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Question Paper Code : 40579

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

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. What are snubber circuits?

2. Draw the circuit symbols of IGBT and IGCT.

3. What is IGR with respect to dual converters?

4. What is the purpose of a light dimmer?

5. Prove the output voltage relation of buck converter in terms of input voltage and duty cycle.

6. What are resonant converters?

7. Define modulation index in Sinusoidal PWM strategy.

8. Mention the types of UPS.

9. Mention the primary advantage of using multistage control in an AC voltage controller.

10. What is bidirectional switch?

PART B — (5 × 13 = 65 marks)

11. (a) Explain the working of power SCR using the two-transistor model and derive an expression for anode current.

Or

(b) Describe the principles of different commutation methods of SCR.

12. (a) Describe the working of single-fully controlled bridge converter in the rectifying mode and inversion mode. And derive the expressions for average output voltage and rms output voltage.

Or

(b) Obtain the effect of source inductance in single-phase fully controlled rectifier and extend the discussion to three-phase converter.

13. (a) Describe the working of class C choppers with mode diagrams and waveforms.

Or

(b) Explain the principle of working of the buck-boost chopper with suitable waveforms and mode diagrams.

14. (a) With neat sketches, explain the operation of three phase voltage source inverter. Draw phase and line voltage waveforms on the assumption that each switch conducts for 180° and the resistive load is star connected.

Or

(b) Enumerate the of working of the single-phase capacitor commutated CSI with relevant diagrams.

15. (a) Describe the operation of the 3-phase thyristorised AC voltage controller in any one configuration with neat power diagram and waveforms.

Or

(b) Discuss the operation of a single-phase to single phase cycloconverter for the output frequency one third of the input frequency.

PART C — (1 × 15 = 15 marks)

16. (a) (i) For a single-phase voltage controller feeding a resistive load, show that power factor is given by the expression (8)

$$\left[\frac{1}{\pi}\left\{(\pi-\alpha)+\frac{1}{2}\sin 2\alpha\right\}\right]^{1/2}$$

(ii) A battery powered electric vehicle uses a dc motor drive, controlled by a dc chopper working at10 kHz The battery voltage is 220V. the minimum turn-on and off-time of the chopper switch (an inverter grade SCR) are 2 μs and 25 μs, respectively. Determine the minimum and the maximum dc voltage that the chopper can deliver to the motor. (7)

Or

(b) (i) A 6-pulse converter connected to the secondary of 6.6kV/415V, 50 Hz, Δ/y transformer is supplying 460V, 200A dc load. Calculate,

(1) firing angle

(2) ac line current

(3) rms value of device current

(4) dc power (8)

(ii) The junction capacitor of the thyristor is 25pF and can be assumed to be independent of the off-state voltage. The charge current to turn on the thyristor is 15mA, If a capacitor of 0.01 μF is connected across the thyristor, determine the permissible value of dv/dt. (7)

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