



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)

OR

- 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 $V_s = 48 \text{ V}$. 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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