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Question Paper Code : 80504

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Sixth Semester

Electrical and Electronics Engineering

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

(Regulations 2008/2010)

(Common to PTEE 2352/10133 EE 602 – Solid State Drives for BE. (Part-Time) Sixth Semester – Electrical and Electronics Engineering – Regulations 2009/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Fig.1 shows plots of speed Vs motor and load torques. Comment on the stability of the operating points A, B, C and D.

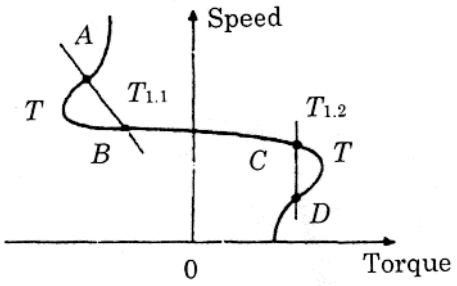

Fig.1

2. What are active and passive load torqueses? Give examples.

3. What is meant by continuous and discontinuous operations?

4. What are the advantages of chopper fed DC drive?

5. What is field weakening mode control in dc drives?

6. Name any two simulation packages used for drive systems.

7. Why is stator voltage control method suitable fan and pump drives?

8. What are the advantages of vector control over scalar control technique?

9. When is a synchronous motor said to be self-controlled.

10. What are the Advertisement of PMSM?

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) A motor drives two loads. One has rotational motion. It is coupled through a reduction gear with a = 0.1 and efficiency of 90%. The load has a moment of inertia of 10 kg-m^2 and a torque of 10 N-m. Other load has a translational motion and consists of 1000 kg weight to be lifted up at an uniform speed of 1.5 m/s. Coupling between this load and the motor has an efficiency of 85%. Motor has an inertia of 0.2 kg-m^2 and runs at a constant speed of 1420 rpm. Determine equivalent inertia referred to the motor shaft and power developed by the motor. (10)

(ii) Explain the multi-quadrant operations of low speed hoist in speed torque plane. (6)

Or

(b) (i) Derive the mathematical condition for steady state stability and equilibrium point. (8)

(ii) Explain the operation of electrical drives in three different modes.(8)

12. (a) Explain the steady state analysis of the single phase fully controlled converter fed separately excited DC motor drive for continuous current mode. Also explain its operation in motoring and regenerating braking mode. (16)

Or

(b) (i) Explain the operation of four quadrant dc chopper drive. (10)

(ii) A 220 V, 20 A, 1000 rpm separately excited dc motor has an armature resistance of 2.5 Ω. The motor is controlled by a step down chopper with a frequency of 1 kHz. The input dc voltage to the chopper is 250 V. What will be the duty cycle of the chopper for the motor to operate at a speed of 600 rpm delivering the rated torque? (6)

13. (a) Derive the closed loop transfer function of converter fed separately excited DC motor. (16)

Or

(b) A 50 kW, 240V, 1700 rpm separately excited dc motor is controlled by a converter. The field current is maintained at I_f = 1.4 A and the machine back emf constant is K_v = 0.91 $V/A\ rad/s$. The armature resistance is R_m = 0.1 Ω and the viscous friction constant is B = 0.3 Nm/rad/s. The amplification of the speed sensor is K1 =95 mV/rad/s and the gain of the power controller is K_2 = 100.

(i) Determine the reference voltage V_r to drive the motor at the rated speed. (8)

(ii) If the reference voltage is kept unchanged, determine the speed at which the motor develops rated torque. (8)

14. (a) (i) Explain about variable frequency control in induction motor drives. (8)

(ii) A three phase 60KW, 4000 rpm, 460V, 60Hz 2 pole star connected induction motor has the following parameters: $R_S = 0$. $R_r = 0.28\Omega$, $X_s = 0.23\Omega$, $X_r = 0.3\Omega$ and $X_m = 11\Omega$. The motor is controlled by varying the supply frequency. If the breakdown torque requirement is 70 Nm. Calculate supply frequency and speed ω_n at the maximum torque. (8)

Or

(b) Explain about VSI induction motor drives and also dosed loop control for VSI induction motor drives. (16)

15. (a) (i) Describe the open loop v/f control of VSI fed synchronous motor drives. (8)

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

Or

(b) With a neat block diagram explain the closed loop speed control of synchronous motor drive. (16)

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