CBCS SCHEME

17EE53

Fifth Semester B.E. Degree Examination, July/August 2021
Power Electronics

Time: 3 hrs.

Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Explain 5 types of power electronics converter system and also specify the form of input and output wave forms. **(10 Marks)**

   b. With block diagram, explain the peripheral effect and remedies of power electronics. **(06 Marks)**

   c. Mention the applications of power electronics. **(04 Marks)**

2 a. With the help of diagram, explain the reverse recovery characteristics of a power diode. And also obtain an expressions for reverse recovery time and peak reverse current. **(10 Marks)**

   b. The reverse recovery time of a diode is 5μsec and rate of fall of diode current is 80A/μsec. Calculate :
   i) Q_{RR} (storage charge)
   ii) I_{RR} (peak reverse recovery current). **(04 Marks)**

   c. Briefly explain different types of power diode. **(06 Marks)**

3 a. Give the list of base drive control circuit for BJT. With neat diagram, explain anti-saturation control. **(07 Marks)**

   b. With neat circuit diagram and switching times explain steady state and switching characteristics of power MOSFET. **(08 Marks)**

   c. With necessary wave form explain the switching characteristic of an IGBT. **(05 Marks)**

4 a. Explain briefly isolation of gate drive using :
   i) pulse transformer and   ii) optocoupler. **(06 Marks)**

   b. List and explain the switching limits of power BJT. **(08 Marks)**

   c. The β of bipolar transistor varies from 12 to 75. The load resistance $R_c = 1.5\Omega$. The supply voltage $V_{CC} = 40V$ and base input voltage is 6V. If $V_{CE(sat)} = 1.2V$, $V_{BE(sat)} = 1.6V$ and $R_B = 0.7\Omega$, calculate :
   i) ODF   ii) Forced β   iii) Total power loss in transistor. **(06 Marks)**

5 a. Explain the operation of thysistor with the help of two-transistor model, also derive expression for anode current. **(09 Marks)**

   b. With the circuit diagram and wave forms explain the working of UJT triggering technique of SCR. **(07 Marks)**

   c. A SCR is connected in series with 0.5H inductor and 20Ω resistor. A 100V DC voltage is applied to the circuit. If the latching current of the SCR is 4mA. Find the minimum width of the gate triggering pulse required to properly turn on the SCR. **(04 Marks)**

6   a.   With current and voltage wave forms explain briefly dynamic turn ON and turn OFF characteristics of SCR. **(09 Marks)**
     b.   Briefly explain the dv/dt and dI/dt protection of the thrysistor. **(07 Marks)**
     c.   Calculate the required parameter for snubber circuit to provide dv/dt protection to a SCR used in single phase bridge converter. The SCR has a maximum dv/dt capability of 60V/μsec. The input line voltage has a peak value of 425V and the source inductance of 0.2mH. Assume $\sigma = 0.65$. **(04 Marks)**

7   a.   With necessary wave forms, explain the operation of a single phase AC voltage controller with resistive load. Derive the expression for the rms output voltage. **(08 Marks)**
     b.   A single phase full wave AC voltage controller has an input voltage of 230V and a load resistance of 10Ω. The firing angle is 45°. Calculate :
       i)   RMS output voltage
       ii)   The output power
       iii)   The input power factor. **(08 Marks)**
     c.   Briefly explain the applications of AC voltage controller. **(04 Marks)**

8   a.   With neat circuit diagram and associated waveform explain the operation of 1–ϕ half wave controlled rectifier with freewheeling diode across RL load. **(08 Marks)**
     b.   With circuit diagram and waveforms explain briefly working of single phase dual converter. **(08 Marks)**
     c.   What are the significance of circulating current in dual converter. **(04 Marks)**

9   a.   Explain the principle of step down chopper and derive an expression for average and output rms voltage. **(07 Marks)**
     b.   Classify the different types of chopper, the help of circuit and quadrant diagram. Explain the operation of four quadrant chopper. **(09 Marks)**
     c.   A chopper circuit is operating on thysistor at a frequency of 2KHz, on a 460V supply, if the load voltage of 350V calculate the conduction period of thysistor in each cycle. **(04 Marks)**

10   a.   Explain the voltage control of single phase inverter using :
       i)   Multiple pulse width modulation
       ii)   Sinusoidal pulse width modulation. **(10 Marks)**
     b.   Briefly explain the factors that influence the performance of inverter. **(08 Marks)**
     c.   Write comparison between Voltage Source Inverter (VSI) and Current Source Inverter (CSI). **(02 Marks)**

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