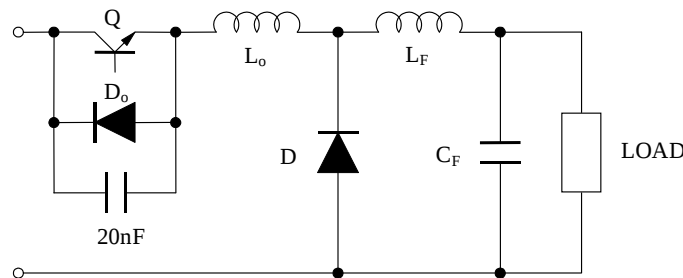


GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2013****Subject code: 1720709****Date: 05-06-2013****Subject Name: Advanced Power Converters****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

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 with switching frequency $N_g < N_g/2$. **07**
- (b) Discuss in brief the significance of μ/Z transformers in context to the multipulse converters and derive the necessary equations for a μ/Z -2 configuration that helps to determine the number of turns to achieve the desired phase shift. **07**
- Q.2** (a) With appropriate block-diagram explain how a 24 pulse converter can be obtained. Clearly indicate the type of phase shifting transformers used with the corresponding phase shift. **07**
- (b) The circuit shown here is infact a Buck Converter with some additional components. With neat waveforms explain the working of circuit clearly stating the significance of the additional components involved. **07**

**OR**

- (b) The PLR dc-dc converter having an isolation transformer with turns ratio $N:1$ is operating in a discontinuous conduction mode. Derive the equations expressing the peak voltage across the capacitor C_r and the peak current through the inductor L_r , where C_r and L_r are the components of resonant circuit. **07**
- Q.3** (a) With neat waveforms discuss the operation of step-down DC-DC ZCS-Resonant-Switch converter. Comment on the current rating of the switch due to the inclusion of the resonating circuit. **07**
- (b) Write a brief note on any one control technique used to operate a 3-phase Matrix converter. **07**

OR

- Q.3** (a) 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**
- (b) Write a brief note on the carrier based PWM control strategies used to control CHB multi-level inverter. **07**

- Q.4 (a)** Classify the space vectors into different groups for a 3-level NPC (diode clamped) inverter. With relevant analysis, obtain the magnitude and orientation for PPP, PNN, PON, and NNO vectors. Also, draw the entire space vector diagram for this inverter. **07**
- (b)** List and explain the design criteria for the space vector control scheme used for Diode Clamped Multilevel inverter from the view point of achieving minimum switching losses and minimum deviation in neutral point voltage. **07**
- OR**
- Q.4 (a)** Suggest a suitable transformer configuration to eliminate harmonics below 10th order in the input line current for a HVDC transmission. Also, derive an equation for primary current of transformer. **07**
- (b)** Write a brief note on STATCOM and explain how it differs from SVC. **07**
- Q.5 (a)** With suitable block diagram discuss the control scheme for Doubly Fed Induction Generator based wind energy generation system. **07**
- (b)** What do you mean by MPPT with respect to Photovoltaic (PV) Systems? With appropriate circuit diagrams and PV characteristics, explain how the maximum power can be obtained from the PV array? **07**
- OR**
- Q.5 (a)** How many levels with equal step size can be obtained at the most with the two cascaded H-bridges having un-identical isolated DC sources? List the different voltage levels available in the phase voltage along with the corresponding switching combinations. **07**
- (b)** Show the block diagram of HVDC transmission system and explain the control scheme to control the converters involved for power transmission between sending and receiving end terminals. **07**
