Roll No.....

# National Institute of Technology Delhi

## Name of the Examination: B.Tech

Branch : EEE & ECE

Semester : VI

Course Name : Power Electronics

Course Code : EEB-351

Time: 2:00 hour

Maximum Marks: 25

Note:

- All Questions are compulsory.
- Do not write irrelevant theory and draw neat waveforms and circuit diagrams.
- Assume data where ever required.

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**Q1)** Sketch switching characteristics of a thyristor during its turn-on and turn-off processes. Show the variation of voltage across the thyristor and current through it during these two dynamic processes. Indicate clearly the various intervals into which turn-on and turn-off times can be subdivided. Discuss briefly the nature of these curves. (5)

**Q2)** A single-phase semiconverter bridge feeds RLE load. Discuss how freewheeling diode comes into operation and holds the output voltage to almost zero for a given firing angle delay. Sketch the time variations of supply voltage, E, load voltage and current, source current, freewheeling diode current and current through the first SCR and voltage across each SCR. Find also the circuit turn-off time. Assume the load current continuous. (4)

**Q3)** Discuss the effect of source inductance with the help of typical voltage and current waveforms on the performance of a single-phase full converter indicating clearly the conduction of various thyristors during one cycle. (4)

**Q4)** Describe the working of a single-phase two-pulse symmetrical semiconverter with RL load. Illustrate your answer with waveforms for source voltage, load voltage and load current, source current, current through and voltage across SCR. Assume continuous conduction. Find also the circuit turn-off time. (4)

**Q5)** A step-up/step-down chopper has input voltage of 220 V and output voltage of 660 V. If the conduction time of thyristor-chopper is 120 μs, compute the pulse width of load voltage. In case output voltage pulse width is increased to three times its previous width, for constant frequency operation, calculate the new value of average output voltage. (4)

**Q6)** A single-phase 220 V, 1 kW heater is connected to a half wave controlled rectifier & it fed from a 220 V, 50 Hz ac supply. Determine the power absorbed by the heater when the firing angle is (a) $\alpha = 30^0$ & (b) $\alpha = 90^0$ (4)