



# Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



5M

5M

## I SEMESTER M.TECH (EMAL/ PESC) MAKE-UP EXAMINATIONS,

#### DEC 2015 / JAN 2016

#### SUBJECT: POWER ELECTRONIC DEVICES AND CONVERTER

## **TOPOLOGIES** [ELE 503]

**REVISED CREDIT SYSTEM** 

Time: 3 Hours

05 January 2016

MAX. MARKS: 50

#### Instructions to Candidates:

- Answer ANY FIVE FULL questions.
- ✤ Missing data may be suitable assumed.
- A single phase full converter bridge is connected to RLE load. The source voltage is 1A. 230V ,50Hz .The average load current of 10A is constant over the working range. For R=0.4 $\Omega$  and L=2mH ,compute the firing angle for E=120V.Sketch the waveforms of output voltage, load current, source current, voltage and current through any one thyristor.
- 1B. With the help of necessary waveforms discuss the effects of source inductance on the performance of line commutated converters. Find the dc output voltage of single phase fully controlled converter fed from a 230 V 50 Hz ac supply considering the effect of source inductance of 5 mH for a firing angle of 45°, with steady load current 5M of 10 A.
- 2A. Explain the operation of  $3\Phi$  full converter. Derive the expression for the average load voltage with RL load if conduction is continuous. Draw the waveforms of load voltage and current for firing angle of 60°. Clearly show the triggering sequence.
- 2B. Explain how two single phase full converters can be connected back to back to form 5M a circulating type of dual converter
- 3A. A single phase full wave ac voltage controller feeds a load of  $R = 20\Omega$  with an input voltage of 230V ,50Hz .Firing angle for both the thyristors is 45°. Calculate (a) rms 5M value of output voltage (b) input p.f (c) average and rms current of thyristors.
- 3B. Describe the working of a class E chopper with relevant circuit diagrams and its 5M operation in all the four quadrants
- 4A. Explain how a three phase bridge inverter topology works with 180° switching scheme with the help of necessary waveforms. Discuss how the inverter performance 5M can be improved with Space vector PWM technique.
- 4B. Discuss the concept of Sinusoidal PWM Unipolar switching as applied to a single 5M phase full bridge Inverter. Comment on the harmonic spectrum.

5A.	Discuss the advantages and disadvantages of flying capacitor multilevel inverter. Explain its working with the help of circuit diagram and relevant waveforms.	6M
5B.	Discuss in brief the triggering methods of SCR. Also list the ways in which SCR gets triggered in an undesirable situation.	4M
6A.	Explain and sketch the switching characteristics of an IGBT.Also Give a comparison between IGBT and MOSFETS.	6M
6B.	Write a technical note on Cycloconverters.	4M