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Question Paper Code : 10584

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

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. List the advantages of electrical drive over mechanical drive.
2. Draw the speed-torque characteristics for traction loads.
3. What is the function of free-wheeling diode used in a phase-controlled rectifier?
4. A 230V, 960 rpm, 200A separately excited dc motor has an armature resistance of 0.02Ω . Calculate the duty ratio of chopper for motoring operation at rated torque and 350 rpm.
5. Write the condition for maximum torque occur in induction motor
6. What is meant by v/f control?
7. State the advantages of permanent magnet synchronous motor
8. Compare VSI and CSI fed synchronous motor drive
9. What are the advantages of closed loop speed control?
10. Write down the transfer function of speed controller

PART B — (5 × 13 = 65 marks)

11. (a) (i) Discuss the multi-quadrant operation of electrical drives. (8)
(ii) Sketch the functional block diagram of electric drive and explain the essential parts. (5)

Or

- (b) (i) What is meant by steady state stability? Derive the mathematical condition for steady state stability analysis of equilibrium operating point. (10)
- (ii) In the figure 11b. Discuss the stability of the equilibrium point A and B. (3)

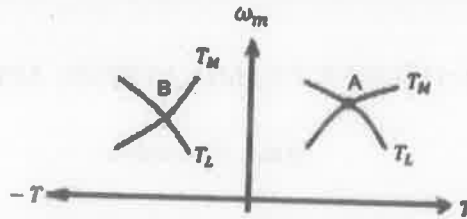


Fig. 11b

12. (a) (i) A 200 V, 875 rpm, 1 50 A separately excited dc motor has an armature resistance of 0.06Ω . It is fed from a single phase fully controlled rectifier with an ac source voltage of 220 V, 50 Hz. Assuming continuous conduction, calculate (5)
- (1) firing angle for rated motor torque and 750 rpm
- (2) firing angle for rated motor torque and (-500) rpm
- (ii) Derive the expression related to speed and torque of a single-phase full converter fed separately excited dc motor drive operating in the continuous conduction mode. (8)

Or

- (b) (i) Discuss the control strategy used for class C chopper drives. (5)
- (ii) Explain the four-quadrant operation of a dc chopper with neat diagram. (8)
13. (a) (i) Describe the speed control of three-phase induction motor using stator voltage control method. (6)
- (ii) Explain in detail the speed control scheme for a three-phase induction motor using rotor resistance control. (7)

Or

- (b) (i) Elaborate the speed control of three-phase slip ring induction motor drive using slip power recovery schemes. (10)
- (ii) Draw the block diagram of vector-controlled drive. (3)
14. (a) Explain the operation of self-controlled synchronous motor with neat diagrams. (13)

Or

- (b) (i) Explain the power factor control of synchronous motor with relevant vector diagrams. (8)
- (ii) Draw and explain the three-phase CSI fed synchronous motor drive. (5)

15. (a) Describe the armature voltage control of dc motor with constant field and field weakening modes. (13)

Or

- (b) Explain in detail the design of current controller of closed loop speed control for DC separately excited motor. (13)

PART C — ($1 \times 15 = 15$ marks)

16. (a) (i) What are heating and cooling curves? Starting from the basic principles derive the expressions for heating and cooling curves for an electrical machine. Also mention the assumptions made. (10)
- (ii) Half hour rating of a motor is 100 kW. Heating time constant is 80 minutes and the maximum efficiency occurs at 70 % of full, load. Determine the continuous rating of the motor. (5)

Or

- (b) (i) Derive the transfer function of separately excited dc motor. (10)
- (ii) Describe briefly the converter selection and characteristics. (5)
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