

Bachelor of Engineering (Electrical Engineering), 2019

(4th Year, 1st Semester)

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 from this part.

Two marks are for neat and well organised answer.

1. a) Classify electric drives according to their method of speed control. State and discuss their main features. 4
- b) What are different methods available for the determination of motor rating for variable load drive? Discuss in brief. 8
- c) For falling speed-torque characteristic of a load it will run stably only when that of motor is less rising --- Correct and / or justify. 4
2. a) Classify motors used in drive system according to the required type of duties. Draw the load-time, loss-time and the temperature rise - time curves in the case of S5 and S6 type of duties. 8
- b) Find out an expression for Temperature Rise of an electric motor with intermittent duty cycle. 8
3. a) Draw and explain connection diagram of a DC shunt motor starter using back emf sensing relay. 8
- b) Draw connection diagram of DOL starter for starting a three phase induction motor with the provision for speed reversal and overload protection. 8
4. a) Derive an expression for speed and current of a DC shunt motor during starting. 8
- b) Derive an expression for speed and current of a DC shunt motor during counter current braking. Also draw the variation of speed and current with time. 8

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| 5. | a) Draw and explain the typical speed-time curve of an electric train. How it is approximated for (i) short run and (ii) long run? Find the peak velocity and the distance covered relationship for the second case. | 6 |
| | b) What are different types of current collector systems used in electric traction? Discuss their advantages and disadvantages, if any. | 6 |
| | c) Write a note on suitability of DC series motor for traction application. | 4 |

PART-II.

Answer *any three* questions from this part.

Two marks are reserved for neat and well organised answer

6. a) Explain briefly with block diagrams the closed loop speed control scheme of dc separately excited motor above and below rated speed with the help of speed feedback. 10
- b) Explain with suitable diagrams the constant torque and constant power regions of the above drive system.

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| 7. | a) A separately excited dc motor of 2.2 kW, 1100 rpm, 200V rating is operated at full load from a three phase fully controlled converter with an input ac voltage of 415V, 50 Hz, three phase. Find (i) the triggering angle of the converter at this load and (ii) the new angle if the speed is to be reduced to half at rated load. Assume $r_a=0.5$ ohm. | 8 |
| | b) Discuss with relevant block diagram the IaRa compensation scheme for a dc drive system. | 8 |
| 8. | a) Discuss with necessary circuit diagram the four quadrant operation of a dc separately excited motor using a dual converter. | 8 |
| | b) Explain with suitable block diagrams, the speed control of induction motor based on slip compensation. | 8 |
| 9 | a) Explain with suitable block diagram, show how a cage type induction motor can be started with the help of power electronic controllers. | 8 |
| | b) Explain how frequency control technique can be applied for the speed control of induction motor below and above rated speed. | 8 |
| 10 | Write short notes on any Two: | 8 + 8 |
| | a) Input overvoltage protection scheme of motors. | |

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- b) Speed control of synchronous motors.
 - c) Closed loop V/f control of induction motors.
 - d) Thermal protection of motors.
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