USN | | | | | | | | | | 21EE54

Fifth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. With neat diagram, explain the different types of power electronic circuits. **(10 Marks)**
    b. List the applications of power electronics. **(06 Marks)**
    c. Write short notes on peripheral effects of power electronic circuits. **(04 Marks)**

OR

2   a. Explain the reverse recovery characteristics of diode. **(07 Marks)**
    b. The reverse recovery time of a diode is trr = 3 μs and the rate of fall of the diode current is $\frac{di}{dt} = 30 \frac{A}{\mu s}$. Determine the (i) Storage charge QRR (ii) Peak reverse current I$_{RR}$.

    (03 Marks)
    c. With neat circuit diagram and waveform, explain the single phase full wave bridge type diode rectifier with R load, derive average and RMS output voltage. **(10 Marks)**

Module-2

3   a. Explain the switching characteristics of MOSFET. **(10 Marks)**
    b. Write short notes on switching limits of BJT. **(06 Marks)**
    c. List the applications of BJT, MOSFET, IGBT. **(04 Marks)**

OR

4   a. Explain the isolation of Gate and Base drives with the help of,
       (i)   Pulse transformer.
       (ii) Opto coupler. **(12 Marks)**
    b. Explain with neat diagram, Anti saturation control of BJT using collector clamping circuit. **(08 Marks)**

Module-3

5   a. Explain the two transistor model of Thyristor with neat diagram and derive the expression for anode current. **(10 Marks)**
    b. Explain different turn ON methods of thyristor. **(05 Marks)**
    c. Draw the VI characteristics of thyristor, define latching current and holding current. **(05 Marks)**

OR

6   a. Explain the $\frac{di}{dt}$ protection of thyristors. **(06 Marks)**
    b. Explain UJT firing circuit for the SCR. **(08 Marks)**
    c. A thyristor operating at 200 V, latching current of the thyristor is 100 mA, for a load of 20 Ω and 0.2 H. Find the minimum width of gate pulse required to turn on the thyristor. **(06 Marks)**

Module-4

7   a.   With neat circuit and waveforms, explain the single phase half wave controlled rectifier with RL load, derive the average and RMS output voltage.   **(10 Marks)**
    b.   Explain with neat circuit and waveform, the single phase dual converter.   **(10 Marks)**

OR

8   a.   Explain the single phase full wave AC voltage controller with R load with neat diagram and waveforms, and derive the RMS output voltage.   **(12 Marks)**
    b.   An AC voltage controller with ON-OFF control has an input of 230 V, 50 Hz is connected to a resistive load of 20Ω. The circuit is operating with the switch ON for 30 cycles and OFF for 30 cycles. Determine (i) RMS output voltage, current   (ii) Input power factor.   **(05 Marks)**
    c.   List the applications of AC voltage controller.   **(03 Marks)**

Module-5

9   a.   With neat diagram and waveform, explain the step-up chopper and derive the expresson for the output voltage.   **(10 Marks)**
    b.   Classify the different types of chopper. With the help of circuit and quadrant diagram, explain four quadrant (Class E) chopper.   **(10 Marks)**

OR

10   a.   With neat circuit and waveform, explain the operation of single phase full bridge inverter and derive the RMS output voltage.   **(10 Marks)**
     b.   List the different types of voltage control techniques for single phase inverters, briefly explain about,
        (i)   Single pulse width modulation.
        (ii)   Sinusoidal pulse width modulation.   **(10 Marks)**

* * * * *