

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code : Q 2219

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Sixth Semester

(Regulation 2004)

Electrical and Electronics Engineering

EE 1351 — SOLID STATE DRIVES

(Common to B.E. (Part - Time) Fifth Semester Regulation 2005)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is passive load torque?
2. Mention the factors to be considered to select a motor to drive the load.
3. What is TRC?
4. How is continuous conduction mode of motor drive obtained?
5. What is meant by slip power recovery system?
6. What are the three regions in the speed-torque characteristics of the induction motor?
7. What are the characteristics of self controlled mode operated synchronous motor?
8. What are the different modes of control that exist in a synchronous motor on a variable frequency supply?

9. What are the advantages of closed loop control of dc drives?
10. Draw the characteristics of maximum torque and power limitations of dc drives operating with combined armature voltage and field control.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain in detail the multi quadrant dynamics in the speed-torque plane. (8)
- (ii) Explain the principle of regenerative braking used in four- quadrant industrial drives. (8)

Or

- (b) (i) Explain the concept of steady state stability condition in Industrial drives. (8)
- (ii) Discuss the different modes of operation of an electrical drives. (8)
12. (a) (i) Explain the steady state analysis of the single phase fully controlled converter fed separately excited DC motor drive. (10)
- (ii) Speed of a separately excited dc motor is controlled by means of two 3 ϕ full converters one in the armature circuit and the other in the field circuit and both are fed from 3 ϕ , 400 V, 50 Hz supply. Resistance of the armature and field circuits are 0.2 Ω and 320 Ω respectively. The motor torque constant is 0.5 V.S/A-rad. Field converter has zero degree firing angle delay. Armature and field currents have negligible ripple. For rated load torque of 60 N-m at 2000 rpm, Calculate the rated armature current. (6)

Or

- (b) (i) Explain the four quadrant operation of the chopper. (8)
- (ii) A dc chopper is used to control the speed of a separately excited dc motor. The dc voltage is 220 V, $R_a = 0.2 \Omega$ and motor constant $k_{\phi} = 0.05 \text{ V/rpm}$. The motor drives a constant load requiring an average armature current of 25 A, Determine.
- (1) The range of speed control.
- (2) The range of duty cycle.
- Assume—continuous conduction. (8)

13. (a) (i) Explain in detail, closed loop control of 3ϕ VSI fed induction motor. (8)
- (ii) A 3ϕ , 56 kW, 4000 rpm, 460 V, 60 Hz, 2 pole star connected induction motor has the following parameters: $R_s = 0$, $R_r = 0.28 \Omega$, $X_s = 0.23 \Omega$, $X_r = 0.23 \Omega$ and $X_m = 11 \Omega$. The motor is controlled by varying the supply frequency. If the break down torque requirement is 70 Nm. Calculate
- (1) The supply frequency and
- (2) The speed ω_m at the maximum torque. (8)

Or

- (b) (i) Explain the principle of operation of static Scherbius system. (8)
- (ii) A 3-phase, 4 pole, 50 Hz slip ring Induction motor when fully loaded, run with a slip of 4%. Find the value of the resistance necessary in series per phase of the rotor to reduce the speed by 15%. Assume that the resistance of the rotor per phase is 0.5 ohm. (8)
14. (a) Explain the closed loop control of synchronous motor with neat block diagram. (16)

Or

- (b) Draw the open loop volts/Hz speed control of multiple PM synchronous motors and volts/Hz speed control characteristics in torque-speed plane. (16)
15. (a) With a block diagram discuss the operation of a closed loop scheme for speed control of a dc motor, below and above the base speed. (16)

Or

- (b) Write short notes on
- (i) Converter selection and characteristics
- (ii) Field weakening mode control.