

**R13**

Code No: 115AF

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B. Tech III Year I Semester Examinations, March - 2017****POWER ELECTRONICS****(Electrical and Electronics Engineering)****Time: 3 hours****Max. Marks: 75****Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A****(25 Marks)**

- 1.a) List out at least two merits of IGBT over MOSFET. [2]
- b) Why trains of narrow gate pulses are required to turn on a thyristor? And why thyristor is called as a semi controlled device. [3]
- c) Draw average output voltage versus triggering angle characteristics of a single phase semi-converter for R-load. [2]
- d) How power flow can be controlled in a single phase fully controlled converter between source and load for R load and RL load? [3]
- e) What is the Time Ratio Control of DC-DC Converter? [2]
- f) List out the disadvantages of Frequency modulation control of dc-dc converter. [3]
- g) What kind of commutation is required for step-up cyclo-converter? [2]
- h) What is the difference single phase ac voltage controller and single phase cyclo-converter? [3]
- i) What do you mean by Harmonics? [2]
- j) How quality of an inverter output voltage can be measured? [3]

**PART - B****(50 Marks)**

- 2.a) Discuss the need for parallel connections of SCRs with necessary diagrams.
  - b) Discuss various protection circuits of a thyristor. [5+5]
- OR**
- 3.a) A thyristor is triggered by a train of pulses of frequency 1 KHZ and of duty cycle 0.4. Calculate the pulse width if average power dissipation is 5 W. Estimate the maximum allowable gate power loss.
  - b) With neat circuit diagram explain how UJT firing circuit will generate pulse for an SCR. [5+5]
- 4.a) Describe with neat circuit diagram and associated waveforms, operation of a 1-  $\Phi$  half wave controlled converter with Inductive load.
  - b) A 1- phase full bridge converter using four SCRs feeds power to RLE load with  $R=10\ \Omega$ ,  $L = 100\text{mH}$ , and  $E = 100\text{V}$ . The ac source voltage is 230 V at 50Hz. Assuming continuous conduction; determine the average value of load current for firing delay angle  $45^\circ$ . [5+5]

**OR**

- 5.a) A 1- phase semi-converter delivers power to RL load with  $R = 5 \Omega$ ,  $L = 10 \text{ mH}$ . The a.c. supply voltage is 230 V, 50 Hz. For the continuous conduction, find the average value of output voltage and current for the firing angle of  $45^\circ$ .
- b) Explain the operation of 3- phase half-wave converter for resistive load with necessary waveform and circuit diagram. [5+5]
- 6.a) Describe the operation of a single phase AC voltage controller with a neat circuit diagram and output wave forms with respect to source voltage waveforms at  $\alpha = 60^\circ$  for R-load.
- b) A single phase voltage controller has input voltage of 230 V, 50 Hz and a load of  $R = 15 \Omega$ . For 6 cycles on and 4 cycles off, determine. (i) rms output voltage (ii) input pF and (iii) average and rms thyristor currents. [5+5]

**OR**

- 7.a) Describe the working principle of 1 – phase to 1 - phase step-down midpoint type cyclo-converter with associated waveforms for R load.
- b) A 1-phase a.c.voltage controller has a resistive load of  $R = 5 \Omega$  and the input voltage is  $V_s = 208 \text{ V}$ , 60 Hz. If the desired output is  $P_O = 2 \text{ kW}$ , Compute i) delay angle,  $\alpha$  and ii) input power factor, PF. [5+5]
- 8.a) Explain the operation of a step down chopper with RLE load. Derive the necessary output voltage and current expressions.
- b) A step-down chopper is fed from a 220 V DC source to deliver a load voltage of 100 V. If the non-conduction time of transistor is  $100 \mu\text{s}$ . The required pulse width would be? [5+5]

**OR**

- 9.a) Write short notes on i) Jones chopper and ii) current limit control of dc-dc converter.
- b) A dc chopper is connected to an inductive load with a resistance of  $5 \Omega$  and an input voltage of 300 V. The on time and off time of the chopper are 20 ms and 10 ms respectively. Estimate the duty ratio, chopping frequency, average load voltage and average load current. [5+5]
- 10.a) Describe the operation of 3-phase bridge inverter circuit diagram with resistive load in  $120^\circ$  conduction mode
- b) A 3-phase bridge inverter is fed from a d.c. source of 200 V. If the load is star-connected of  $10 \Omega$  /phase resistance, Estimate the RMS load current, the required RMS current rating of the thyristors and the load power for i)  $120^\circ$  firing and ii)  $180^\circ$  firing. [5+5]

**OR**

- 11.a) The square-wave inverter of 1-phase full bridge type has  $V_{dc} = 125 \text{ V}$ , an output frequency of 60 Hz, and a resistive load of  $12.5 \Omega$ . Sketch the currents in the load, each switch, and the source, and determine the average and rms values of each.
- b) With the help of neat circuit diagram and associated waveforms, explain operation of 1-phase full bridge voltage source inverter with RL load. [5+5]

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