CBCS SCHEME

USN | | | | | | | | | | 15EC73

Seventh Semester B.E. Degree Examination, Feb./Mar. 2022
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. What is a Converter? How are Power Converter classified? Explain briefly. **(08 Marks)**
    b. Explain the peripheral effects caused by Power Electronic Converters. What are the remedies for them? **(08 Marks)**

OR

2   a. Mention the applications of Power Electronics. **(06 Marks)**
    b. A simple transistor switch is used to connect a 24V DC supply across a relay coil, which has a DC resistance of 200Ω. An input pulse of 0 to 5V amplitude is applied through a series base resistance R_B at the base so as to turn on the transistor switch. Calculate
        i)   ICS.
        ii) Value of Resistor R_B required to obtain over drive factor of 2.
        iii) Total power dissipation in the transistor that occurs during the saturation state. **(10 Marks)**

Module-2

3   a. Using two transistor models, explain how a small gate current can turn ON a SCR when blocking toward voltage. **(06 Marks)**
    b. Draw and explain the V – I characteristics of SCR. And also explain the mode of operations. **(10 Marks)**

OR

4   a. What is the need for protection of thyristor? Explain how thyristors are protected against high di/dt and $\frac{dv}{dt}$. **(06 Marks)**
    b. Explain the different turn ON methods of SCR. **(05 Marks)**
    c. The thyristor is gated with a pulse width of $40\mu sec$. The latching current of thyristor is 36mA. For a load of 60Ω and 2H, will be thyristor get turned ON? If not, how it can be overcome for the given load? Find its value ($V_s = 220V$). **(05 Marks)**

Module-3

5   a. Show the circuit diagram of a $1 - \phi$ semi converter and explain the operation, assuming constant load current. Sketch waveforms of output voltage and current in one SCR for a firing angle 45°. **(10 Marks)**
    b. What is Freewheeling diode? What are the advantages of freewheeling diode in rectifier circuits feeding inductive load? **(06 Marks)**

OR

6   a. With a circuit diagram and waveform, explain the operation of a 1- ϕ ON – OFF type ACVC. Derive an expression for rms output voltage. **(10 Marks)**

b. A single phase half wave AC voltage controller. Shown in Fig. Q6(b) feeds power to a resistive load of 6Ω from 230V, 50Hz source. The firing angle of SCR is $\alpha = \pi/2$. Calculate
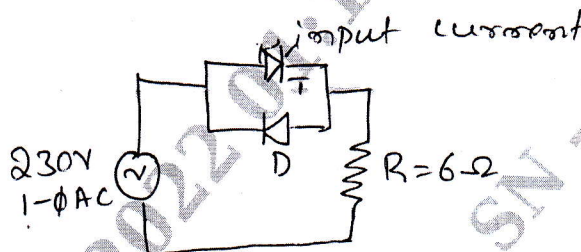   i) RMS value of output voltage ii) Input power factor iii) Average input current.
   (06 Marks)

Fig. Q6(b)

Module-4

7 a. With a neat circuit and waveform, explain the basic principles of operation of a step – down chopper with resistive load. Obtain the expression for i) DC output voltage ii) Output power iii) Chopper efficiency. **(10 Marks)**
   b. Explain the class E Chopper. **(06 Marks)**

OR

8 a. In a DC chopper the average load current is 30A. The chopping frequency is 250Hz and supply voltage is 110V. Calculate ON and OFF periods, if the load resistance is 2Ω. **(06 Marks)**
   b. With a neat circuit and waveform, explain the step up chopper and derive output voltage $V_{O(avg)}$. **(10 Marks)**

Module-5

9 a. Draw the circuit diagram of 1- φ, current source inverter employing power switching transistors. Sketch the gating single waveforms and the load current waveform. Explain the operation of the circuit. **(10 Marks)**
   b. Define the Performance Parameters for inverters. **(06 Marks)**

OR

10 a. Considering a 1- φ bridge inverter, explain the Phase Displacement method of output voltage control, if the DC input voltage is 200V and the required rms fundamental output voltage is 90V. Determine the delay angle β. **(04 Marks)**
    b. Comparison between Voltage Source inverter and Current Source inverter. **(06 Marks)**
    c. Write a note on Voltage Control of Single phase inverters by Sinusoidal pulse width modulation technique. **(06 Marks)**

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