

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain in detail about four quadrant operation of a hoist system. (10)
- (ii) What are the main factors which decide the choice of an electrical drive for a given application? (6)

Or

- (b) (i) Sketch the essential parts of an electrical drive. Explain the functions of each component. (10)
- (ii) A drive has following equations for motor and load torques $T = (1 + 2w_m)$ and $T_L = 3(w_m)^{1/2}$ obtain the equilibrium points and determine their steady state stability. (6)
12. (a) A 220 V, 875 rpm, 150 A separately excited DC motor has an armature resistance of 0.06Ω . It is fed from a single phase fully controlled rectifier with AC source voltage of 220 V, 50Hz. Assume continuous conduction mode and find
- (i) Firing angle for rated torque at 750 rpm and -500 rpm. (16)
- (ii) Motor speed for $\alpha = 160^\circ$ at rated torque. (16)

Or

- (b) A 230 V, 960 rpm and 200 A separately excited DC motor has an armature resistance of 0.02Ω . The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230 V. Assume continuous conduction.
- (i) Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm.
- (ii) Calculate duty ratio of chopper for braking operation at rated torque and 350 rpm
- (iii) If maximum duty ratio of chopper is limited to 0.95 and maximum permissible motor current is twice the rated, calculate maximum permissible motor speed obtainable without field weakening and power fed to the source. (16)
13. (a) (i) Compare VSI and CSI fed induction motor drive. (8)
- (ii) Highlight the features of PWM inverter fed Induction motor drive. (8)

Or

- (b) (i) Explain the stator voltage control of induction motor drives. (6)
- (ii) Describe the closed loop speed control of VSI fed and CSI fed induction motor drives. (10)

14. (a) (i) Explain Margin angle control of synchronous motor drives. (8)
(ii) With neat block diagram, explain the variable frequency control of multiple synchronous motor. (8)

Or

- (b) Explain the closed loop speed control of sinusoidal PMAC motor drive. (16)

15. (a) Explain the armature voltage control and field weakening mode control of separately excited DC motor drive. (16)

Or

- (b) (i) Explain the factors involved in converter selection and equations involved in controller characteristics. (8)
(ii) Discuss the design procedure for speed controller and current controller of an electrical drive. (8)