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B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2007.

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. List the differences between SCR and TRIAC?

2. What is holding and latching currents in SCR?

3. What is an overlap angle?

4. Mention the quadrants of operation of half converter and full converter with diagrams.

5. Define duty cycle.

6. Name some thyristor forced commutation techniques.

7. Mention the merits of using PWM inverters?

8. Distinguish between voltage source and current source inverters?

9. For a single phase ac voltage controller feeding RL–load draw the output voltage waveform for a triggering angle of 45°. Assume discontinuous current mode.

10. What is a cycloconverter?

11. (a) (i) Explain the principle of operation of IGBT. (8)

 (ii) Draw and explain the switching characteristics of SCR? (8)

Or

 (b) Describe in detail the various protection circuits required for thyristor.
 (16)

12. (a) With a aid of neat circuit diagram and waveform explain the effect of source inductance in single phase full converter. Derive the expression for the average output voltage. (16)

Or

 (b) Draw the circuit diagram of a three phase semiconverter with RL–load and explain its operation. Sketch the output voltage waveform for a firing angle delay of $\alpha < 60°$. Assume continuous load current. (16)

13. (a) (i) Briefly explain complementary commutation technique applied to thyristors. (8)

 (ii) For a chopper circuit shown in Fig. 13 (a) (ii), dc source voltage = 230 V, load resistance = $10\,\Omega$. Take a voltage drop of 2 V across chopper when it is ON. For a duty cycle of 0.4 calculate average output voltage, rms output voltage and chopper efficiency. (8)
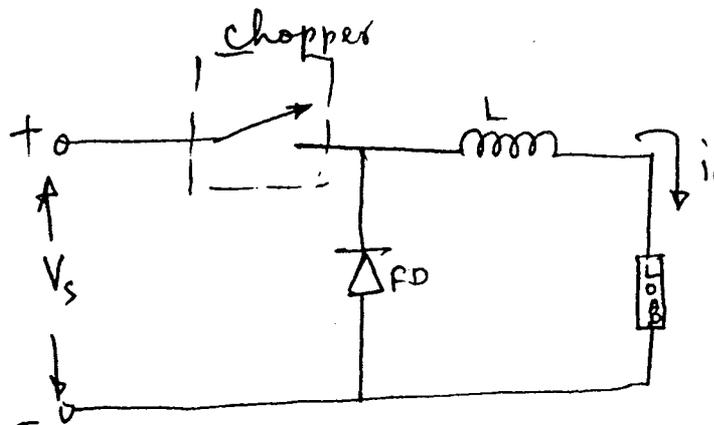

Fig. 13 (a) (ii)

Or

 (b) Draw the power circuit diagram of voltage commutated chopper. Explain its operation with relevant waveforms. (16)

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14. (a) Explain the working of single phase full bridge inverter circuit for R, RL and RLC loads. Draw the output voltage and current waveforms for all types of loads. (16)

Or

(b) Explain sinusoidal pulse modulation as used in PWM inverters. Discuss about the harmonics present in the inverter output voltage. (16)

15. (a) Describe the working of a two stage sequence control of voltage controllers for both R and RL loads. What is the advantage of this controller over single-phase full wave voltage controller. (16)

Or

(b) Draw the power circuit of a 1 ϕ – 1 ϕ step down cycloconverter. Explain its operation with output voltage and current waveforms. Assume load current is continuous. (16)

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