

BE ELECTRICAL ENGINEERING EXAMINATION, 2023
(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): CO1 10
 - a) Classify electric drives according to their method of speed control. State and discuss their main features.
 - 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): CO2 10
 - 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.
 - b) Find out an expression for Temperature Rise of an electric machine with Intermittent Short Time ratings.

3. Answer any one from (a) and (b): CO3 10
 - a) Draw and explain connection diagram of an automatic DC shunt motor starter using Back emf relay.
 - b) Draw connection diagram of DOL starter for starting a three phase induction motor with the provision for speed reversal and overload protection.

4. Answer any one from (a) and (b): CO4 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.

5. Answer any one from (a) and (b): CO5 10
 - a) Draw the time-speed curve for short run and derive an expression for maximum speed of an electric train.
 - b) What are different types of current collector systems are used in electric traction? Discuss their advantages and disadvantages.

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PART-II.

Answer *ALL* questions from this part.

6. a) Explain briefly with block diagrams the closed loop speed control scheme of dc separately excited motor below rated speed with the help of speed feedback. (CO1) 10
or
b) Explain with suitable diagrams that, "Armature voltage control method is called constant torque variable power mode whereas field control is called constant power variable torque mode" for the speed control of dc separately excited motor.(CO1)
7. a) Discuss with necessary circuit diagram the four quadrant operation of a dc separately excited motor.(CO2) 10
or
b) Discuss with relevant block diagram the IaRa compensation scheme for a dc drive system.(CO2)
8. a) A separately excited dc motor of 2.0 kW, 1150 rpm, 220V rating is operated at full load from a three phase fully controlled converter with an input three phase ac voltage of 415V, 50 Hz. Find (i) the triggering angle of the converter at rated load and rated speed (ii) the new triggering angle if the speed is to be reduced to 500 rpm at rated armature current. Assume $r_a=0.5$ ohm and rated field flux during the operation. (CO3) 10
or
b) A separately excited dc motor of 1.2 kW, 1100 rpm, 160V rating is operated at rated speed and full load from a DC-DC boost converter fed from a battery of 36V. Find (i) the converter output voltage (ii) battery current and (iii) duty ratio when the motor takes 6.5A at 900 rpm. Assume $r_a=1.5$ ohm rated field current and no converter losses. (CO3)

- 9 a) Explain with suitable block diagram and torque speed characteristics, how the speed of a cage type induction motor can be controlled with the help of open loop V/f control. Also discuss why V/f characteristic near low speed becomes non-linear. (CO4) 10

or

- b) Explain with suitable block diagrams, the speed control of induction motor based on stator voltage variation. Also enumerate its advantage and disadvantages. (CO4)

- 10 Write short notes on any Two: 5 + 5

- a) Slip compensation scheme of induction motors. (CO2)
- b) Speed control method of synchronous motors. (CO2)
- c) Input over voltage and under voltage protection of motors. (CO2)
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