

# CBCS SCHEME

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17EC73

## Seventh Semester B.E. Degree Examination, June/July 2023 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. What is a power converter? List the different types of power converters and mention their conversion function. (10 Marks)
- b. Explain the control characteristics of IGBT and SCR. (05 Marks)
- c. Discuss the peripheral effects of power-electronic equipments. (05 Marks)

OR

- 2 a. With the help of switching waveforms explain the switching characteristics of power MOSFET. (06 Marks)
- b. Give the comparison between BJT, MOSFET and IGBT. (06 Marks)
- c. For the transistor switch shown in Fig Q2(c).
  - i) Calculate forced beta  $B_f$  of transistor
  - ii) If the manufacturer's specified  $\beta$  is in the range 8 to 40, calculate the minimum overdrive factor (ODF)
  - iii) Obtain the power loss  $P_T$  of the transistor.

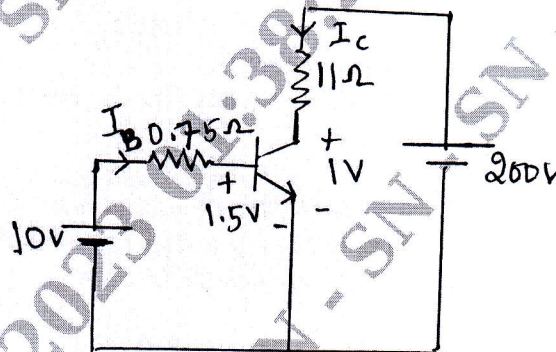


Fig Q2(c)

(08 Marks)

### Module-2

- 3 a. Draw the two transistor model of thyristor and derive an expression for the a node current in terms of common base current gain  $\alpha_1$  and  $\alpha_2$  of the transistors. (10 Marks)
- b. Explain the various methods of turning on a thyristor. (05 Marks)
- c. Explain how thyristors are protected against high  $\frac{di}{dt}$ . (05 Marks)

OR

- 4 a. Explain R firing circuit and RC firing circuit with relevant waveforms. (10 Marks)
- b. An UJT used in a relaxation oscillator circuit is having  $\eta = 0.7$ ,  $V_v = 1V$  and the supply voltage to the circuit is 15V. Design the suitable values of R and C given that the frequency of oscillation is 1KHz. Peak current is 1mA and valley current is 8mA. (05 Marks)
- c. Compare 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 230V 50Hz supply. Find the average load voltage and current if the load resistance is  $10\Omega$  and firing angle is  $45^\circ$ . (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  $V_s = 120V, 60Hz$ . 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. Explain the operation of a step down chopper with RL load and also derive an expression for peak-peak output ripple current. (10 Marks)
- b. Explain the principle of operation of a step-up chopper. (05 Marks)
- c. What are the applications of choppers? (05 Marks)

**OR**

- 8 a. Explain the classification of choppers. (10 Marks)
- b. Explain the operation of Boost regulation with circuit and waveforms. (10 Marks)

**Module-5**

- 9 a. Explain the performance parameters of an inverter. (08 Marks)
- b. Explain the principle of operation of a single phase half bridge inverter. (06 Marks)
- c. Explain the operation of single phase AC switch. (06 Marks)

**OR**

- 10 a. Explain single pulse width modulation and multiple pulse width modulation methods of controlling the output voltage of inverter. (10 Marks)
- b. Write a brief note on current source inverter. (05 Marks)
- c. A single phase bridge inverter has a resistive load of  $R = 2.4\Omega$  and dc input voltage is  $V_s = 48V$ . Determine
- The RMS output voltage at the fundamental frequency
  - The output power
  - The average and peak current of each transistor
  - Peak reverse blocking voltage of each transistor. (05 Marks)

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