

Reg. No. :

Question Paper Code : 70562

B.E./ B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

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. How SCR is protected from the high rate of change in anode current?
2. What is the main drawback of power MOSFET?
3. What is the purpose of the free-wheeling diode in a full-wave rectifier circuit?
4. Why power factor of a semi converter is better than a full converter?
5. Define the duty cycle.
6. What is meant by a resonant converter?
7. What is meant by harmonics in output voltage of the Inverter?
8. Compare voltage and current source inverters.
9. What is meant by matrix converter?
10. Give the relation for RMS output voltage of a single-phase half-wave ac voltage controller.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain the constructional details of IGBT along with its characteristics. (9)
(ii) Compare Power MOSFET and power IGBT. (4)
- Or
- (b) (i) Describe the UJT triggering circuit with a neat sketch. (5)
(ii) Explain the two-transistor model of SCR. (8)

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

Or

- (b) Determine the effect of source inductance in the phase full converter.
13. (a) Explain the use of time ratio control for controlling the output voltage in class A choppers. Also derive the relation of average Ripple.

Or

- (b) (i) Explain the working of the buck-boost converter with a circuit diagram and waveforms. (8)
- (ii) Describe the structure of EV. (5)
14. (a) Compare the three-phase voltage source inverter with 180° and 120° conduction modes in terms of wave forms and device conduction sequence.

Or

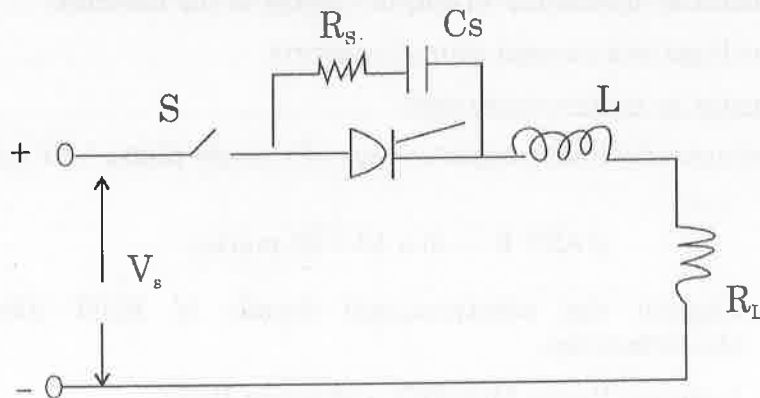
- (b) Explain the working of any one CSI.
15. (a) Explain the operation of the matrix converter.

Or

- (b) Describe the working of a three-phase to three-phase cyclo converter with the necessary circuit diagram and waveforms.

PART C — (1 × 15 = 15 marks)

16. (a) (i) Figure shows a thyristor controlling the power in a load resistance R_L . The supply voltage is 240V dc and the specified limits for $\frac{di}{dt}$ and $\frac{dv}{dt}$ for the SCR are $50A/\mu\text{sec}$ and $300v/\mu\text{sec}$ respectively. Determine the values of the $\frac{di}{dt}$ inductance and the snubber circuit parameter R_s and C_s . (8)



- (ii) The input to a three phase dual converter is 400 V 50Hz. If peak value of circulatory current is limited to a value 20A, find the value of inductance of the reactor for a firing angle of 60° . (7)

Or

- (b) A single -phase full-wave ac voltage controller is connected to a resistive load of 10Ω . The input voltage to the ac voltage controller is 230 V, 50 Hz. The firing angle of the thyristors in the ac voltage controller is 100° . Calculate,
- (i) the RMS value of load voltage, (3)
 - (ii) the input power factor, (3)
 - (iii) the average value of current through the thyristor, (3)
 - (iv) the RMS value of thyristor current and (3)
 - (v) load power. (3)
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