

1. Answer any **five** of the following :—
 - (a) Explain the terms 'soft recovery' and 'abrupt recovery' in power diodes. Give relevant waveforms. Give advantage of using soft recovery diode over abrupt recovery diode in some applications. 4
 - (b) Compare power factor at inputs of semiconverter and full converter (both working as rectifiers). Draw relevant waveforms. 4
 - (c) Draw two circuit diagrams which provide isolation between the control circuit and power circuit and explain the importance of isolation in practical applications. 4
 - (d) List techniques used for control of a.c. 3 phase wound rotor slip ring motors. Which of these can be used to run the motor above synchronous speeds ? 4
 - (e) Draw relevant waveforms for full converter working in inverter mode. Explain the working of this circuit. 4
 - (f) With suitable diagram explain working of separately excited d.c. shunt motor driven by armature voltage control in constant torque region and constant power region. Give reason of occurrence of these two regions. 4
2. (a) Explain the effect of source inductance on performance of full converter. Give relevant voltage waveforms in case of single phase and three phase converters. Give relevant expressions for d.c. output voltages in the two circuits. 10
(b) A 3 phase full controlled rectifier is supplied with 440 V 50Hz supply. The load current is continuous and ripple free. If the source inductance is 0.3 mH and load current is 120 Amps. Calculate angle of overlap (μ) if firing delay angle is $\pi/6$. 10
3. (a) Draw the circuit diagram of impulse commutated chopper using SCR's, draw related waveforms of voltages/currents and explain the operation. 10
(b) A d.c. separately excited shunt motor with rating 110 V, 900 RPM, 50 Amps with armature resistance $R_a = 0.12$ ohm working in braking mode using chopper rheostatic brake circuit. Choose suitable value for R_b and find duty cycle δ for braking torque equal to rated torque of the motor at full load. 10
4. (a) Draw circuit diagram of series inverter using SCR's. Give relevant waveforms and explain its working. 10
(b) Explain v/f control of a.c. induction motor. Give details of constant torque and constant power operation. 10
5. (a) Explain working of PWM inverter and its importance in a.c. motor control applications. Give appropriate circuit diagram and waveforms. 10
(b) Explain the working of control of induction motor using slip power recovery. 10
6. (a) Explain operation of 3 phase inverters working in 120 degrees and 180 degrees conduction modes. Draw appropriate waveforms. 10
(b) Explain working of cyclo converter using appropriate waveforms. 10
7. Write short notes on any **three** of the following :— 20
 - (a) Vector control of a.c. induction motor
 - (b) Current source inverters
 - (c) Power factor improvement techniques in converters
 - (d) Dual converters for d.c. motor control.