



## Seventh Semester B.E. Degree Examination, Dec.2024/Jan.2025 Power Electronics

Time: 3 hrs

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Draw symbols and control characteristics of the following power semiconductor devices  
i) SCR    ii) GTO    iii) SITH    iv) IGBT    v) BJT. (10 Marks)
- b. Explain different types of power electronics circuits and mention their applications. (10 Marks)

**OR**

- 2 a. Explain the switching characteristics of power BJT with the help of its transient model. (10 Marks)
- b. Explain the operation of n-channel enhancement types MOSFET with its transfer characteristics. (10 Marks)

### Module-2

- 3 a. Explain two transistor model of SCR and derive an expression for anode current in terms of transistor parameters for a thyristor. (10 Marks)
- b. Explain static anode-cathode characteristics of SCR. (10 Marks)

**OR**

- 4 a. Explain gate characteristics of SCR with a neat diagram. (10 Marks)
- b. Explain different turn-on methods of SCR. (05 Marks)
- c. Differentiate between natural and forced commutation. (05 Marks)

### Module-3

- 5 a. Explain the operation of single phase semi converter with inductive load with relevant waveforms. (08 Marks)
- b. Explain the principle of on-off control of a AC voltage controller. (06 Marks)
- c. A single phase full converter is fed from 230 V 50 Hz supply. Find the average load voltage and current if the load resistance is 10  $\Omega$  and firing angle is 45°. (06 Marks)

**OR**

- 6 a. Explain the operation of single phase full converter with RL load with relevant circuit and waveforms. (08 Marks)

- b. A single phase half wave AC voltage controller has a resistance load of  $R = 5 \Omega$  and input voltage  $V_s = 120 \text{ V}$ , 60 Hz. The delay angle of thyristor is  $\alpha = \pi/3$ . Determine :
- RMS output voltage
  - Input power factor
  - Average input current.
- (07 Marks)
- c. What are the applications of AC voltage controller? (05 Marks)

#### Module-4

- 7 a. The dc chopper has a resistive load  $R = 10 \Omega$  and the input voltage is  $V_s = 220 \text{ V}$ . When the converter switch remains 'ON' its voltage drop is  $V_{ch} = 2 \text{ V}$  and the chopping frequency is  $f = 1 \text{ KHz}$ . If the duty cycle is 50%, calculate
- The average output voltage
  - The rms output voltage
  - The converter efficiency
  - The effective input resistance  $R_i$  of the converter
- (10 Marks)
- b. Explain the operation of step down chopper with RL load and derive an expression for peak to peak load ripple current. (10 Marks)
- 8 a. With the help of circuit diagram, explain four quadrant type E chopper. (10 Marks)
- b. With the help of circuit diagram and waveforms, explain the operation of a boost regulator. Derive the expression for peak – to – peak ripple current. (10 Marks)

#### Module-5

- 9 a. Explain single phase half bridge inverter with neat circuit diagram and waveforms. (10 Marks)
- b. The single-phase half-bridge inverter has a resistive load of  $R = 2.4 \Omega$  and the dc i/p  $V_g = 48 \text{ V}$ . Determine i) the rms o/p  $V_g$  at the fundamental frequency  $V_{01}$ , ii) the output power  $P_0$  iii) average and peak currents of each transistor iv) the peak reverse blocking voltage  $V_{BR}$  of each transistor. (10 Marks)
- OR**
- 10 a. Explain dc switches with neat circuit diagram. (06 Marks)
- b. Outline various performance parameters used for inverters. (08 Marks)
- c. Explain single phase AC switches. (06 Marks)

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