B.E. ELECTRICAL ENGINEERING THIRD YEAR SECOND SEMESTER EXAM 2024

ELECTRICAL DRIVES

Time: Three hours   Full Marks: 100

(50 marks for each part)
(Use separate Answer Script for each part)

PART – I

1.   (a) Find out Motor rating for intermittent load based on average power.   10
Or,
(b) (i) What do you understand by the term "Motor-Load Stability"? Discuss with suitable examples.

(ii) What is 'Four quadrant operation of electric drive'? Explain with a suitable example.

2.   (a) Draw and explain connection diagram of an automatic DC shunt motor starter   10
using current sensing relay.
Or,
(a) Draw connection diagram of an autotransformer starter for an SQIM and explain its functioning.

3.   (a) Find out an expression for Temperature Rise of an electric motor driving   10
intermittent load.
Or,
(b) How electric motors are classified according to their duty cycle? Draw and discuss the load-time, loss-time and temperature rise-time curves for different duty cycles.

4.   (a) Derive an expression for speed and current of a D.C. shunt motor during   10
starting. Also draw the variation of speed and current with time.
Or,
(b) Derive an expression for speed and current of an Induction motor during plugging. Also draw the variation of speed and current with time.

5.   (a) Draw the time-speed curve of a long distant train and derive an expression for   10
maximum speed.
Or,
(a) What are the different components of tractive effort for propulsion of train?

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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 diagram the closed loop speed control scheme of dc separately excited motor below rated speed. (CO1) 8

   b) Explain the constant torque and constant power modes for the speed control of dc separately excited motor. (CO1) 8

7. a) A separately excited dc motor of 4.5 kW, 1100 rpm, 220V rating is operated from a step-up chopper with input voltage of 100V. Find (i) the duty ratio of the converter at rated condition and (ii) the new duty ratio when the speed is to be decreased to 600 rpm at rated armature current. Assume ra=0.5 ohm and continuous ripple free armature current. (CO 3) 8

   b) Discuss with necessary diagrams, the slip compensation scheme of induction motors. (CO 2) 8

8. a) Discuss with necessary circuit diagram the IR compensation scheme of a dc separately excited motor. (CO 3) 8

   b) Explain with suitable block diagrams, the speed control of induction motor based on stator frequency variation. Indicate the major application areas of such schemes. (CO1) 8

9. a) Explain with suitable block diagram the open loop V/f control scheme of a three phase induction motor. Discuss the disadvantages of the above scheme. (CO1) 10

   b) The speed of a 1 kW, 1440 rpm, 415V, three phase cage type induction motor is to be controlled with the help of an inverter following V/f technique. Find the motor input voltage and frequencies when the given speed references are (i) 200 rpm (ii) 700 rpm (iii) 1750 rpm all at no load. Assume stator and rotor resistances of 1.0 ohm with negligible stator and rotor leakage reactance and a no load current of 1.0 A , 0.2 pf lag at rated condition. (CO 4) 6

10. Write short notes on any Two: (CO 2) 8 + 8

a) Speed control of dc separately excited motor above rated speed.

b) Speed control method of synchronous motors.

c) Principle of operation of cyclo converters.

d) Thermal protection of motors.

e) Over voltage and under voltage protection of drive system.