G 1236

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

Fourth Semester/Fifth Semester

Electrical and Electronics Engineering

EE 332 — POWER ELECTRONICS

(Common to B.E. Mechatronics Engineering)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List out any two differences between GTO and SCR.

2. Define reverse recovery time in diodes.

3. A 2-pulse converter is fed with a 230 V, 50 Hz supply. The load on the converter is a pure resistance of $R = 10 \ \Omega$. Obtain the average output voltage for a firing angle of $\alpha = 135°$.

4. By what factor the dc output voltage of 6-pulse converter is reduced due to the effect of source inductance.

5. Define current commutation.

6. How does the chopping frequency affect the load current in chopper circuits?

7. Differentiate between voltage source and current source inverters.

8. List the power devices which are preferred in inverter circuits.

9. What is a cyclo-converter?

10. Draw 2 cycles of the input and output voltage waveforms of a single phase AC voltage controller with RL-load for a firing angle of $\alpha = 60°$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Draw and explain the switching characteristics of IGBT. (8)

    (ii) Explain the principle of operation of TRIAC. (8)

Or

    (b) (i) Explain with neat model the characteristics of GTO. (8)

    (ii) Draw and explain the switching characteristics of power BJT. (8)

12. (a) Draw the power circuit diagram of a 6-pulse converter. Explain its working with relevant waveforms. Draw the input-output voltages and current waveforms for a firing angle of $\alpha = 60°$. Derive the expression for average and rms output voltage. (16)

Or

    (b) (i) Explain any one of the power factor improvement methods in converter circuits. Draw relevant waveforms. (8)

    (ii) Explain the effect of source inductance on output voltage with necessary equations in single phase converter circuits. (8)

13. (a) (i) Explain the various modes of operation of load commutated chopper with necessary circuit diagram and waveforms. (10)

    (ii) Explain briefly the firing circuits used in chopper circuits. (6)

Or

    (b) (i) Compute the dc output voltage of a step up chopper for a dc input voltage of 110 V, chopping frequency 5 kHz and $T_{on} = 80 \mu s$. Derive the formula used. (8)

    (ii) Explain briefly the working of voltage commutated chopper. (8)

14. (a) Draw the power circuit diagram of a 3-phase voltage source inverter. Explain its working in 120° mode. Draw appropriate waveforms. (16)

Or

    (b) (i) Explain with necessary diagram the working of a series inverter. (8)

    (ii) Explain the sinusoidal PWM technique to control the output voltage of the inverter. (8)

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15.   (a)   (i)   Draw the power circuit diagram of a cyclo-converter. Explain the step down operation with relevant waveforms.   (8)

(ii)   Discuss briefly the gate pulse requirement in AC voltage controllers.   (8)

Or

(b)   (i)   Explain briefly multistage sequence control.   (8)

(ii)   Explain the working of 3-phase to 1-phase cycloconverter with necessary circuit diagram and waveform.   (8)

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