

# Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



#### I SEMESTER M.TECH (EMAL / PESC)

#### **END SEMESTER EXAMINATIONS, NOV/DEC 2015**

## SUBJECT: POWER ELECTRONIC DEVICES AND CONVERTER

### **TOPOLOGIES** [ELE 503]

Time: 3 Hours

REVISED CREDIT SYSTEM 03 December 2015

MAX. MARKS: 50

#### **Instructions to Candidates:**

- ✤ Answer ANY FIVE FULL questions.
- ✤ Missing data may be suitably assumed.
- **1A.** A single phase full converter is operated from a 230V, 50Hz supply. The load consists of series connected resistance R=10 $\Omega$ , inductance L=5mH and battery voltage E=20V. The delay angle is  $\alpha = \pi/4$ . (a) Express the output voltage in a Fourier series and (b) determine the rms value of the lowest order output harmonic voltage.
- **1B.** A single phase Semiconverter is operated from a 230V, 50Hz supply. The load current with an average value of  $I_0$  is continuous with negligible ripple content. If the delay angle is  $\alpha = \pi/3$ . Express the input current in a Fourier series. Calculate (a) the T.H.D of the input current (b) the displacement factor (c) the input power factor.
- 2A. A three phase full converter with a highly inductive load is operated from a three phase Y connected 415V, 50Hz supply If it is required to obtain an average output voltage of 50% of the maximum possible output voltage. Calculate (a) the delay angle  $\alpha$  (b) Draw the waveforms of output voltage, output current, input current, voltage and current through SCR T1.
- 2B. A single phase AC voltage Controller has a 120V, 60Hz source. The load is a series RL combination with L=5mH and R=5Ω. The delay angles of SCRs T1 and T2 are equal to 75°. Determine (a) the expression for load current for first half period (b) the rms output voltage (c)the rms SCR current(d) the average SCR current (e) the input p.f.
- **3A.** Design a buck boost converter for continuous conduction to supply a load of 75W at 50V from a 40V source .The output ripple must not be more than 1 percent. If the switching frequency is 100kHz, determine the inductor and the capacitor size. Derive the formula used. Also sketch the inductor and the capacitor currents.

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3B.	A full bridge square wave inverter with Vdc=100V, R= $20\Omega$ , L= $50$ mH f= $50$ Hz. Determine (a) the amplitude of the Fourier series terms for the square wave load voltage, (b) the amplitudes of the Fourier series terms for load current and(c) the power absorbed by the load. (d) THD of the load voltage. (Calculate upto harmonic number n=7).	05
4A.	Discuss the concept of Sinusoidal PWM Bipolar switching as applied to a single phase full bridge Inverter. Comment on the harmonic spectrum.	05
4B.	Discuss the Space Vector modulation for 3 phase Inverter circuits.	05
5A.	Describe a single phase auto-sequential CSI with inductive load with the help of circuit diagram and relevant waveforms.	05
5B.	Explain the basic concepts of the snubber action as applied to MOSFETs with generic turn–OFF and turn-ON snubber circuits.	05
6A.	Discuss the switching characteristics of IGBT with relevant waveforms.	05
6B.	Explain the reverse recovery characteristics of Power diodes.	02
6C.	Explain MOSFET drive circuit with an illustration.	03