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**Question Paper Code : 80577**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Sixth Semester

Electrical and Electronics Engineering

EE 8601 – SOLID STATE DRIVES

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Specify the functions of power modulator used in solid state electric drive system.
2. Mention the different factors for the selection of electric drives?
3. What are the drawbacks of rectifier fed dc drives?
4. Why self-commutated devices are preferred over thyristors for chopper circuits?
5. What are the different methods of speed control of induction motor?
6. What are the three regions in the speed-torque characteristics of induction machine?
7. Give the application of CSI fed synchronous motor.
8. Define self-controlled mode of synchronous motor.
9. What are the advantages of closed loop system?
10. What are the basic blocks of a closed loop system of a dc motor?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Describe four quadrant operation of motor driving a hoist load with suitable diagram. (10)
- (ii) Draw the speed-torque characteristics for the following
- (1) Fan/compressors (1)
  - (2) High speed hoist (1)
  - (3) Traction Load (1)

Or

- (b) Explain the following modes of operation
- (i) steady-state mode (5)
  - (ii) acceleration including starting mode (4)
  - (iii) deceleration including stopping mode. (4)
12. (a) (i) The speed of a 10 HP, 210 V, 1000 rpm separately excited dc motor is controlled by a single-phase full converter. The rated motor armature current is 30 A, and the armature resistance is 0.25  $\Omega$ . The ac supply voltage is 230 V. The motor voltage constant is  $K_a \Phi = 0.172$  V/rpm. Assume armature current is continuous and ripple free. For the firing angle  $\alpha = 45$  deg, and rated armature current determine
- (1) motor torque (2)
  - (2) Speed of the motor. (3)
- (ii) Explain the power circuit of semi converter feeding a separately excited d.c. motor. Also draw the relevant waveforms with continuous current mode. (8)

Or

- (b) (i) Describe the operation of step-down chopper feeding a separately excited d.c. motor and obtain the expression of motor speed for continuous conduction. (8)
- (ii) Explain the different control strategies of chopper. (5)
13. (a) (i) Draw the block diagram and explain the vector control scheme. (7)
- (ii) Draw the circuit diagram and explain the operation of rotor resistance control in induction motor drive. (6)

Or

- (b) Describe how the speed control of 3-phase induction motor is obtained by the static scherbius drive. Also, contrast static kramer drive with static scherbius drive. (13)

14. (a) Explain the working of a self-controlled synchronous motor fed from a three - phase inverter. Why a self-controlled synchronous motor is free from hunting oscillations? (13)

Or

- (b) Describe the margin angle control and power factor control of synchronous motor drive.
15. (a) Draw the circuit diagram and explain the closed-loop operation of armature voltage control method with field weakening. (13)

Or

- (b) Explain in detail about the converter selection and characteristics. (13)

PART C — (1 × 15 = 15 marks)

16. (a) (i) A 2.8 kW, 400V, 50Hz, 4-pole, 1370 rpm delta connected squirrel cage induction motor has following parameters referred to the stator.

$$R_1 = 2\Omega, \quad R_2' = 5\Omega \quad X_1 = X_2' = 5\Omega \quad X_m = 80\Omega$$

Motor speed is controlled by stator voltage control. When driving a fan load it runs at rated speed at rated voltage. Calculate motor terminal voltage, current and torque at 1200 rpm. (10)

- (ii) Explain why the stator voltage controlled induction motor drive is not suitable for constant load torque type loads. (5)

Or

- (b) Explain in detail the design of current controller of closed loop system for DC separately excited motor. (15)