CBCS SCHEME

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18EE53

Fifth 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. Explain the various types of power electronic converters with the help of circuit diagram, input and output waveforms. **(10 Marks)**

b. With the help of suitable waveforms, explain the reverse recovery characteristics of power diode. Define reverse recovery time and derive equations for t_{rr} and I_{rr}. **(10 Marks)**

OR

2 a. With the help of circuit diagram and waveform, explain the single phase full wave rectifier with 'R' load. **(06 Marks)**

b. With the help of circuit diagram and waveforms, Explain the operation of single phase diode rectifier feeding resistive load. Derive expression for average output voltage and rms value of output voltage. **(10 Marks)**

c. The reverse recovery time or a diode is 3μs and rate of fall of current is 30A/μs. Calculate:
i) Storage charge ii) Peak reverse current. **(04 Marks)**

Module-2

3 a. Explain steady state and switching characteristics of MOSFET. **(08 Marks)**

b. Explain the anti saturation control of BJT with the help of suitable circuit diagram and equations. **(06 Marks)**

c. Give a comparision between BJT, MOSFET and IGBT. **(06 Marks)**

OR

4 a. Explain the steady state and switching characteristics of BJT. **(09 Marks)**

b. Explain the switching limits. **(06 Marks)**

c. Explain the gate drive circuit of MOSFET with the help of circuit diagram. **(05 Marks)**

Module-3

5 a. Explain the V-I characteristics of SCR with the help of graph indicating all necessary details. Also define: i) Latching current ii) Holding current. **(08 Marks)**

b. Explain various method of turning on of a SCR. **(06 Marks)**

c. Design a SCR triggering circuit using UJT. The parameters of UJT are $V_s = 30V$, $\eta = 0.66$, $I_p = 15\mu A$, $V_v = 3V$ and $I_v = 10mA$. The frequency of oscillations is f = 500Hz and width of gate pulse if $t_g = 30\mu s$. Assume $V_D = 0.5V$ and $C = 0.5\mu F$. **(06 Marks)**

OR

6 a. Derive an expression for the anode current of SCR with the help of two transistor analogy. **(06 Marks)**

b. Explain in brief why two thyristors of same rating when connected in parallel do not share equal currents. Suggest a method to equalize the currents and explain. **(06 Marks)**

c. Explain UJT triggering circuit for full control of SCR with waveforms. **(08 Marks)**

Module-4

7 a. Explain the operation of single phase half wave rectifier with RLE load. Draw relevant circuit diagram and waveforms. **(08 Marks)**

b. Explain the operation of single phase full wave ac voltage controller with inductive load. Draw the circuit diagram and waveforms. **(06 Marks)**

c. A single phase fully controlled bridge rectifier circuit is used for obtaining a regulated dc output voltage. The rms value of the ac input voltage is 230V and firing angle is maintained at $\pi/3$. So that the load current is 4A. Calculate:

i) DC output voltage
ii) Active power output
iii) Load resistance. **(06 Marks)**

OR

8 a. With the help of circuit diagram and waveforms, explain the working of integral cycle (on-off) control of ac voltage controller feeding resistive load. Derive an expression for rms output voltage. **(08 Marks)**

b. With the help of suitable circuit and waveforms. Explain the working of single phase dual converter circulating current mode of operation. **(07 Marks)**

c. Find the power consumed in the heater element if both SCRs are fired with delay angle of 45° for the Fig.Q.8(c). **(05 Marks)**

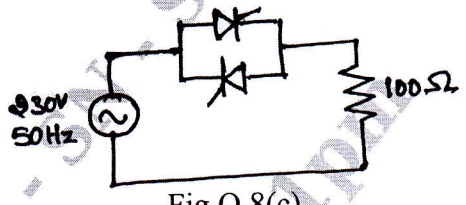

Fig.Q.8(c)

Module-5

9 a. With the help of schematic diagram and waveforms, explain the operation of step up chopper with RL load. Derive an expression for average output voltage. **(08 Marks)**

b. Explain the working of single phase bridge inverter feeding resistive load. Draw the circuit diagram and waveforms. **(06 Marks)**

c. A step up chopper has input voltage of 220V and output voltage of 660V. If the conducting time of chopper is 100μs, calculate turn off time of output voltage. In case output voltage pulse width is halved for constant frequency operation, find the average value of new output voltage. **(06 Marks)**

OR

10 a. Explain the performance parameters of DC-DC converters. **(06 Marks)**

b. Explain the construction and working of transistorized current source inverter. Draw the circuit diagram and waveforms. **(08 Marks)**

c. The DC-DC converter has a resistive load of R = 10Ω and the input voltage is V_s = 220V. When the converter switch remains on, its voltage drop V_{ch} = 2V and the chopping frequency is f = 1kHz. If the duty cycle is 50%. Calculate:

i) Average output voltage
ii) Rms output voltage
iii) Converter efficiency. **(06 Marks)**

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