Reg. No. : | | | | | | | | | | | |

C 3277

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

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 — ($10 \times 2 = 20$ marks)

1. Mention the necessary condition to obtain the three modes of operation of an electric drive.

2. What are the types of electric braking? Is braking applicable for any type of motor?

3. What are the types of control strategies in a dc chopper?

4. State the advantages of DC chopper drives.

5. Draw the speed - torque characteristics of Induction motor.

6. What do you understand by V / F control?

7. What is self control of synchronous motor drives?

8. State the advantages of PMSM.

9. Mention the types of current controllers for drive system.

10. Give any four factors to be considered for the selection of controller.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Derive the mathematical expression for the analysis of steady state stability of equilibrium point. (8)

(ii) Explain the multi quadrant operation of low speed hoist drive with neat diagram. (8)

Or

(b) Derive the expressions to find the equivalent load torque and equivalent inertia of loads in Transnational and Rotational motion. (16)

12. (a) Explain the motoring operation of a single phase fully controlled converter fed separately excited motor in continuous and discontinuous modes with steady state analysis and waveforms. (16)

Or

(b) (i) Explain the operation of four quadrant Chopper fed dc separately excited motor drive with necessary diagrams. (8)

(ii) A 220V, 1500rpm, 50A separately excited motor with armature resistance of 0.5 Ω is fed from a 3-phase fully controlled rectifier. Available ac source has a line voltage of 440V, 50Hz, A star delta connected transformer is used to feed the armature so that motor terminal voltage equals rated voltage when converter firing angle is zero.

(1) Calculate transformer turns ratio.

(2) Determine the value of firing angle when (a) motor is running at 1200rpm and rated torque; (b) when motor is running at 800 rpm and twice the rated torque.

Assume continuous conduction (8)

13. (a) Mention the various speed control techniques of three phase induction motor and explain any two methods of speed control in detail. (16)

Or

(b) With neat sketch explain the **Slip Power Recovery schemes** of induction motor. (16)

14. (a) With necessary diagram explain the closed loop speed control of load commutated inverter synchronous motor drive. (16)

Or

(b) Explain in detail the construction, principle of operation and applications of Permanent Magnet Synchronous Motor. (16)

15. (a) Write the step by step procedure and Derive the transfer function of the DC motor and load System. (16)

Or

(b) Design a speed controlled DC motor drive maintaining the field flux constant. The motor parameters and ratings are as follows. (16)

220 V, 8.3 A, 1470 rpm, Ra = 4Ω, J = 0.0607 kg – m2, La = 0.072 H,

Bt = 0.0869 Nm/rad/sec Kb = 1.26 V rad/ sec

The converter is supplied from 230 V, 3-phase AC at 60Hz. The converter is linear and its maximum control input voltage is ± 10 V.

The tachogenerator has the transfer function $\mathbf{G_w(s) = 0.065 / (1 + 0.002_s)}$. The speed reference voltage has a maximum of 10 V. The maximum current permitted in the motor is 20 A.
