Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 30580

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Fifth Semester

Electrical and Electronics Engineering

EE 8552 – POWER ELECTRONICS

(Common to : Mechatronics Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List any four applications of TRIAC.

2. What is the purpose of a gate driver circuit for an IGBT?

3. What is meant by the peak inverse voltage of a thyristor in a rectifier circuit?

4. Mention the standard Test conditions for a solar PV Panel.

5. What is meant by the current limit control of the chopper?

6. List any four application applications of boost converter.

7. Define modulation index.

8. Why inverter is essential in the construction of UPS?

9. List the types of AC voltage controllers.

10. What are the advantages of a matrix converter over a cyclo converter?

PART B — (5 × 13 = 65 marks)

11. (a) Explain the turn-on and turn-off characteristics of MOSFET.

Or

(b) Explain the forced commutation techniques of SCR.

12. (a) Describe the operation of a single-phase semi-converter with necessary waveforms. Also, derive the expression for the average output voltage of a single-phase semi-converter.

Or

(b) Describe the operation of the single-phase dual converter with the necessary diagram and waveforms. Also, derive the expression for the circulating current in the single-phase dual converter.

13. (a) Explain the operation of the boost converter with the necessary circuit diagram and waveforms. Also, derive the expression for the output voltage of the boost converter.

Or

(b) Explain the operation of the resonant converter with the necessary circuit diagram and waveforms.

14. (a) Describe the operation of a three-phase voltage source inverter in 180° conduction mode with necessary waveforms.

Or

(b) Describe the sinusoidal PWM-based control of a three-phase voltage source inverter with the circuit diagram and waveforms.

15. (a) A single-phase AC voltage controller feeds a resistive load of 15 Ω from 230 V, 50 Hz power supply. Calculate the RMS output voltage, input power factor, and average and r.m.s thyristor currents if the thyristors are turned on for 4 cycles and turned off for 5 cycles.

Or

(b) Draw and explain the matrix converter.

PART C — (1 × 15 = 15 marks)

16. (a) A three-phase full wave-controlled rectifier is supplied constantly from 415 V, 50 Hz power supply. If the load is 110 Ω.

Calculate

(i) delay angle which results in average load current of 2A. (8)

(ii) The amplitude of first voltage harmonic (at 300 Hz). (7)

Or

(b) A 250 W full bridge LLC resonant converter has an input voltage varying from 18 V to 50 V, and a nominal input voltage 33 V. The output voltage obtained is 400 V at the resonant frequency of 100 kHZ, and the maximum quality factor is 0.5. Calculate the transformer turns ratio, maximum and minimum values of converter voltage gain, reflected load resistance at full load, resonant inductor and capacitor and magnetizing inductance. Assume that the ratio of total primary inductance to resonant inductance to resonant inductance is 6.3