B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Fifth Semester

Electrical and Electronics Engineering

EE 6503 — POWER ELECTRONICS

(Common to Electronics and Instrumentation Engineering, Instrumentation and Control Engineering, Mechatronics Engineering)

(Regulation 2013)

(Also common to PTEE 6503 – Power Electronics for B.E. Part-Time – Fourth semester – Electrical and Electronics Engineering – Regulation 2014)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by commutation of SCR and list its types?

2. What are the advantages of GTO over SCR?

3. Classify the different types of controlled Rectifier.

4. What is the function of freewheeling diode and state its advantages.

5. What is the effect of load inductance on the load current waveforms in the case of DC chopper?

6. What is the disadvantage of frequency modulated chopper?

7. Compare CSI and VSI.

8. Give the use of resonant switching in power electronic circuits.

9. What is integral cycle control ?

10. What are the different control techniques for AC regulator?

PART B — (5 × 13 = 65 marks)

11. (a) Explain the static and switching characteristics of IGBT and MOSFET.

(13)

Or

(b) Explain why triac is rarely used in I quadrant with negative pulse and in III quadrant with positive pulse.

(13)

12. (a) Explain the operating principle of a single phase full controlled bridge converter.

Or

(b) Explain the operating principle of three phase dual converter with necessary waveforms.

13. (a) Derive the expression for voltage gain in a dc – dc boost converter and explain the modes of operation with relevant waveforms.

Or

(b) Explain the working principle of voltage commutated chopper showing the current and voltage waveform across each device.

14. (a) Explain the operation of 3 phase bridge inverter for 120 degree mode of operation with phase and line voltage waveforms.

Or

(b) State different methods of voltage control in inverters. Describe about PWM control in inverter.

15. (a) Explain the working of three phase to single phase cycloconverter with neat circuit diagram and necessary waveforms.

Or

(b) (i) Write a short notes on matrix converter.

(ii) Explain the operation of single phase full wave A.C voltage regulator with help of voltage and current waveform.

PART C — (1 × 15 = 15 marks)

16. (a) A single-phase, half-wave rectifier with an AC voltage of 150 V has a pure resistive load of $9\,\Omega$. The firing angle α of the thyristor is $\frac{\pi}{2}$. Determine the

(i) Rectification efficiency

(ii) Form factor

(iii) Transformer derating factor

(iv) Peak inverse voltage of the SCR

(v) Ripple factor of the output voltage.

Assume that the transformer ratio is 2 : 1.

Or

(b) The series resonance turn-off-circuit of Fig.16.b has the following data: $E = 160$ V, $L = 8$ MH, resistance of inductor coil $r_L = 0.2\,\Omega$, $R_{ld} = 0.6\,\Omega$ and $C = 65\,\mu F$.

Determine:

(i) Derive an expression for the current i(t).

(ii) The pulse width and

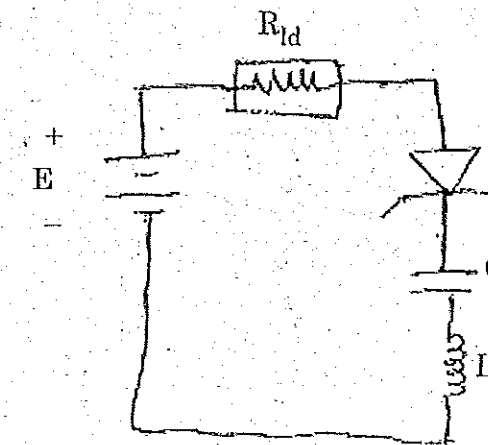(iii) The time required for the capacitor voltage to attain a voltage equal to 1.7 E.

Fig.16.b