## B 2198

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 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 methods used to turn on a thyristor?

2. How many different modes by which a triac can be triggered?

3. What are the different types of single phase converters?

4. State any two advantages circulating current mode of operation in single phase dual converter.

5. Draw the circuit of a step down chopper.

6. What are the three different ways of controlling the average value of the load current in a step down chopper?

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

8. What are the performance parameters by which the quality of an inverter is normally evaluated?

9. What are the most common applications of a.c. voltage controllers?

10. Define a cyclo converter.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw and explain the switching model of MOSFETS and its typical switching wave forms and times. (8)

   (ii) With symbol and circuit for an IGBT, explain typical output and transfer characteristics of IGBT. (8)

Or

(b) Explain the construction switching characteristics of BJT. (16)

12. (a) (i) Explain the principle of a single phase half wave controlled converter operation with a resistive load. (8)

(ii) If the converter of fig. 1 has a purely resistive load of R and the delay angle in $\alpha = \frac{\pi}{2}$ determine (1) the rectification efficiency (2) the form factor (FF), (3) The ripple factor (RF), (4) the TVF, and (5) the PIV of thyristor $T_1$. (8)
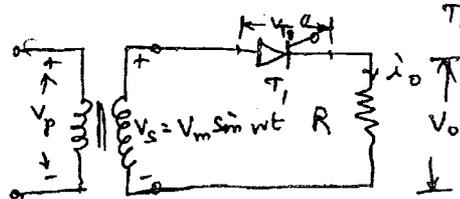


Fig. 1

Or

(b) (i) Draw the circuit of a three phase full converters and its output voltage waveform with RLE load. (8)

(ii) A three-phase full converter is supplied from a three phase 230 V, 60 Hz supply. The load current is continuous and has negligible ripple. If the average load current $I_{dc} = 150$ A and the commutating inductance $L_c = 0.1$ mH, determine the overlap angle when (1) $\alpha = 10°$, (2) $\alpha = 30°$ and $\alpha = 60°$. (8)

13. (a) Explain the operation of voltage commutated chopper with necessary waveforms. (16)

Or

(b) A highly inductive load is supplied by a converter as shown in fig 2. The average load current is $I_a = 100$ A and the load ripple current can be considered negligible ($\Delta I = 0$). A simple LC input filter with $L_e = 0.3$ mH and $C_e = 4500$ μF is used. If the converter is operated at a frequency of 350 HZ and a duty cycle of 0.5, determine the maximum rms value of the fundamental component of converter-generated harmonic current in the supply line. (16)
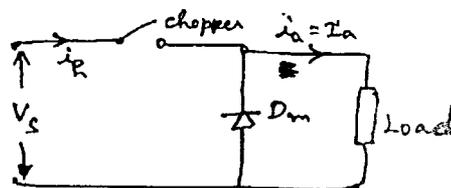


Fig 2.

(a) Draw the circuit of a series inverter and explain its operation with neat sketches. (16)

Or

(b) Draw the circuit of a three-phase current-source inverter and the waveform for gating signals and line currents for a Yconnected load. (16)

5. (a) Draw a single phase AC voltage controller with RL load and explain wave forms for the thyristor current, gating pulses, and input voltage. (16)

Or

(b) With the circuit diagram of a three phase cyclo converter draw the synthesis of output wave form for an output frequency of 12 HZ. (16)

———————