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Z 6399

M.E. DEGREE EXAMINATION, MAY/JUNE 2008.

First Semester

Power Electronics and Drives

PE 1603 — ANALYSIS OF POWER CONVERTERS

(Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the use of free wheeling diodes in AC-DC converters?
2. What is the cause of circulating currents in dual converters?
3. How do you relate output ripple voltages with delay angle?
4. What is effect of source impedance in the AC-DC converters?
5. How is the filter size affected by the switching frequency of chopper?
6. State the principle of step-down chopper.
7. Differentiate integral cycle control and phase control.
8. List few applications of ac voltage controllers.
9. What are the methods of harmonic reduction in cycloconverters?
10. What is the difference between envelope cycloconverter and phase controlled cycloconverter?

PART B — (5 × 16 = 80 marks)

11. (a) (i) A single phase full converter has an RLE load ($R = 1.5 \Omega$, $L = 4.5 \text{ m H}$, $E = 10 \text{ V}$). Compute the average value of load current and load voltage at $\alpha = 30^\circ$. Also draw the necessary waveforms. (8)
- (ii) Discuss briefly continuous and discontinuous modes of operation of single phase AC-DC converters. (8)

Or

- (b) (i) Discuss (1) Harmonic factor (2) Displacement factor (3) Input power factor of single phase semi converter. (8)
- (ii) Discuss with relevant waveforms rectification mode and inversion mode of operations of AC-DC converters. (8)
12. (a) (i) With relevant circuit diagram and waveforms explain the principle of operation of three-phase fully controlled converter with RL load. (10)
- (ii) How does the load and source inductances affect the performance of three phase full converter? (6)

Or

- (b) (i) Draw the circuit diagram of three-phase dual converter and explain its principle of operation. Also draw the relevant waveforms. (10)
- (ii) Discuss how power factor improvement can be achieved with converters. (6)
13. (a) (i) Explain the control strategies of a dc chopper. (8)
- (ii) Explain the principle of operation of cuk converter. Also derive the expressions for average output voltage and average output current. (8)

Or

- (b) With a neat circuit diagram, explain the principle of operation of
- (i) Resonant converter (8)
- (ii) Buck-Boost converter. (8)

14. (a) (i) An ac voltage controller feeds a pure resistive load of $R = 10$ ohms. Determine the values of rms value of current, displacement factor and power factor. Assume supply voltage = 220 V and $\alpha = 45^\circ$. (10)
- (ii) Explain the application of a single phase a.c. voltage controller as a transformer tap changer. (6)

Or

- (b) (i) With a neat circuit diagram, explain the principle of operation of three phase ac voltage controller feeding RL load. (8)
- (ii) A three phase ac voltage controller feeds a star connected balanced resistive load. For a firing angle $\alpha = 60^\circ$, draw load voltage (phase as well as line) and thyristor voltage waveforms. (8)
15. (a) (i) Draw the schematic arrangement of single phase to single phase cycloconverter. With relevant waveforms explain its principle of operation. (8)
- (ii) Compare circulating and noncirculating current modes of operation of cycloconverters. (8)

Or

- (b) (i) With a neat circuit diagram and relevant waveforms explain the operation of three phase to single phase cycloconverter. (8)
- (ii) Explain force commutated and line commutated cycloconverters. (8)