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Question Paper Code : 60510

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

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 B.E. (Part-Time)
Sixth Semester – Electrical and Electronics Engineering – Regulations 2009/2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is dynamic torque?
2. Draw the load torque characteristics of constant power loads.
3. What are the drawbacks of rectifier fed DC drives?
4. Can a semi converter fed DC drive operated in quadrant IV? Justify your answer.
5. Write any two advantages of closed loop control system.
6. What do you mean by field weakening mode control?
7. What is slip power recovery scheme?
8. What is meant by super synchronous operation?
9. What are the modes of adjustable frequency control in synchronous motor drives?
10. When can a synchronous motor be load commutated?

PART B — (5 × 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-m² 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-m² 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 transfer function of dc motor-load system with converter fed armature voltage control. (16)

Or

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

14. (a) A 2.8 kW, 400 V, 50Hz, 4 pole, 1370 rpm, delta connected squirrel cage induction motor has following parameters referred to the stator $R_s = 2 \Omega$, $R_r = 5 \Omega$, $X_s = X_r = 5 \Omega$, $X_m = 80 \Omega$. Motor speed is controlled by stator voltage control. When driving a fan load it rated speed at rated voltage. Calculate motor terminal voltage and torque at 1200 rpm. (16)

Or

- (b) (i) Explain the concept of V/f control in detail. (8)
(ii) Make a comparison between voltage/current fed inverters. (8)
15. (a) (i) Explain the open loop V/f speed control of multiple permanent magnet synchronous motors. (8)
(ii) Explain with the block diagram, the torque angle control of self controlled synchronous motor drive. (8)

Or

- (b) With a neat block diagram explain the closed loop control of load commutated inverter fed synchronous motor drive. (16)