

CBCS SCHEME

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18EE53

Fifth Semester B.E. Degree Examination, Jan./Feb. 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. List the different types of power electronic circuits and mention their conversion functions. (10 Marks)
b. Mention the various characteristics and specifications of switches. (06 Marks)
c. Explain the peripheral effects in power electronic circuits. (04 Marks)

OR

- 2 a. Describe reverse recovery characteristics of diode. (08 Marks)
b. Derive the time constant of RC circuit. (08 Marks)
c. The forward voltage drop of a power diode is $V_D = 1.2$ V at $I_D = 300$ A, assuming $n = 2$ and $V_T = 25.7$ mV, find the reverse saturation current I_S . (04 Marks)

Module-2

- 3 a. Discuss the different operating regions of a power BJT. (06 Marks)
b. Describe the switching characteristics of power BJT with necessary waveforms during turn-on. (08 Marks)
c. Explain the steady state characteristics of following devices: (i) MOSFET (ii) IGBT (06 Marks)

OR

- 4 a. Explain with neat circuit diagrams proportional base control and anti-saturation control. (10 Marks)
b. Explain the necessity of isolation using pulse transformer and opto-couplers. (10 Marks)

Module-3

- 5 a. Using two transistor analogy, derive an expression for anode current in a thyristor. (10 Marks)
b. Distinguish between:
(i) Latching current and holding current of a thyristor
(ii) Converter grade and inverter grade thyristors (04 Marks)
c. Sketch the VI characteristics and then explain latching current, holding current and break over voltage. (06 Marks)

OR

- 6 a. Explain the need for $\frac{dv}{dt}$ and $\frac{di}{dt}$ protection. (06 Marks)
b. A SCR circuit has the following data:
supply voltage = 200 V, $\frac{dv}{dt}$ rating = $100 \frac{V}{\mu s}$, $\frac{di}{dt}$ rating = $50 \frac{A}{\mu s}$,
calculate the snubber circuit elements. (06 Marks)
c. With a neat circuit diagram and waveforms, explain the RC triggering for SCR. (08 Marks)

Module-4

- 7 a. With neat circuit and waveforms, derive an expression for the rms value of output voltage of 1- ϕ full wave controlled rectifier with R load. (08 Marks)
- b. For the 1- ϕ full converter having inductive load and continuous load current, obtain:
(i) Average output voltage (ii) rms output voltage (06 Marks)
- c. Describe the working of 1- ϕ dual converter and draw the waveforms. (06 Marks)

OR

- 8 a. Derive an expression for the rms value of the output voltage of a bi-directional AC voltage controller employing ON-OFF control. (10 Marks)
- b. With necessary waveforms, derive the expression for rms output voltage of a 1- ϕ full wave controller with inductive load for discontinuous load current. (10 Marks)

Module-5

- 9 a. Explain the principle of operation of a step-up chopper. (06 Marks)
- b. Classify the different types of chopper circuits. (04 Marks)
- c. With the help of circuit and quadrant diagrams, explain the working of a class E chopper. (10 Marks)

OR

- 10 a. Explain the operation of single phase full bridge inverter with R load and draw the waveforms. (08 Marks)
- b. Explain sinusoidal PWM technique used for controlling the output voltage of an inverter. (06 Marks)
- c. Write a note on performance parameters for inverters. (06 Marks)

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