T 8191

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2006.

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. IGBT is a voltage controlled device. Why?

2. Define circuit turn-off time.

3. Define Voltage ripple factor.

4. What is meant by input power factor in controlled rectifier?

5. Mention a few applications of AC chopper.

6. What are the schemes to control the average value of output voltage in choppers?

7. Why are thyristors not preferred for inverters?

8. Compare CSI and VSI.

9. What is meant by sequence control of ac voltage controllers?

10. Which circuit is called as frequency changer? Define the working. What are its applications?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw the two-transistor model of SCR and derive an expression for anode current. (8)

(ii) Explain the principle of operation and draw the characteristics of MOSFET. (8)

Or

(b) (i) Explain the principle operation and draw the characteristics of IGBT. (8)

(ii) With the aid of circuit diagram explain the operation of GTO. (8)

12. (a) Describe the working of single phase fully controlled bridge converter in the rectifying mode and inversion mode and derive the expressions for average output voltage and rms output voltage. (16)

Or

(b) (i) A three phase fully controlled bridge converter is connected to a three phase AC supply of 400 V, 50 Hz and operates with a firmy angle $\alpha = 45°$. The load current is maintained constant at 10 A and the load voltage is 360 V. Compute source inductance (L_s) , Load resistance (R) and Overlap angle (μ). (8)

(ii) Describe the working of dual converter and explain the operation with relevant wave forms. (8)

13. (a) (i)

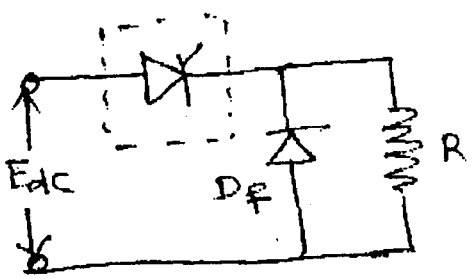

Fig. 13.a

For the chopper circuit shown in Fig. 13.a, express the following variables of E_{dc} and duty cycle α compute average output voltage and current, output current at the instant of commutation, average and rms free wheeling diode currents and rms value of the output voltage and average load current. (12)

(ii) Draw the power circuit diagram of current commutated chopper. What are the assumptions made? (4)

Or

(b) Explain the working of voltage commutated chopper with aid of circuit diagram and necessary wave forms. Derive an expression for its output voltage. (16)

(a) Describe the operation of series inverter with aid of diagrams. Derive the expressions for output frequency, current and voltages. (16)

Or

(b) Explain the operation of three phase bridge inverter.

(i) 180° modes of operation. (8)

(ii) 120° modes of operation. (8)

15. (a) (i) Explain the operation of single phase AC voltage controller with R load. (8)

(ii) A single phase AC voltage controller with RL loads has the following details : Supply voltage = 230 V, 50 Hz ; R = 4Ω ; X_L = 3Ω. Calculate the control range of Firmy angle, the maximum value of rms load current, the maximum power and the maximum power factor. (8)

Or

(b) Draw the circuit diagram and explain the operation of single phase to single phase step-down cyclo-converter with voltage and current wave forms for continuous load current and discontinuous load current. (16)