B. E. ELECTRICAL ENGINEERING (PART TIME)

FOURTH YEAR SECOND SEMESTER (OLD) 2017

Subject: ELECTRIC DRIVES

Time: Three hours   Full Marks: 100

(50 marks for each Part)

Use a separate Answer-Script for each Part

PART-I

Answer any *three* questions

Two marks reserved for neat and well organized answer

1. a) Using the torque balance equation in a motor with load, state the conditions for acceleration, deceleration and constant speed operation. When does a DC motor act as a generator and under what circuit condition is braking torque produced? Similarly, explain braking condition of Induction motor also.

    6

   b) Using the expressions for a Separately Excited DC Motor, explain what are the advantages of constant flux operation in DC motors ? Why is field weakening used?

    5

   c) Explain the various methods by which the speed of an induction motor can be controlled electronically, with their advantages and disadvantages.

    5

2. a) Sketch and explain a simple scheme to control the speed of a separately excited DC motor using armature terminal voltage control in closed loop. How does the principle of IaRa compensation (where speed feedback is not used) gives better performance over a simple voltage feedback method.

    8

   b) Sketch and explain the principle of closed loop speed control of a DC motor using dual feedback loops with speed and current feedback.

    8

3. a) Sketch and explain how the principle of slip compensation for speed control of an Induction motor (where speed feedback is not used) gives better performance over open loop method.

    8

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b) Sketch and explain the principle of speed control of an Induction motor using speed feedback.

8

4. a) Explain the effects of harmonics on induction motor core loss and copper loss. Make suitable assumptions.

6

b) Explain the effects of harmonics on induction motor flux and torque.

10

5. a) Sketch and briefly justify the nature of the terminal voltage versus frequency for an Induction Motor from zero speed to twice rated speed.

4

b) Derive to show that under constant flux, the Torque-Speed curves of an Induction Motor are straight lines, parallel to each other.

12

PART – II

Answer any three questions from this part.
Twomarks are reserved for neat and well organised answer.

6. a) Classify electric drives according to their method of speed control. State and discuss 4
   their main features.

   b) What are different methods available for the determination of motor rating for variable 8
   load drive? Discuss in brief.

   c) For falling speed-torque characteristic of a load it will run stably only when that of 4
   motor is less rising --- Correct and / or justify.

7. a) Classify motors used in drive system according to the required type of duties. Draw the 8
   load-time, loss-time and the temperature rise – time curves in the case of S5 and S6 type
   of duties.

   d) Find out an expression for Temperature Rise of an electric motor with intermittent duty 8
   cycle.

8. a) Draw and explain connection diagram of a DC shunt motor starter using back emf 8
   sensing relay.

   e) Draw connection diagram of DOL starter for starting a three phase induction motor 8
   with the provision for speed reversal and overload protection.

9. a) Draw the time-speed curve for short run and derive an expression for maximum speed 6
   of an electric train.

   b) What are different types of current collector systems are used in electric traction? Discuss 6
   their advantages and disadvantages, if any.

   c) Write a note on suitability of DC series motor for traction application. 4

10. Write notes on any two of the following: 2x8

a) Selection of Electric Drives

b) Four Quadrant operation of Electric Drives

c) Braking of DC motors