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Question Paper Code : 91447

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Sixth Semester

Electrical and Electronics Engineering

EE 2352/EE 62/10133 EE 602 — SOLID STATE DRIVES

(Regulation 2008/2010)

(Common to PTEE 2352/10133 EE 602 — Solid State Drives for B.E. (Part – Time) Sixth Semester Electrical and Electronics Engineering — Regulation 2009/2010)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1.   What is an electrical drive?

2.   What is regenerative braking?

3.   What are the advantages of chopper fed drive over converter fed drive?

4.   What is the necessity of DC choke coil and freewheeling diode in a converter circuit?

5.   What is the function of current control loop in closed loop speed control system?

6.   What are the factors to be considered for the selection of controller?

7.   What are the different methods of speed control of induction motor?

8.   Distinguish between VSI and CSI.

9.   When can a synchronous motor be load commutated?

10.   Write down the torque equation of synchronous motor.

PART B — (5 × 16 = 80 marks)

11. (a) (i) A motor is coupled to a load having the following characteristics :

Motor : $T_m = 15 - 0.5\,\omega_m$

Load : $T_L = 0.5\omega_m^{2}$

Find out the stable operating point for this condition. (8)

(ii) Explain in detail about steady state stability in electrical drive system. (8)

Or

(b) (i) Explain in detail the multi quadrant dynamics in the speed- torque plane. (8)

(ii) Discuss the different modes of operation of an electrical drive. (8)

12. (a) (i) Explain in detail the single phase fully controlled rectifier control of dc separately excited motor with neat waveforms. (8)

(ii) A 220 V, 1500 rpm, 10 A separately excited DC motor has an armature resistance of $1\,\Omega$. It is fed from a single phase fully controlled rectifier with a source voltage of 230 V 50 Hz. Assuming continuous load current. Compute (1) Motor speed at the firing angle of 30° and Torque of 5Nm. (2) Developed Torque at the firing angle of 45° and speed of 1000rpm. (8)

Or

(b) (i) Explain in detail the regenerative operation of three phase fully controlled rectifier control of separately excited DC motor. (8)

(ii) Explain in detail the four quadrant operation of chopper fed drive. (8)

13. (a) Explain in detail the operation of a closed loop scheme for speed control of a DC motor, below and above the base speed. (16)

Or

(b) (i) Derive the transfer function of DC motor — load system. (8)

(ii) Derive the transfer function of the speed controller. (8)

14. (a) (i) Describe the VSI fed induction motor drive. (8)

   (ii) Explain in detail the static rotor resistance control in the Induction motor. (8)

Or

(b) Explain in detail about the vector control for a induction motor. (16)

15. (a) (i) Explain self control of synchronous motor drive operated with constant margin angle control. (8)

   (ii) Explain power factor control of synchronous motor drive. (8)

Or

(b) (i) Write brief notes on different types of permanent magnet synchronous motors. (8)

   (ii) A 3-phase 400V, 50Hz, 6 pole. à star connected round — rotor synchronous motor has $Z_s = 0 + j2 \ \Omega$. Load torque, proportional to speed squared, is 340Nm at rated synchronous speed. The speed of the motor is lowered by keeping v/f constant and maintaining unity PF by field control of the motor. For the motor operation at 600 rpm, calculate (i) supply voltage (ii) the armature current (iii) excitation voltage (iv) load angle (v) pullout torque. Neglect rotational losses. (8)

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