Enrollment No......................................

Faculty of Engineering
End Sem Examination May-2023
EE3CO25 / EX3CO25
Fundamentals of Industrial Electrical Drives

Programme: B.Tech.   Branch/Specialisation: EE/EX

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. Which of the following is used to build an electric drive?   1
   (a) Source   (b) Motor   (c) Control unit   (d) All of these

 ii. Which of the following exhibits linearly rising load torque 1
   characteristics?
   (a) Rolling Mills
   (b) Fan load
   (c) Separately excited dc generator connected to the resistive load
   (d) Elevators

 iii. Which braking is not possible in series motor?   1
   (a) Regenerative braking   (b) Dynamic braking
   (c) Counter current braking   (d) Rheostat braking

 iv. An elevator drive is required to operate in-   1
   (a) One quadrant only   (b) Two quadrants
   (c) Three quadrants   (d) Four quadrants

 v. The concept of V/f control of inverters driving induction motors 1
   results in-
   (a) Constant torque operation (b) Speed reversal
   (c) Reduced magnetic loss   (d) Hormonic elimination

 vi. The power input to a 3-phase IM is 60 kW and stator loss is 1 kW the 1
   rotor cu loss per phase is-
   (a) Slip × 50 / 3   (b) Slip × 59 / 3
   (c) Slip × 69 / 3   (d) 1

vii. In a synchronous machine, the phase sequence can be reversed by reversing the _____. **1**
(a) Rotor direction   (b) Field polarities
(c) Armature terminal   (d) Both (a) & (c)

viii. A 3- phase synchronous motor can operate over a wide range of power factors i.e. from lagging to leading power factor. This is achieved by- **1**
(a) Varying the speed   (b) Changing the load
(c) Varying the applied voltage   (d) Changing the field excitation

ix. The most popular language for PLCs is- **1**
(a) C++   (b) Ladder diagram
(c) OOP+   (d) VHDL

x. The PLC is used in _____. **1**
(a) Machine tools
(b) Automated assembly equipment
(c) Moulding and extrusion machines
(d) All of these

Q.2 i. Explain selection criteria of motor rating. **2**

ii. What do you mean by electrical drives? Draw the block diagram of electrical drive system. **3**

iii. Explain constant power and constant torque drives. **5**

OR iv. A motor is driving a hoist load. Discuss four quadrant operation of the motor and show that in the speed-torque plane. **5**

Q.3 i. What are the different types of braking in DC motors? Why plugging is not popular. How the dynamic braking can be implemented by using a chopper. **4**

ii. Describe, with appropriate voltage and current wave-form, the working of a single phase full-converter fed dc drive. **6**

OR iii. Explain four quadrant chopper fed separately excited dc motor drive. **6**

Q.4 i. Explain the difference between the VSI fed induction motor drive and CSI fed induction motor drive. **3**

ii. Draw and explain the speed torque characteristics of a variable stator voltage-controlled induction motor. Why stator voltage control is not suitable for speed control of induction motor with constant load torque. **7**

OR iii. What is slip power recovery scheme? Describe static Scherbius drive. Why it is always suggested to use a transformer in line side converter for static Scherbius drive? **7**

Q.5 i. When a synchronous motor is operating in true synchronous mode, frequency must be varied in steps. Why? **3**

ii. Explain power and torque capability curves of a synchronous motor drive. In variable frequency control of synchronous motor drive, why V/f ratio is maintained constant up to base speed and voltage constant above base speed. **7**

OR iii. Discuss with the help of a suitable schematic diagram the operation of a load commutated fed synchronous motor drive. Why this drive is suitable for high speed? **7**

Q.6   Attempt any two:

i. Explain the principles of operation of PLC with block diagram. **5**

ii. Describe major application of PLC. Explain PLC applications in ac drive control. **5**

iii. Discuss the ladder diagram of the PLC. **5**

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Marking Scheme
EE3CO25-EX3CO25 Fundamentals of Industrial Electrical Drives

Q.1 i) Which of the following is used to build a electric drive?   1
d) All of the mentioned

ii) Which of the following exhibits linearly rising load torque characteristics?   1
c) Separately excited dc generator connected to the resistive load

iii) Which braking is not possible in series motor?   1
a) Regenerative braking.

iv) An elevator drive is required to operate in   1
d) Four quadrants.

v) The concept of V/f control of inverters driving induction motors results in   1
a) Constant torque operation

vi) The power input to a 3 - Φ IM is 60 kW and stator loss is 1 kW the rotor cu loss per phase is   1
b) slip × 59 / 3

vii) In a synchronous machine, the phase sequence can be reversed by reversing the _____   1
a) Rotor direction

viii) A 3- phase synchronous motor can operate over a wide range of power factors i.e. from lagging to leading power factor. This is achieved by   1
d)changing the field excitation.

ix) The most popular language for PLCs is: 1
b)Ladder diagram

x) The PLC is used in _____.   1
d)all of the above

Q.2 i. Explain selection criteria of motor rating.   2

ii. What do you mean by electrical drives?   1 Mark   3
Draw the block diagram of electrical drive system.   2 Mark

iii. Explain constant power and   2.5 Mark   5
constant torque drives.   2.5 Mark

OR iv. A motor is driving a hoist load.   2 Mark   5
Discuss four quadrant operation of the motor and show that in the speed-torque plane.   3 Mark

Q.3 i. What are the different types of braking in DC motors?   2 Mark   4
Why plugging is not popular.   1 Mark
How the dynamic braking can be implemented by using a chopper.   1 Mark

ii. Describe, with appropriate voltage and current wave-form, 2 Mark   6
the working of a single phase full-converter fed dc drive.   4 Mark

OR iii. Explain four quadrant diagram   2 Mark   6
chopper fed separately excited dc motor drive.   4 Mark

Q.4 i. Explain the difference between the VSI fed induction motor drive   3
and CSI fed induction motor drive.   0.5 mark for each difference

ii. Draw and   2 Mark   7
explain the speed torque characteristics of a variable stator voltage-controlled induction motor.   3 Mark
Why stator voltage control is not suitable for speed control of induction motor with constant load torque.   2 Mark

OR iii. What is slip power recovery scheme?   1 Mark   7
Describe static Scherbius drive.   4 Mark
Why it is always suggested to use a transformer in line side converter for static Scherbius drive?   2 Mark

Q.5 i. When a synchronous motor is operating in true synchronous   3
mode, frequency must be varied in steps. Why?   3 Mark

ii. Explain power and torque capability curves of a synchronous   7
motor drive.   3 Mark
In variable frequency control of synchronous motor drive, why V/f ratio is maintained constant up to base speed and voltage constant above base speed.   4 Mark

OR iii. Discuss with the help of a suitable schematic diagram   2 Mark   7
the operation of a load commutated fed synchronous motor drive.   3 Mark

Why this drive is suitable for high speed.   2 Mark

Q.6   Attempt any two:
   i.   Explain the principles of operation of PLC with   3 Mark   5
           block diagram.   2 Mark
   ii.   Describe major application of PLC.   2 Mark   5
           Explain PLC applications in ac drive control.   3 Mark
   iii.   Discuss the   3 Mark   5
           ladder diagram of the PLC.   2 Mark

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