National Institute of Technology Delhi

Name of the Examination: Mid Semester March-2022 (B. Tech.)

Branch: EEE & ECE

Course Name : Power Electronics

Time: 1:5 Hrs

Semester   : VI

Course Code : EEB-351

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.

Q1) (a) Sketch switching characteristics of a thyristor during its turn-on and turn-off processes. Indicate clearly the various intervals into which turn-on and turn-off times can be subdivided. Discuss briefly the nature of these curves.

(b) Discuss the two transistor analogy of a thyristor.

(6)

Q2) A single-phase full converter feeds power to RLE load. For discontinuous load current, draw:

(a) the source voltage, output voltage, load current, source current waveforms as a function of time, when extinction angle, $\pi < \beta < (\pi+\alpha)$,

(b) the output voltage & load current waveforms when, extinction angle $\beta < \pi$ with $V_m \sin \beta < E$

Explain how various waveforms are obtained and discuss their nature.

(5)

Q3) A single-phase semiconverter bridge feeds RLE load. Discuss its operation and how freewheeling diode action holds the output voltage to almost zero for a given firing angle. Sketch output waveforms of supply voltage, load voltage and current, source current, freewheeling diode current and current of first SCR and voltages of both SCRs. Derive the expression for average output voltage and circuit turn-off time. Assume the load current continuous.

(5)

Q4) Discuss the operation of a 3-phase full converter with RLE load. Sketch output voltage waveforms at firing angles, $\alpha = 60$ degree, $\alpha = 120$ degree and derive the expression for its average output voltage.

(4)

Q5) Explain the operation of Type A and Type D chopper. The input voltage to step up chopper is 200 V and the output voltage is 600 V. If conducting time of chopper is 400 μsec, calculate pulse width, chopping frequency and if the pulse width is halved for constant frequency operation, evaluate the new value of output voltage.

(5)