

## Seventh Semester B.E. Degree Examination, July/August 2022 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. Illustrate V-I characteristics of SCR with its different modes of operation. (10 Marks)
- b. Describe turn on methods of SCR. (04 Marks)
- c. Draw two transistor model of SCR and derive expression for anode current. (06 Marks)

**OR**

- 4 a. Define Commutation. List the differences between Natural and Forced commutation. (06 Marks)
- b. Describe the operation of SCR. Resistance firing circuit with neat circuit and waveforms. (08 Marks)
- c. Explain Class – A commutation circuit with waveforms. (06 Marks)

### Module-3

- 5 a. With circuit diagram, explain single phase full converter with RL load derive equation for average output voltage and rms output voltage. (10 Marks)
- b. With neat diagram and waveforms, explain the principle of phase controlled converter operation. (08 Marks)
- c. What is the role of freewheeling diode in controlled rectifiers with R-L load? (02 Marks)

**OR**

- 6 a. An ac voltage controller has resistance load  $R = 10\Omega$  and root mean square input voltage (rms) is  $V_s = 120V$ , 60Hz. The thyristors switch is 'ON' for  $n = 25$  cycles and is 'OFF' for  $m = 75$  cycles. Calculate i) The rms output voltage  $V_o$  ii) The input power factor (PF) iii) The average and rms current of thyristors. (Refer Fig Q6(a))

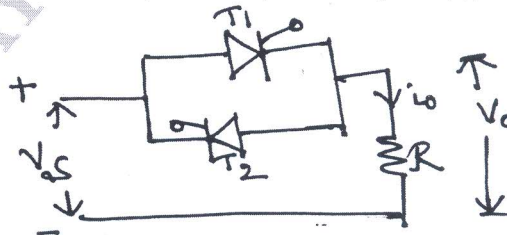


Fig Q6(a)

1 of 2

(06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

- b. Explain the principle of phase control, with the help of waveforms and obtain an expression for average value of output voltage. (08 Marks)
- c. Explain the operation of a single phase bidirectional controller with resistive load and write an equation for rms output voltage. (06 Marks)

**Module-4**

- 7 a. The dc chopper has a resistive load  $R = 10\Omega$  and the input voltage is  $V_s = 220V$ . When the converter switch remains 'ON' its voltage drop is  $V_{ch} = 2V$  and the chopping frequency is  $f = 1KHz$ . 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 the performance parameters of inverters. (08 Marks)
- b. Give the comparison between Current Source Inverter (CSI) and Voltage Source Inverter (VSI). (04 Marks)
- c. With circuit diagram, explain single phase bridge inverter. (08 Marks)

**OR**

- 10 a. Write a short notes on
- Single phase AC switches
  - Solid state Relays
- (10 Marks)
- b. Explain the working of variable dc-link inverter. (10 Marks)

\*\*\*\*\*