

2125
B.E. (Electrical and Electronics Engineering)
Seventh Semester
PC-EE-701: Power Electronics and Drives

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part.

x-x-x

1. (i) Draw a 3-phase to 3-phase CC using 36 SCRs for non-isolated load phases. (2)
- (ii) Write the expression of average value of output voltage for a single-phase half wave and single-phase full wave AC Voltage controller feeding a R-load? (2)
- (iii) In a series inverter, the load consists of $R=10$ ohms in series with commutating components $L=10$ mH and $C=10$ μ F. Check whether circuit satisfies the essential criteria for series inverter? (2)
- (iv) Explain how can we exercise stator-voltage control for an Induction motor using an electric drive. (2)
- (v) Draw the circuit of three-phase, three level H-bridge MLI. (2)

PART-A (Attempt any two)

2. (i) Draw a neat circuit diagram of 2-stage sequence control of Voltage Controllers for R-load. 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 R 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 at 12.5 hz. Clearly indicate the sequence of triggering of SCRs. (5)
3. (i) For three-phase ,3-L diode clamped MLI, draw its switching table to obtain three levels of output phase voltage and 5-levels of V_{ab} . Also specify how many switches, diodes and capacitors will be required for 5 Level diode clamped MLI. (5)
- (ii) The speed of a 15 HP,220V,1000 rpm dc series motor is controlled using a single-phase half-controlled bridge converter. The combined armature and field resistance is 0.2 ohms. Assuming continuous and ripple free motor current and speed of 1000 rpm and $k=0.03$ Nm/amp² ,determine (a) motor current (b) motor torque. (5)
4. (i) Draw the circuit diagram of Current Source Inverter. Explain its working with Capacitive load. (5)
- (ii) For a case of a single-phase bridge inverter feeding a RLC overdamped load circuit, draw its circuit diagram, explain its working and draw the relevant waveforms for output voltage and current. (5)

PART- B (Attempt any two)

5. (i) Explain the working of single-phase bridge cycloconverter working in step-up mode for continuous current conduction mode [$\beta=(\pi+\alpha)$]. (5)
- (ii) For a three-phase AC Voltage controller feeding a balanced star-connected load, choose firing angle as 30 degrees and explain the working of the controller with help of relevant waveforms. (5)

(2)

6. (i) State the advantage of DC Link Static Scherbius Drive over other drives used for Induction motors. Explain its operation to obtain super-synchronous speed of Induction Motors. (5)
- (ii) Draw the circuit of a single-phase full converter drive for dc motors. Draw the relevant waveforms for input armature and field voltages fed to dc motors and the currents. Also derive the expressions for average output voltages. (5)
7. (a) What is the significance of Pulse Width Modulation in inverters? Explaining how modulated single-pulse width can be obtained? What is Modulation index in SPWM? How a particular low-order harmonics can be eliminated in SPWM, specify the relevant equations to support your answer. (5)
- (b) The chopper used for on-off control of a dc separately-excited motor has supply voltage of 230 V dc, an on-time of 10 msecs and off-time of 15msec. Calculate the average load current when the motor speed is 1500 rpm and has a voltage constant of 0.5 V/rad per sec. The armature resistance is 3 ohms. Draw the circuit of the drive. (5)

x-x-x