

# CBCS SCHEME

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21EE54

## Fifth Semester B.E./B.Tech. 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

- Mention and explain the different types of power electronic converter systems. Draw their input output characteristics. (08 Marks)
  - With circuit diagram and waveforms explain single phase full wave rectifier with RL load. (08 Marks)
  - List the applications of power electronics. (04 Marks)

OR

- With the help of diagram, explain the reverse recovery characteristics of a power diode. (06 Marks)
  - Discuss the peripheral effects of static power converter system. (06 Marks)
  - List the major types of power electronic devices with their symbols. In each case, draw their output characteristics. (08 Marks)

### Module-2

- Discuss the needs and methods for providing isolation of gate/base circuits from power circuit with necessary circuit diagrams. (08 Marks)
  - With neat circuit diagram and switching times explain study state and switching characteristics of power MOSFET. (08 Marks)
  - What is di/dt and dv/dt protection for transistor? (04 Marks)

OR

- A transistor switch of Fig.Q4(a) has  $\beta$  in the range of 10 to 50. Calculate :
    - The value of  $R_B$  that results in saturation with an overdrive factor of 6
    - The forced  $\beta_f$
    - The power loss in the transistor.

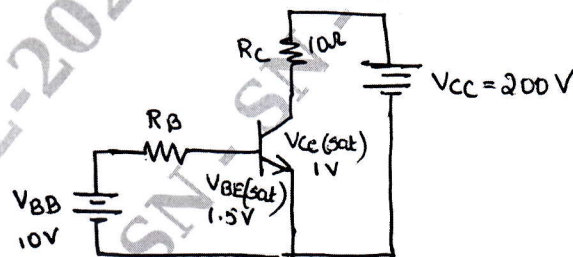


Fig.Q4(a)

- With the help of a circuit diagram, how the base current peaking is obtained during turn-on of power transistors? (08 Marks)
- Draw and explain switching characteristics of power IGBT. (06 Marks)

### Module-3

- Using 2 transistor model, explain how a small gate current can turn-on the SCR when blocking forward voltage. (08 Marks)
  - Define holding current and latching current of a thyristor. (06 Marks)
  - With a neat circuit, explain the R-firing circuit of thyristor with necessary waveform. (06 Marks)

OR

- 6 a. The values of protection elements of a protection circuit for a thyristor, used as a switch connecting a load to a supply are,  $R_s = 15\Omega$ ,  $C_s = 0.1 \mu\text{F}$  and  $L_s = 150 \mu\text{H}$ . If the supply voltage is 300 V AC and load resistance is  $10 \Omega$ . Calculate the maximum permissible  $\frac{dv}{dt}$  and  $\frac{di}{dt}$  values. (08 Marks)
- b. Explain thyristor characteristics and modes of operation with a suitable diagram. (08 Marks)
- c. What is the necessity of series and parallel connection of thyristors. (04 Marks)

**Module-4**

- 7 a. Describe the operation of single phase semi-converter feeding resistive load. obtain expression for the average DC o/p. (10 Marks)
- b. With the circuit diagram and waveforms explain the operation of a 3-phase dual converter. (10 Marks)

OR

- 8 a. With the help of neat circuit diagram and waveforms explain the operation of a bidirectional controller with R – load. Derive equation for  $V_0(\text{rms})$ . (10 Marks)
- b. A single phase half wave AC voltage controller shown in the Fig.Q8(b) feeds power to a resistive load of  $6\Omega$  from 230V, 50 Hz source. The firing angle of SCR is  $\alpha = \frac{\pi}{2}$ .

Calculate :

- RMS value of o/p voltage
- Input power factor
- Average input current.

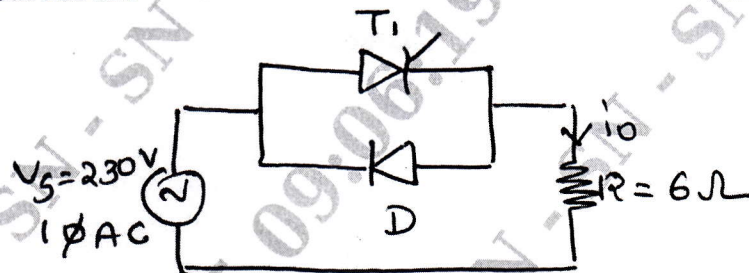


Fig.Q8(b)

(10 Marks)

**Module-5**

- 9 a. A step up chopper has input voltage of 220 V and output voltage of 660 volts. If the non-conducting time of thyristor chopper is  $100 \mu\text{sec}$ , compute the pulse width of output voltage. In case pulse width is halved for constant frequency operation, find new output voltage. (08 Marks)
- b. With the help of circuit and waveforms, explain the operation of step up chopper. (06 Marks)
- c. How choppers are classified? Write quadrant of operation. (06 Marks)

OR

- 10 a. What are inverters? Explain the operation of single phase full bridge inverter for R – L load. (10 Marks)
- b. Explain the voltage control of single phase inverter using :  
 i) Multiple pulse width modulation  
 ii) Sinusoidal pulse width modulation. (10 Marks)

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