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Question Paper Code : 21510

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

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. Write down the speed torque equation of a single phase fully controlled converter fed separately excited dc motor drive.

4. What are the advantages of chopper fed dc drives over controlled rectifier fed dc drives?

5. Write the transfer function of converter in closed loop control of dc motor drives.

6. Write any two parameters of converter selection and characteristics.

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. Why is frequency command applied through a delay circuit in open loop v/f control of synchronous motor drives?

10. What are the types of permanent magnet synchronous motor drives?

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-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 of equilibrium point. (8)

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

12. (a) Give the steady state analysis of 3 phase controlled converter fed separately excited dc motor in continuous and discontinuous conduction modes. (16)

Or

(b) (i) A 200 V, 875 rpm, 150 A separately excited dc motor has an armature resistance of 0.06 Ω. It is fed from a single phase fully controlled rectifier with an ac source voltage of 220 V, 50 Hz. Assuming continuous conduction, calculate

(1) Firing angle for rated motor torque and (-750) rpm

(2) Motor speed for $\alpha = 160^\circ$ and rated torque. (10)

(ii) Explain the four quadrant operation of chopper fed dc drives. (6)

13. (a) Derive the transfer function of separately excited dc motor with armature voltage control. (16)

Or

(b) Design the speed controller of converter fed separately excited dc motor with inner current control and outer speed control loops. (16)

14. (a) (i) A 2.8 kW, 400 V, 50 Hz, 4 pole, 1370 rpm, delta connected squirrel cage induction motor has following parameters referred to the stator: Rs = 2 Ω, $Rr' = 5\ \Omega, Xs = Xr' = 5\ \Omega, Xm = 80\ \Omega$. Motor speed is controlled by stator voltage control. When driving a fan load it runs at rated speed and rated voltage. Calculate motor terminal voltage, current and torque at 1200 rpm. (10)

(ii) Write short notes on energy efficient drives. (6)

Or

(b) (i) Explain constant air gap flux based closed loop v/f control technique of induction motor drive in detail with neat sketch and necessary equations. (8)

(ii) Make a detailed comparison between VSI and CSI fed induction motor drives. (8)

15. (a) (i) Explain the concept of self control in detail. (8)

(ii) Explain the open loop v/f control of synchronous motor drives. (8)

Or

(b) Explain the constant marginal angle control technique of self controlled synchronous motor drive employing load commutated thyristor inverter. (16)
