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P 1200

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Fourth Semester

Mechatronics Engineering

EE 332 — POWER ELECTRONICS

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the types of power diodes?

2. What are the advantages of IGBTs over MOSFETs and BJTs?

3. What are the effects of source inductances on the output voltage of a rectifier?

4. What is pulse-width-modulation control of a converter?

5. What is the principle of operation of a step-up converter?

6. Draw the simple circuit of a Impulse commutated chopper.

7. What are the control methods employed for controlling the inverter output voltage?

8. What is a current source inverter?

9. What is a cycloconverter?

10. Draw the circuit diagram of a single phase bidirectional controller.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw two series connected diodes with reverse bias and explain steady state voltage sharing characteristics. (8)

(ii) Sketch the transfer characteristics of IGBT and explain them. (8)

Or

(b) (i) Draw Four-transistor GTO model and explain how it yields improved on-state, turn-on, and turn-off characteristics. (8)

(ii) Draw and explain steady-state and switching characteristics of power MOSFETS. (8)

12. (a) (i) Explain the operation of a three-phase bridge rectifier considering the effect of source inductances. (8)

(ii) Draw the circuit diagram and explain the operation of a $1 - \phi$ fully controlled converter supplying RLE load. (8)

Or

(b) (i) Draw the circuit diagram and explain the working principle of a three phase fully controlled converter supplying 'R' load. Sketch the load voltage waveforms for $\alpha = 30°$ and $90°$ and derive an expression for average output voltage. (12)

(ii) The power factor of semi converters supplying RL loads is always better than full converters supplying RL loads. Why? (4)

13. (a) Explain the modes of operation of a step up chopper with relevant equivalent circuit diagrams and current waveforms. (16)

Or

(b) Draw the circuit diagram of a Impulse commutated chopper and explain the various phases of operations. (16)

14. (a) (i) What are the commonly used PWM techniques for the control of the inverters. Explain one of them. (8)

(ii) Explain simple series resonant inverters with unidirectional switches. (8)

Or

(b) Draw the circuit diagram and explain the working principle of a three-phase current-source inverter supplying a balanced connected resistive load. Also sketch the waveforms of gating signals and line currents. (16)

15. (a) (i) Explain the principle of on-off control in a single-phase full wave AC controller supplying a resistive load. (4)

(ii) A $1-\phi$ full wave ac voltage controller supplies a R load. Derive an expression for the RMS value of the output voltage and supply p.f. Also sketch the waveforms of source current, device current and load current. (12)

Or

(b) (i) Draw the circuit diagram and explain the principle of operation of a single phase to single phase cycloconverter supplying a resistive load. (8)

(ii) Explain the working of a three phase to single phase cycloconverter to produce output voltage with a frequency of 12 Hz. (8)
