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J 3217

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Fourth Semester

Mechatronics Engineering

EE 1263 — POWER ELECTRONICS

(Regulation 2004)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is reverse recovery time t_{rr} in a Power diode?

2. Why di/dt protection is required in a Thyristor circuit?

3. Sketch the variation of output voltage with firing angle α for semi and fully converter in a same graph.

4. Draw the triggering circuit using a pulse transformer and mention the advantages.

5. A DC chopper is connected to an inductive load with a resistance of 5 Ω 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 and chopping frequency.

6. What is meant by load commutation of a Thyristor?

7. Write down the major limitations of the series inverter.

8. What is meant by PWM control?

9. A 230 V, 50 Hz single phase full wave ac voltage controller is connected to a resistive load of 10 Ω. Estimate the RMS output voltage for the firing angle of 90°.

10. Mention a few applications of a cycloconverter.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the construction and characteristic features of a TRIAC. (8)

(ii) Explain the dv/dt and di/dt protection techniques for the Thyristors. (8)

Or

(b) (i) With a suitable diagram explain the characteristics of a MOSFET. (8)

(ii) Give the comparison between transistor and thyristor (8)

12. (a) (i) With the suitable diagram and waveform explain the operation of a single phase fully controlled bridge rectifier with RL load. (8)

(ii) Draw and explain the synchronized UJT triggering circuit with necessary waveform. (8)

Or

(b) (i) Explain the effect of source inductance on the performance of a single phase fully controlled bridge rectifier. (8)

(ii) A three phase full converter is fed by a 400 V, 3 - Phase, 50 Hz supply. The average load current is 100 A, assuming a highly inductive load, find for a firing angle of 60°.

(1) Output voltage

(2) Output power

(3) PIV of the thyristor. (3 + 3 + 2)

13. (a) (i) Draw and explain the circuit diagram for four quadrant chopper. (8)

(ii) What are the two control strategies employed in DC chopper? Explain them in detail with the waveform. (8)

Or

(b) (i) What is meant by current commutation? Explain the operation of current commutated chopper with neat circuit diagram. (10)

(ii) A chopper circuit is operating on TRC principle at a frequency of 2 kHz on a 220 V DC supply. If the load voltage is 170 V, compute the conduction and blocking period of thyristor in each cycle. (6)

14. (a) (i) Draw the circuit diagram and waveform of a parallel inverter and explain. (8)

(ii) Explain the operation of 180° mode three phase voltage source bridge inverter with necessary waveform. (8)

Or

(b) (i) List the commonly used PWM techniques and explain sinusoidal pulse width modulation in detail. (8)

(ii) Explain the single phase current source inverter with a neat circuit and waveform. (8)

15. (a) (i) With the help of a circuit diagram and waveform explain the operation of a single phase fully controlled AC voltage controller with RL load. (8)

(ii) Describe the bridge type single phase to single phase cyclo converter with necessary diagram. (8)

Or

(b) (i) Draw the circuit diagram for multi stage sequence control of AC voltage regulator and explain. (8)

(ii) A single phase full wave AC voltage controller has a resistance load of 5 ohm. The input AC voltage is 230 V at 50 Hz. for a delay angle of 120° determine the RMS load voltage, RMS load current and input power factor. (8)
