



Roll No.....

National Institute of Technology Delhi

End Semester Examinations May 2017

Name of Specialization: Electrical & Electronics Engg

Course Name: Power Electronics Devices & Converters

Course Code: EEL-501

IIIRD Sem
Maximum Marks – 50
Total Time: 3:00 Hours

Note:

- All Questions are compulsory.
- Do not write irrelevant theory and draw neat waveforms and circuit diagrams.
- Assume data where ever required.
- Questions are to be attempted in a proper sequence otherwise it will not be evaluated.

Section A (01 mark each and all parts are compulsory)

- Q1) Draw pulse train gating circuit diagram. (1)
- Q2) Mention the applications of cycloconverter. (1)
- Q3) What is the main drawback of a single phase half bridge inverter. How this drawback is overcome. (1)
- Q4) Define three phase-dual converters. (1)
- Q5) Discuss how distortion factor related to THD. (1)
- Q6) Define harmonic reduction by stepped -wave inverters. (1)
- Q7) Define latching and holding current. (1)
- Q8) What is the purpose of connecting diodes in antiparallel with thyristor in inverter circuits? (1)
- Q9) Explain THD for an inverter system. (1)
- Q10) How much is TUF value for single phase half wave rectifier. (1)

Section B (Any four (04) are to be attempted)

- Q11) A single-phase full converter feeds power to RLE load. For discontinuous load current, draw the source voltage, output voltage, load current, source current waveforms as a function of time when: (a) extinction angle, $\pi < \beta < (\pi + \alpha)$ (b) draw 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)
- Q12) What is pulse width modulation? List the various PWM techniques. How do these differ from each other, explain. (5)
- Q13) A 3-phase M-3 converter is operated from 3-phase, 230 V, 50 Hz supply with load resistance $R = 10 \Omega$. An average output voltage of 50 % of the maximum possible output voltage is required. Determine (a) the firing angle (b) average and rms value of load current (c) rectification efficiency. (5)

Q14) A 3-phase full converter bridge is connected to supply voltage of 230 V per phase and a frequency of 50 Hz. The source inductance is 4 mH. The load current on dc side is constant at 20A. If the load consists of a dc source of internal emf 400 V with internal resistance of 1Ω , then calculate:

(a) firing angle delay (b) overlap angle in degrees. (5)

Q15) A single-phase symmetrical semiconverter is connected to RL load. Discuss its working. Illustrate your answer with waveforms of source voltage, output voltage, output current, thyristor current, source current & voltage across thyristor. (5)

Section C (Any two (02) are to be attempted)

Q16) (a) Discuss the principle of working of a three-phase bridge inverter with an appropriate circuit diagram. Draw and explain phase and line voltage waveforms on the assumption that each thyristor conducts for 180° . The sequence of firing of various SCRs should also be indicated in the diagram. (5)

(b) Discuss the working of single-phase CSI with ideal switches with the help of power circuit diagram and the waveforms for input current, output current, output voltage and input voltage. (5)

Q17) A three-phase bridge inverter delivers power to a resistive load from a 450 V dc source. For a star-connected load of 10Ω per phase, determine for both (a) 180 degree mode and (b) 120 degree mode,

(i) rms value of load current

(ii) rms value of thyristor current

(iii) load power (5+5)

Q18)(a) Explain the operation of single-phase to single-phase step down Cycloconverter for RL load. Discuss its voltage and current waveforms. Assume the continuous load current. (4)

(b) A single-phase bridge inverter, fed from 230 V dc, is connected to load $R = 10\Omega$ and $L = 0.03$ H. Determine the power delivered to load in case the inverter is operating at 50 Hz with (a) square wave output (b) quasi-square wave output with an on-period of 0.5 of a cycle and (c) two symmetrically spaced pulses per half cycle with an on-period of 0.5 of a cycle. (6)