

Reg. No. :

**Question Paper Code : 90514**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Third Semester

Manufacturing Engineering

EE 8353 — ELECTRICAL DRIVES AND CONTROLS

(Common to Mechanical Engineering/Mechanical and Automation Engineering)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List the main components in any electrical drive.
2. What you mean by cooling time constant?
3. List the advantages of electric braking.
4. Draw the mechanical characteristics of split phase single phase induction motor.
5. Why any electrical motor draws high starting current?
6. List the limitations of direct on line starter.
7. Name the factors affecting the speed of DC motor.
8. Define duty ratio of chopper. Also mention the range of the duty ratio.
9. How to reverse the rotating direction of three phase induction motor?
10. Mention the limitations of voltage controller fed three phase induction motor speed control method.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Step by step, derive and draw the heating and cooling curves of any electric machine. (8)
- (ii) What basis the electric drive is selected? Also list the factors and explain. (5)

Or

- (b) (i) A three phase, 50kW, 6 pole, 960 rpm induction motor has a constant load torque of 300Nm and at wide intervals additional torque on 1500Nm for 10 seconds. Calculate
- (1) The weight of the flywheel used for load equalization, if the motor torque were not to exceed twice the rated torque and the radius of gyration is 0.9 m,
- (2) the time taken after removal of additional load before the motor torque becomes 700 Nm. (8)
- (ii) Elucidate the various types of duty applicable to electric drive. (5)
12. (a) Draw and explain the mechanical characteristics of DC shunt, DC series motor. Also explain how this mechanical characteristic is modified with the help of supply voltage, armature and field resistances. (13)

Or

- (b) Explain the following braking methods suitable for three phase induction motor.
- (i) Plugging (6)
- (ii) Dynamic braking. (7)
13. (a) With neat control circuit diagram, explain the operation of starters suitable for DC shunt and DC series motor. (13)

Or

- (b) Elucidate the operation of the following starters :
- (i) Star – Delta starter (5)
- (ii) Auto transformer starter (4)
- (iii) Rotor resistance starter. (4)

14. (a) (i) A DC shunt motor is connected to constant voltage mains and drives a load torque which is independent of speed. Prove that, if induced emf is greater than the half of the supply voltage, increasing the air gap flux per pole decreases the speed of the motor, while, if induced emf is less than the half of the supply voltage, increasing the air gap flux per pole increases the speed. (8)
- (ii) Explain how the speed of DC motor is controlled with the help of Ward Leonard control scheme. Also mention its advantages and limitations. (5)

Or

- (b) (i) Explain the controlled rectifier suitable to control the speed of DC shunt motor both in forward and reverse direction. (8)
- (ii) Elucidate the working of DC chopper fed DC motor speed control scheme. (5)
15. (a) (i) Explain the working of three phase induction motor if its ratio of voltage and frequency is maintained constant. Also draw the speed — torque characteristics of the same. (8)
- (ii) Write the operation of induction motor by adding the external resistance in the rotor circuit with the help of solid state device. (5)

Or

- (b) Explain the working of three phase induction motor with variable supply voltage and frequency is maintained constant. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Draw and explain the control circuit suitable to control the speed of DC motor, below and above the rated speed of DC motor. Also, justify the same with necessary mathematical expressions. (15)

Or

- (b) Explain any one slip power recovery scheme related to three phase induction motor. (15)