USN [| | | | | | | | | |]   **17EC73**

Seventh Semester B.E. Degree Examination, July/August 2022
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. Draw symbols and control characteristics of the following power semiconductor devices
       i) SCR   ii) GTO   iii) SITH   iv) IGBT   v) BJT.   **(10 Marks)**
    b. Explain different types of power electronics circuits and mention their applications.
                                                                               (10 Marks)

OR

2   a. Explain the switching characteristics of power BJT with the help of its transient model.
                                                                               (10 Marks)
    b. Explain the operation of n-channel enhancement types MOSFET with its transfer
       characteristics.   **(10 Marks)**

Module-2

3   a. Illustrate V-I characteristics of SCR with its different modes of operation.   **(10 Marks)**
    b. Describe turn on methods of SCR.   **(04 Marks)**
    c. Draw two transistor model of SCR and derive expression for anode current. **(06 Marks)**

OR

4   a. Define Communication. List the differences between Natural and Forced commutation.
                                                                               (06 Marks)
    b. Describe the operation of SCR. Resistance firing circuit with neat circuit and waveforms.
                                                                               (08 Marks)
    c. Explain Class – A commutation circuit with waveforms.   **(06 Marks)**

Module-3

5   a. With circuit diagram, explain single phase full converter with RL load derive equation for
       average output voltage and rms output voltage.   **(10 Marks)**
    b. With neat diagram and waveforms, explain the principle of phase controlled converter
       operation.   **(08 Marks)**
    c. What is the role of freewheeling diode in controlled rectifiers with R-L load? **(02 Marks)**

OR

6   a. An ac voltage controller has resistance load $R = 10\Omega$ and root mean square input voltage
       (rms) is $V_s = 120V$, 60Hz. The thyristors switch is 'ON' for n = 25 cycles and is 'OFF' for
       m = 75 cycles. Calculate i) The rms output voltage V_0 ii) The input power factor (PF)
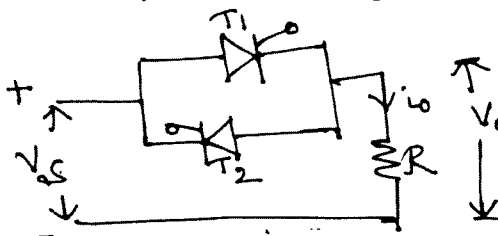   iii) The average and rms current of thyristors. (Refer Fig Q6(a))

Fig Q6(a)   **(06 Marks)**

b. Explain the principle of phase control, with the help of waveforms and obtain an expression for average value of output voltage. (08 Marks)

c. Explain the operation of a single phase bidirectional controller with resistive load and write an equation for rms output voltage. (06 Marks)

Module-4

7 a. The dc chopper has a resistive load $R = 10\Omega$ and the input voltage is $V_s = 220V$. When the convertor switch remains 'ON' its voltage drop is $V_{ch} = 2V$ and the chopping frequency is $f = 1KHz$. It the duty cycle is 50%, calculate
   i) The average output voltage
   ii) The rms output voltage
   iii) The converter efficiency
   iv) The effective input resistance R_i of the converter (10 Marks)

b. Explain the operation of step down chopper with RL load and derive an expression for peak to peak load ripple current. (10 Marks)

OR

8 a. With the help of circuit diagram, explain four quadrant type E chopper. (10 Marks)

b. With the help of circuit diagram and waveforms, explain the operation of a Boost regulator. Derive the expression for peak – to – peak ripple current. (10 Marks)

Module-5

9 a. Explain the performance parameters of inverters. (08 Marks)

b. Give the comparison between Current Source Inverter (CSI) and Voltage Source Inverter (VSI). (04 Marks)

c. With circuit diagram, explain single phase bridge inverter. (08 Marks)

OR

10 a. Writ a short notes on
   i) Single phase AC switches
   ii) Solid state Relays (10 Marks)

b. Explain the working of variable dc-link inverter. (10 Marks)

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