

Code No: 125AF

R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, May - 2018

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) What is the two transistor model of SCRs? [2]
- b) What is a forced commutation? What are the advantages of forced commutation for ac-dc converters? [3]
- c) What is symmetric-angle control of converters? [2]
- d) Does the input power factor of converters depend on the load power factor? [3]
- e) What are the advantages and disadvantages of a boost converter? [2]
- f) What is the discontinuous mode of operation of a regulator? [3]
- g) What are the steps involved in determining the output voltage waveforms of three phase bidirectional controllers? [2]
- h) What are the advantages and disadvantages of cycloconverters? [3]
- i) What are the advantages of parallel resonant inverters? [2]
- j) What are the effects of eliminating lower order harmonics? [3]

PART - B

(50 Marks)

- 2.a) What are the problems associated with firing of parallel connected SCRs? Draw and explain circuit for firing of parallel connected SCRs.
- b) Draw and explain the necessity of static and dynamic equalizing circuit for series connected SCRs? Derive relations used for determining the values of shunt resistor R and capacitor C in this circuit. [5+5]

OR

- 3.a) What will happen if one of the SCR has large delay time in parallel SCRs? Explain the convenient method of triggering parallel connected SCRs.
- b) Draw and explain the simultaneous triggering circuit of series connected SCRs. [5+5]
- 4.a) A three phase fully controlled bridge converter is connected to three phase ac supply of 400V, 50Hz and operates with a firing angle  $\alpha = \pi/4$ . The load current is maintained constant at 10a and the load voltage is 360V, compute: (i) Source inductance  $L_s$  (ii) Load resistance R, (iii) Overlap angle,  $\mu$ .
- b) Explain the operation of three phase, half wave controlled converter with resistive load and inductive load. Sketch the associated waveforms also. [5+5]

OR

- 5.a) Describe the working of six pulse midpoint converter with interphase reactor. Sketch the waveforms for  $\alpha=30^\circ$  and  $\alpha=120^\circ$ .
- b) Explain the effect of battery load on the performance of single phase fully controlled bridge converter. [5+5]
- 6.a) With the circuit diagram and output voltage waveforms, explain the working of Jones chopper.
- b) A dc on-off chopper operating at 1 kHz and duty cycle of 10% is supplied from a 200V source. If the load inductance is 10mH and resistance 10 $\Omega$ . Compute the maximum and minimum current in the load. [5+5]
- OR
- 7.a) Draw a schematic diagram of a single phase ac chopper and discuss in brief with output voltage and current waveforms.
- b) Explain in brief how average voltage across the load is made more than dc supply voltage using chopper. Derive the expression for the average voltage. [5+5]
- 8.a) Draw and explain the control circuit block diagram for a cycloconverter with non-circulating current mode.
- b) A three phase resistive load is to be controlled by three Triacs from a 415V supply. If the load is 15 kW, determine the required ratings of Triacs. If thyristors were used instead of Triacs, determine their rating. [5+5]
- OR
- 9.a) Describe the control scheme for a cycloconverter using voltage sensing principle of converter group selection. Also, draw and discuss the various voltage waveforms of a control scheme.
- b) A single phase half wave AC voltage controller, using one SCR in antiparallel with a diode. Feeds 1kW, 230V heater. Find the load power for a firing angle of (i)  $0^\circ$  (ii)  $180^\circ$  (iii)  $70^\circ$ . [5+5]
- 10.a) Explain the single phase PWM, transformer connection, multiple commutation and filter methods used for reduction of harmonics in inverter output.
- b) Draw and explain the operation of the time sharing inverter circuit. Also draw the related voltage and current waveforms. [5+5]
- OR
- 11.a) A single phase half bridge inverter may be connected to a load consisting of (i) R (ii) RL and RLC overdamped (iii) RLC underdamped. For all these loads, draw the load voltage and load current waveforms under steady state operating conditions. Also, indicate the conduction of the various elements of the inverter circuit.
- b) Give the detailed design aspects of series inverter. [6+4]

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