GUJARAT TECHNOLOGICAL UNIVERSITY
ME – SEMESTER II (OLD) – • EXAMINATION – SUMMER 2016

Subject Code: 1720709   **Date:20/05/2016**

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 series loaded resonant (SLR) half-bridge DC-DC converter operating in discontinuous mode. **07**

(b) With the help of neat circuit and phasor diagram, derive the necessary equations for a Y/Z-1 configuration that helps to determine the number of turns to achieve the desired phase shift. **07**

Q.2 **(a)** With relevant analysis show how harmonic cancellation occurs in a 12 pulse converter. Also, comment on the dominant harmonics in the line current and the output voltage. **07**

(b) With neat waveforms discuss the operation of ZVS (Zero Voltage Switching) resonant switch converter. **07**

OR

(b) The Zero Voltage Switching (ZVS) forward converter shown below works with a range of load currents from 5A to 15A. The supply voltage is 40V and the load voltage is 20V. You may assume that the output filter inductor current is smooth. **07**
    (i) Determine the value of L_O if it is chosen so that ZVS is just possible at the minimum load current.
    (ii) Calculate the converter operating frequency when operating at 5A output.
    (iii) Calculate the peak voltage across the transistor when operating at maximum load current.
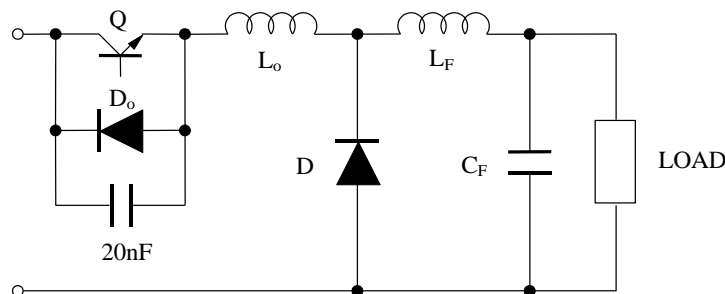
Q.3 **(a)** What factors lead to deviation of neutral-point voltage? How can this deviation be minimized in a three level diode clamped inverter? **07**

(b) 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**

OR

Q.3 **(a)** Write a brief note on over-voltage protection schemes of Matrix converter. **07**

(b) Compare the two-step and four-step current commutation strategy for Matrix converter. **07**

Q.4 **(a)** Draw the space vector diagram for diode-clamped 3-level inverter. Hence, derive the dwell time equations for the space vectors for any one region. **07**

(b)	Write a brief note on Flyback Capacitor multi-level inverter.	**07**

<div align="center">OR</div>

Q.4	**(a)**	Draw the configuration of SVC and STATCOM and compare them on various aspects.	**07**
	(b)	With neat diagram, explain the control scheme for a STATCOM to provide reactive power compensation.	**07**
Q.5	**(a)**	Write a brief note on the control of rectifier and inverter units of HVDC converter.	**07**
	(b)	Draw I-V and P-V characteristics of a PV array and explain the effect of temperature and insolation on it. Also, define fill factor and discuss its significance for PV cell.	**07**

<div align="center">OR</div>

Q.5	**(a)**	With neat waveforms explain phase-shifted multi-carrier modulation control for five-level CHB multi-level inverter.	**07**
	(b)	Discuss in brief MPPT control required for a Wind Energy Conversion System.	**07**

<div align="center">*************</div>