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Question Paper Code : 20450

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Third Semester

Mechanical Engineering

EE 6351 — ELECTRICAL DRIVES AND CONTROLS

(Common to Manufacturing Engineering, Mechanical and Automation Engineering, Petrochemical Engineering, Production Engineering, Chemical Engineering, Petrochemical Technology)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is an electrical drive?

2. Define cooling time constant.

3. What are the three regions in the speed torque characteristics (for $(0 < s < 1)$, $(s < 0)$, $(1 < s < 2)$) of an induction motor?

4. List some application of D.C. series motor.

5. What is the necessity of a starter?

6. What are the disadvantages of a three point starter?

7. Define time-ratio control in a D.C. chopper circuit.

8. What are the disadvantages of a field control method?

9. What is meant by V/F control?

10. What is meant by Slip-Power recovery system?

PART B — (5 × 13 = 65 marks)

11. (a) Explain heating and cooling curves of a motor and obtain the expression for maximum temperature attained. (13)

Or

(b) (i) At full load of 10 H.P., the temperature rise of a motor is 30°C after one hour and 40°C after two hours. Calculate (1) The final temperature rise on full load, (2) Heating time constant of motor. (8)

(ii) Tabulate the merits and demerits of ac and dc drives. (5)

12. (a) (i) Draw and explain the speed-torque characteristics of different types of load with graph. (6)

(ii) A 3-Phase, 50 Hz, 8 pole induction motor has a full load slip of 4%. The rotor resistance is 0.001 Ω / phase and standstill reactance is 0.005 Ω / phase. Find the ratio of maximum to full load torque and the speed at which the maximum torque occurs. (7)

Or

(b) (i) A 12 pole 50 Hz, 3 phase induction motor has rotor resistance of 0.15 Ω and standstill reactance of 0.25 Ω per phase. On full load it is running at a speed of 480 r.p.m. The rotor induced e.m.f. per phase at standstill is observed to be 32 V. Calculate (1) starting torque, (2) full load torque, (3) maximum torque (4) speed at maximum torque. (8)

(ii) Describe how a DC motor is brought to stop by dynamic braking. (5)

13. (a) (i) Examine the operation of four point starter with a neat diagram. (8)

(ii) Find the percentage tapping required on an auto-transformer required for a squirrel-cage motor to start the motor against 1/4 of full load torque. The short-circuit current on normal/voltage is 4 times the full-load current and the full-load slip is 3%. (5)

Or

(b) Explain the different types of starters used in cage induction motor with a neat sketch. (13)

14. (a) (i) With a neat diagram, explain the working of Ward-Leonard speed control of DC motor. (7)

(ii) With a neat diagram, explain the speed control using flux control in a DC motor. (6)

Or

(b) With the neat circuit diagram, explain chopper fed four quadrant DC drives. (13)

15. (a) With a simple block diagram explain the operation of a variable voltage variable frequency (VVVF) inverter fed 3φ induction motor drive. (13)

Or

(b) Explain the static Kramer and Scherbius drive for the speed control of an induction motor. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Sketch a schematic circuit diagram of a direct on line starter for a three phase induction motor and explain its working, also explain how the protection against over load works. (15)

Or

(b) Explain with a neat diagram, the solid state speed control of A.C. drives. (15)