

B.E. ELECTRICAL ENGINEERING EXAMINATION – 2022

(3rd Year, 2nd Semester)

ELECTRICAL DRIVES

Time : Three hours

Full Marks : 100

(50 marks for each part)

(Use separate Answer Script for each part)

PART – I

1. Answer any one from (a) and (b): 10
 - a) Classify electric drives according to their method of speed control. State and discuss their main features. What are factors are to be considered for selection of drive?
 - b) What do you mean by four quadrant operation of an electric drive? Explain. Why is it necessary? Discuss with an example.

2. Answer any one from (a) and (b): 10
 - a) Find out an expression for Temperature Rise of an electric machine with Intermittent Short Time ratings.
 - b) 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.

3. Answer any one from (a) and (b): 10
 - a) Draw and explain connection diagram of an automatic DC shunt motor starter using current sensing relay.
 - b) Draw connection diagram for starting a three phase slip ring induction motor with frequency sensing relay.

4. Answer any one from (a) and (b): 10
 - a) Derive an expression for speed and current of a DC shunt motor during starting.
 - 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.

[Turn over

5. Answer any one from (a) and (b): 10
- a) Draw the time-speed curve for short run and derive an expression for maximum speed of an electric train.
 - b) What is the requirement of current collector system in electric traction system? Describe different types of current collector systems are used in electric traction? Discuss their advantages and disadvantages.

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 below rated speed without speed feedback. 8
- b) Explain with suitable diagrams the constant torque variable power mode and constant power variable torque mode for the speed control of dc separately excited motor. 8

7.	a) A separately excited dc motor of 5.5 kW, 1100 rpm, 220V rating is operated from a three phase half controlled converter with an input three phase ac voltage of 415V, 50 Hz. Find (i) the triggering angle of the converter at rated condition and (ii) the new triggering angle and motor input power if the speed is to be decreased to 500 rpm at rated armature current. Assume $r_a=0.5$ ohm and continuous ripple free armature current.	8
	b) Discuss the different schemes of how motor speed and current can be sensed for a dc drive system and enumerate the advantages and disadvantages of each scheme.	8
8.	a) Discuss with necessary circuit diagram the closed loop speed control scheme of a dc separately excited motor using speed and current feedback.	8
	b) Explain with suitable block diagrams, the speed control of induction motor based on stator voltage variation. Indicate the major application areas of such schemes.	8
9	a) Explain with suitable block diagram the closed loop V/f control scheme of a three phase induction motor. Discuss about the nature of V vs f characteristics for such scheme.	10
	b) Explain why frequency control technique for induction motor is difficult to implement below rated speed.	6
10	Write short notes on any Two:	8 + 8
	a) Slip compensation scheme of induction motors.	

- b) Speed control method of synchronous motors.
- c) Chopper fed dc drive system.
- d) Thermal protection of motors.
- e) Over voltage and under voltage protection of drive system.