

2123

B.E. (Electrical and Electronics Engineering)
Seventh Semester
PC-EE-701: Power Electronics and Devices

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 (Part-A) which is compulsory and selecting two questions each from Part B-C.

x-x-x

PART-A

1. (i) Why internal control of inverter is preferred over external control of output voltage in inverters. (2)
- (ii) What is Integral control of AC Voltage controllers. (2)
- (iii) Explain basic principle of sinusoidal pulse modulation for inverters. (2)
- (iv) For controlling Induction motors, the drives do not practise reduced-supply frequency methods. Justify this statement. (2)
- (v) Which type of cycloconverters requires forced commutation and why. (2)

PART-B

2. (i) Draw a neat circuit diagram of 2-stage sequence control of Voltage Controllers. Choose a triggering sequence and explain its working. Also draw appropriate waveforms for output voltage and current clearly marking the sequence of triggering of SCRs for RL load. (5)
- (ii) For a three phase CC that accepts 230 V/50 hz supply, draw its schematic diagram and fabricate a single phase output voltage waveform from it with reduction factor of $1/4$ th. Clearly indicate the sequence of triggering of SCRs. (5)
3. (i) For a three phase full wave ac voltage controller feeding a star connected three phase load, explain its working and sketch the output voltage waveform along with gating signals for firing angle $=30$ degrees. (5)
- (ii) The speed of a separately excited dc motor is controlled by means of a three-phase semi-converter from a three phase, 415 V, 50 hz supply. The motor constants are inductance 10 mH, resistance 0.9 ohms and armature constant 1.5 V/rad/s(Nm/A). Calculate the speed of this motor at a torque of 50 Nm when the converter is fired at 45 degrees. (5)
4. (i) Draw the configuration for single-phase 5 level H-bridge MLI. Write the switching states to obtain the 5 different levels of output voltage from it. (5)
- (ii) For a case of a single-phase bridge converter feeding a RLC underdamped load circuit, draw its circuit diagram, explain its working and draw the relevant waveforms for output voltage and current. (5)

PART-C

5. (i) With help of a well-labelled diagram of Single-Phase Capacitor-Commutated CSI with R load, explain the four modes in brief which leads to inverter behavior of CSI. (5)
- (ii) Showing the type of converters, draw the circuit of a chopper drive capable of motoring and regeneration of dc motor. Specify the quadrant of operation, draw the relevant waveforms and equations. (5)

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(2)

6. (i) Draw the electric drive that works on controlling the rotor resistance of induction motor and explain its operation with help of proper waveforms. Also show the plot for T-S as rotor resistance is varied. (5)
- (ii) A DC series motor is fed from 600 V dc source through a chopper. The dc motor has following parameters: $r_a=0.04$ ohms, $r_s=0.06$ ohms, $k=4 \times 10^{-3}$ Nm/amp². The average armature current of 300 A is ripple free. For a chopper duty cycle of 60 % determine the power input to the motor and the motor speed. (5)
7. (i) Draw the circuit of a basic series inverter. Explain its principle of operation and working with relevant waveforms. And derive the expression for output frequency of the inverter. (5)
- (ii) Draw the circuit for step-up bridge cycloconverter feeding a RL Load. Explain its working for obtaining continuous output load current. Draw the relevant waveforms. (5)

X-X-X