18EE741

USN

Seventh Semester B.E. Degree Examination, Jan./Feb. 2023
Industrial Drives & Applications

Time: 3 hrs.   Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. With a neat block diagram, explain the various components of an Electrical Drive. **(10 Marks)**
   b. Explain the modes of operation of an electrical drives. **(10 Marks)**

OR

2 a. Explain the necessity of mounting the flywheel on the motor shaft in non-reversible drives. Also obtain the equations to calculate the moment of inertia of the flywheel. **(10 Marks)**
   b. Explain the speed torque conventions and multi quadrant operation of a motor driving hoist load. **(10 Marks)**

Module-2

3 a. With a neat circuit diagrams and waveforms, explain 3-phase fully controlled rectifier control of separately excited D.C.Motor. **(10 Marks)**
   b. A 200 V, 875 rpm, 150 A separately excited motor with armature resistance of 0.06 ohm. It is fed from a single phase fully-controlled rectifier with an ac source voltage of 220 V, 50 Hz. Assuming continuous conduction,
   Calculate :
   - (i)   Firing angle for rated motor torque and 750 rpm.
   - (ii) Firing angle for rated motor torque and (-500) rpm.
   - (iii) Motor speed for $\alpha = 160°$ and rated torque. **(10 Marks)**

OR

4 a. Explain chopper control of saperately excited D.C.Motor. **(10 Marks)**
   b. A 230 V, 960 rpm and 200 A separately excited D.C.Motor has an armature resistance of 0.02 Ω. The motor is fed from a chopper which provides both motoring and braking operations. The source has a voltage of 230 V. Assuming continuous conduction.
   - (i)   Calculate duty ratio of chopper for motoring operation at rated torque and 350 rpm.
   - (ii) Calculate duty ratio of chopper for braking operation at rated torque and 350 rpm.
   - (iii) If maximum duty ratio of chopper is limited to 0.95 and maximum permissible motor current is twice the rated. Calculate maximum permissible motor speed obtainable without field weakening and power fed to the source.
   - (iv) If motor field is also controlled in, (iii) above, calculate field current has a fraction of its rated value for a speed of 1200 rpm. **(10 Marks)**

Module-3

5 a. Explain the effect of unbalanced source voltages and single phasing on 3-phase induction motor. **(10 Marks)**

b. A 2200 V, 2600 kW, 735 rpm, 50 Hz, 8-pole, 3-phase squirrel-cage induction motor has following parameters referred to the stator.

$R_S = 0.075\,\Omega,\ R_r' = 0.1\,\Omega, X_S = 0.45\,\Omega,\ X_r' = 0.55\,\Omega.$

Stator winding is delta connected and consists of two sections connected in parallel.

   (i) Calculate starting torque and maximum torque as a ratio of rated torque, if the motor is started by star-delta switching. What is the maximum value of line current during starting?

   (ii) What will be value of maximum line current and torque during starting, if the part winding method of starting is employed?

   (iii) If motor is started by connecting series reactors in line, what should be the value of reactors so as to limit line current to twice the rated value? **(10 Marks)**

OR

6 a. Explain A.C. dynamic braking of 3-phase induction motor with two lead and three lead connections. **(10 Marks)**

  b. Explain variable frequency control of induction motor with necessary diagrams. **(10 Marks)**

Module-4

7 a. Explain the operations of voltage source inverter fed induction motor drives. Also sketch the various schemes of VSI fed induction drive. **(10 Marks)**

  b. With a neat drive circuit diagram, explain the current regulated voltage source inverter control. **(10 Marks)**

OR

8 a. Explain the operation of synchronous motor fed from fixed frequency supply. **(10 Marks)**

  b. With a neat circuit diagram, explain closed-loop speed control and converter rating for VSI and cyclo converter induction motor drives. **(10 Marks)**

Module-5

9 a. Explain the self controlled synchronous motor drive employing load commutated thyristor inverter. **(10 Marks)**

  b. Explain brushless D.C. motor drive for servo applications. **(10 Marks)**

OR

10 a. With a neat process flow diagram, explain the process flow of Textile Mill and also list the requirements of drive. **(12 Marks)**

  b. List the advantages and disadvantages of stepper motor. **(08 Marks)**

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