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Question Paper Code : 20947

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fifth Semester

Electrical and Electronics Engineering

EE 3012 — ELECTRICAL DRIVES

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is an Electric Drive? List different components involved in an electric drive.
2. Mention different components of load torque.
3. Define TRC.
4. Compare CCM and DCM in chopper drives.
5. What is slip power?
6. Why stator voltage controlled induction motor drive is suitable for fan type loads?
7. Draw the speed-torque characteristics of synchronous motor.
8. What is meant by self control?
9. Define back emf constant. Also mention its unit.
10. What is meant by mechanical time constant?

PART B — (5 × 13 = 65 marks)

11. (a) What are the different components of a load torque? Explain each component in detail.

Or

- (b) Derive the mathematical condition to obtain the steady state stability of equilibrium point.
12. (a) With a neat sketch, explain the motoring and braking operation of three phase fully controlled rectifier control of separately excited DC motor.

Or

- (b) A step down D.C chopper has a resistive load of $R=15\text{ ohm}$ and input voltage $E_{dc} = 200\text{V}$. When the chopper remains ON, its voltage drop is 2.5V . The chopper frequency is 1 kHz . If the duty cycle is 50% , determine:
- (i) Average output voltage (4)
 - (ii) RMS output voltage (3)
 - (iii) Chopper efficiency (3)
 - (iv) Effective input resistance of chopper (3)
13. (a) Explain any two-speed control of three phase induction motor drive. Write its advantages and disadvantages.
- Or
- (b) Explain the working of CSI fed induction motor drive.
14. (a) Explain the self-control of synchronous motor with suitable diagrams.
- Or
- (b) Explain in detail about the power factor improvement in synchronous motor drive.
15. (a) Derive the transfer function of armature controlled DC motor.
- Or
- (b) Explain the steps involved in selection and design of feedback controllers in the closed loop control of dc drives.

PART C — (1 × 15 = 15 marks)

16. (a) (i) Explain in detail about various speed control methods of DC motor. (8)
- (ii) A shunt motor supplied at 230V runs at 900 rpm while taking armature current of 30A . The resistance of armature circuit being 0.4 ohm . Calculate the resistance required in series with the armature circuit to reduce the speed to 500 rpm , assuming that the armature current is 25A . (7)
- Or
- (b) (i) How the torque and speed characteristics of an induction motor can be controlled by changing the supply frequency? (8)
- (ii) A three-phase, 11.2 kW , 1750 rpm , 460 V , 60 Hz , four pole Y-connected induction motor has the following parameters: $R_s = 0$, $R_r = 0.38\text{ ohm}$, $X_s = 1.14\text{ ohm}$, and $X_m = 33.2\text{ ohm}$. The motor is controlled by varying the supply frequency. If the breakdown torque requirement is 35 N-m , Calculate (1) The supply frequency, and (2) The speed ω_m at the maximum torque. (7)