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III/IV B.E. DEGREE EXAMINATION.

Second Semester

Electrical and Electronics Engineering

POWER ELECTRONICS

(Effective from the admitted batch of 2006–2007)

Time : Three hours   Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1.   (a)   List the different Turn ON and Turn OFF methods of SCR.

   (b)   Draw the static V-I characteristics of the following devices :

   (i)   IGBT

   (ii)   GTO

   (iii)   Power MOSFET and

   (iv)   Power Transistor.

6. (a) Explain the principle of operation of 3-phase cycloconverter. Distinguish between circulating and non-circulating current modes.

    (b) Describe the principle of D.C. chopper operation. Derive an expression for its average D.C. output voltage.

7. (a) Explain the basic structure, principle of operation and static characteristics of TRIAC.

    (b) Compare IGBT and power MOSFET.

8. Write short notes on the following :

    (a) Measurement of thyristor parameters

    (b) Self commutated invertors.

    (c) Single-phase cycloconverter.

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(c) State the advantages and disadvantages of cycloconverters over phase controlled, inverter circuits.

(d) R-firing circuit will not function for $\alpha > 90°$. Explain why?

(e) Draw a single-phase AC voltage controller circuit diagram and its resistive load voltage waveform.

(f) Why is ON state voltage drop of a power MOSFET more? Explain briefly.

(g) Explain the working of half-controlled rectifier with R-L load.

2. (a) Define latching and holding currents as applicable to an SCR. Show these currents on its static V-I characteristic.

(b) Explain using two transistor analogy; the switching of an SCR.

(c) A thyristor is triggered by a pulse train of 5 kHz. The duty ratio of the pulse train 0.5. If allowable average gate power is 100 watts, calculate the maximum allowable gate drive power.

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3. (a) What are the various problems connected with the series operation of thyristors? Discuss briefly the various methods of overcoming them. How are the series connected thyristors fired?

    (b) Explain the operation of UJT and draw its static characteristics. Also, explain how UJT can be used as a relaxation oscillator.

4. (a) Draw the circuit of a 3-phase symmetrical half-Controlled rectifier and explain its operation. Also, sketch the output voltage, current and voltage across thyristor waveforms.

    (b) For the 3-phase fully controlled SCR bridge converter operating from 3-phase 400 volts, 50 Hz A.C. supply; calculate the average D.C. output voltage for a firing angle of 45°.

5. (a) Explain with a neat circuit diagram the operation of Mc-Murray inverter.

    (b) Explain the operation of single-phase current source inverter (CSI). Draw the load current, voltage and capacitor voltage waveforms.

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