Fourth Semester B.E. Degree Examination, June/July 2016
Power Electronics

Time: 3 hrs.   Max. Marks:100

Note: *Answer FIVE full questions, selecting*
at least TWO questions from each part.

PART – A

1 a. Draw the control characteristics of the following: i) SCR; ii) BJT; iii) MCT; iv) GTO; v) MOSFET. **(10 Marks)**
   b. Explain any four industrial applications of power electronics. **(10 Marks)**

2 a. What is a MOSFET? Draw static and switching characteristics of a MOSFET and explain the operation of MOSFET as a switch. **(12 Marks)**
   b. A simple transistor switch is used 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 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. **(08 Marks)**

3 a. With neat circuit diagram and waveforms explain R-triggering technique of SCR. **(08 Marks)**
   b. Derive an expression for the anode current of thyristor with the help of two transistor analogy. **(08 Marks)**
   c. An SCR is connected in series with a 0.5H inductor and 20Ω resistance. A 100V DC voltage is applied to this circuit. If the latching current of the SCR is 4mA, find the minimum width of the gate trigger pulse required to properly turn-on the SCR. **(04 Marks)**

4 a. What do you mean by natural and forced commutation in thyristor circuits? Explain with waveform and circuit complimentary commutation. **(12 Marks)**
   b. Explain external pulse commutation with neat circuit and waveform and derive an expression for circuit turn off time. **(08 Marks)**

PART – B

5 a. What is controlled rectifier? With neat circuit and waveform explain single phase semiconverter with R-load. **(12 Marks)**
   b. For a 3ϕ fully controlled SCR bridge converter operating from 400V, 3ph ac supply, calculate the average DC output voltage for a firing angle of 45°. Write the necessary diagram. **(08 Marks)**

6 a. Explain the classification of chopper with neat circuit diagram and wave form. **(12 Marks)**
   b. A step-up chopper has input voltage of 220 V and an output voltage of 660 V. If the non-conducting time of thyristor chopper is $100\mu sec$, compute the pulse width of output voltage. In case pulse width is halved for constant frequency operation, find the new output voltage. **(08 Marks)**

7 a. What is an inverter? Explain half bridge inverter with R-load. **(10 Marks)**
   b. Briefly explain performance parameters of an inverter. **(06 Marks)**
   c. With relevant waveform explain the sinusoidal pulse width modulation of an inverter. **(04 Marks)**

8 a. With the help of neat circuit diagram and waveform explain on-off control and derive an expression for i) RMS value of o/p voltage; ii) Input power factor. **(12 Marks)**
   b. A single phase half wave ac voltage controller has a resistive load of R = 5Ω and input voltage V_S = 120V, 60Hz. The delay angle of thyristor is $\alpha = \pi/3$. Determine: i) RMS output voltage; ii) Input power factor; iii) Average input current. **(08 Marks)**

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