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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