USN

15EC73

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Power Electronics

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1   a.   Draw the control characteristics of the following:
       i) SCR   ii) GTO   iii) MCT   iv) IGBT   **(08 Marks)**
     b.   What are the peripheral effects of power electronics equipment and mention how to overcome it?   **(08 Marks)**

OR

2   a.   Explain different types of power electronics converter circuits with input and output waveforms   **(08 Marks)**
     b.   Explain the switching characteristics of IGBT and mention its advantages.   **(08 Marks)**

Module-2

3   a.   Explain two-transistor analogy of SCR.   **(08 Marks)**
     b.   i)   Explain the need for dv/dt and di/dt protection for SCR.
        ii)   A SCR circuit has the following data: $v_s = 200v$, $dv/dt = 100v/\mu s$, $di/dt = 50\ A/\mu s$. Calculate the snubber circuit components.   **(08 Marks)**

OR

4   a.   Discuss dynamic turn-on and turn-off characteristics of SCR.   **(08 Marks)**
     b.   With neat circuit diagram, explain the working of class-A self commutation with relevant waveforms.   **(08 Marks)**

Module-3

5   a.   Explain the operation of single-phase full converter with neat circuit diagram and waveform. Derive expression for average and rms output voltage.   **(08 Marks)**
     b.   i)   Explain how a dual-converter works in all four quadrants.
        ii)   A single phase dual converter is operated from a 120V, 50Hz supply and the load resistance R = 10Ω. The circulating inductance is $L_r = 40mH$. Delay angles are $\alpha_1 = 60°$ and $\alpha_2 = 120°$. Calculate the peak circulating current and the peak current of converter 1.   **(08 Marks)**

OR

6   a.   Explain the principles of ON-OFF control for single-phase AC voltage controller. Draw the circuit and relevant waveforms.   **(08 Marks)**
     b.   A single phase full converter working on ON-OFF control technique has supply voltage of 230V RMS, 50Hz, load = 50Ω. The controller is ON for 30 cycles and OFF for 40 cycles. Calculate:
        i)   ON and OFF time intervals
        ii)   RMS output voltage
        iii)   Input pf
        iv)   Avg and rms thyristor currents.   **(08 Marks)**

15EC73

Module-4

7 a. Explain the working of step down choppers with waveforms and derive the expression for output voltage. **(08 Marks)**

b. Explain the working of boost-regulator and derive expression for average output voltage. **(08 Marks)**

OR

8 a. Explain the principle of step-up chopper. Derive expression for output voltage. **(08 Marks)**

b. I. Explain four quadrant operation of chopper.

II. Consider the switch, to be ideal in the circuit of Fig.Q.8(b), determine:
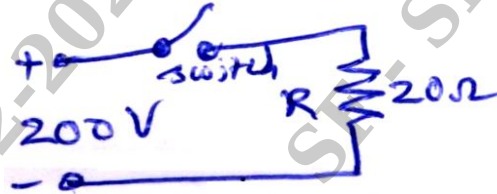   i) Duty cycle K for which $V_{0\,av} = V_{0,rms}$
   ii) The chopper efficiency

Fig.Q.8(b)

(08 Marks)

Module-5

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

b. i) Give comparison between voltage source inverter and current source inverter.
   ii) Explain half bridge inverter with inductive load. **(08 Marks)**

OR

10 a. Explain the working of transistorized current source inverter. **(08 Marks)**

b. i) Explain with neat circuit variable dc link inverter. Mention its advantages and disadvantages.
   ii) Considering a single phase bridge inverter if $V_s = 200v$ and $V_{01(rms)}$ is 90V, determine the delay angle β. **(08 Marks)**

* * * * *