonics is achieved in case of multi-pulse (consider 12 pulse converter) converter. **07**
- (b) The ZCS switched resonant BUCK converter has an input voltage of 12V. The values of resonant inductor L_r and resonant capacitor C_r are $2\mu\text{H}$ and 79nF , respectively. The average output voltage is 9V across a 9Ω resistor. The output inductor and capacitor are 10mH and $100\mu\text{F}$, respectively. Determine (a) the switching frequency, f_s (b) the duration for which the energy stored (increases) in the resonant inductor (c) the peak current in the resonant inductor and (d) the peak voltage across the resonant capacitor. **07**
- OR**
- (b) Discuss the working of Zero Current Switching Resonant Switch Converter with the various modes in which it operates. **07**
- Q.3** (a) List the various possible switch combinations and the state space vectors for three-level NPC multilevel inverter. Also indicate the magnitudes of the space vectors. **07**
- (b) Draw the basic matrix converter configuration. Mention the rules that guide the status of the various switches of the converter and hence, list the various possible useful switching state combinations. **07**
- OR**
- Q.3** (a) Discuss the need of input filter and clamping circuit for the matrix converter. **07**
- (b) Draw the circuit topology of a 4-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**
- Q.4** (a) Write a brief note on the four-step current commutation of bi-directional switches of a matrix converter. **07**
- (b) Draw the V-I characteristics of STATCOM and SVC and critically compare them with respect to their construction, control and performance. **07**
- OR**
- Q.4** (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) Write a brief note on UPFC converter. **07**
- Q.5** (a) With relevant waveforms, explain any one level-shifted carrier based modulation scheme used to control 5-level CHB inverter. **07**

- (b) Write a brief note on the control strategy used for transmitting the power through SCR based HVDC terminals. 07

OR

- Q.5** (a) Draw the I-V and P-V characteristics of a PV array. Also plot a characteristic to represent a fixed resistive load R_L on the same plots. On the same characteristics (and with the given resistive load), clearly indicate the regions which one will be able to track if the load R_L is connected to PV array through following: (i) Buck converter (ii) Boost converter and (iii) Buck-Boost converter. 07
- (b) How is variable speed wind turbine superior to fixed speed wind turbine? Discuss how the power electronics converter employed with the variable speed wind turbine can help in maximizing the power generation. 07
