



Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH (EE) (Separate Supple)/SEM-7/EE-701/2011

2011

ELECTRIC DRIVES

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :
 $10 \times 1 = 10$
 - i) In multiquadrant operation of Electric Drives, quadrant III operation is known as
 - a) Forward motoring
 - b) Forward braking
 - c) Reverse braking
 - d) Reverse motoring.
 - ii) Short time rating of an electric machine
 - a) is equal to name plate rating
 - b) is less than the name plate rating
 - c) is greater than the name plate rating
 - d) has no bearing to its name plate rating.



- iii) A motor driving a passive load is said to be steady state stable if
- a) $\frac{dT_L}{d\omega} - \frac{dT_M}{d\omega} = 0$ b) $\frac{dT_L}{d\omega} - \frac{dT_M}{d\omega} < 0$
- c) $\frac{dT_L}{d\omega} - \frac{dT_M}{d\omega} > 0$ d) All of these.
- iv) In case of d.c. drives, field control at rated armature voltage signifies the fact that,
- a) maximum power developed by the motor has a constant value
- b) the maximum torque that the machine can deliver has a constant value
- c) both of (a) and (b)
- d) none of (a) and (b)
- v) The speed control below synchronous speed
- a) The slip power is pumped back to the supply
- b) The slip power is injected into the rotor circuit
- c) There is no effect on slip power
- d) None of these.
- vi) In case of rotor resistance control of induction motor drives, for the same torque
- a) speed falls with an increase in rotor resistance
- b) speed increases with an increase in rotor resistance
- c) speed falls with fall in rotor resistance
- d) speed increases with fall in rotor resistance.



- vii) A single-phase fully controlled rectifier fed d.c. separately excited motor operates in
- a) quadrant I and II b) quadrant II and III
 - c) quadrant III and IV d) quadrant I and IV.
- viii) In self-control mode operation of synchronous motor drive, stator supply frequency is changed so that
- a) synchronous speed is the same as motor speed
 - b) synchronous speed is greater than motor speed
 - c) synchronous speed is less than motor speed
 - d) none of these
- ix) Regenerative braking can take place
- a) when the rotor rotates in the same direction as that of the stator magnetic field
 - b) with a rotor speed greater than the synchronous speed
 - c) all of these
 - d) none of these.
- x) While plugging a 3-phase induction motor, if one supply terminal gets disconnected, then the motor will
- a) continue to run in the same direction
 - b) stop
 - c) start rotating in the opposite direction at the same speed
 - d) start rotating in the opposite direction at reduced speed.



- xi) The most suitable solid state converter for controlling the speed of the three-phase cage motor at 25 Hz is
- a) cyclo converter
 - b) current source inverter
 - c) voltage source inverter
 - d) Load commutated inverter.
- xii) Chopper control for DC motor provides variation in
- a) input voltage
 - b) frequency
 - c) both (a) and (b)
 - d) None of (a) and (b).

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. How are electrical drives classified ? Explain each class with examples.
3. Briefly describe the multi-quadrant operation of drives.
4. A 200V, 10·5 A , 200 rpm shunt motor has the armature and field resistances of 0·5 and 400 Ω respectively.

It drives a load whose torque is constant at rated motor torque. Calculate motor speed if the source voltage drops to 175 V.



5. Discuss about regenerative and dynamic braking of d.c. motor drives.

6. A drive has the following parameters

$$J = 10 \text{ kg} - \text{m}^2, T = 100 - 0.1N, \text{ N-M, passive load torque}$$

$$T_L = 0.05N, \text{ N-M where N is the speed in rpm.}$$

Initially the drive is operating at steady-state. Now it is to be reversed. For this motor characteristic is changed to $T = -100 - 0.1N, \text{ N-M}$ Calculate the time of reversal.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Explain the principle of variable voltage variable frequency (VVVF) control of induction motor.

b) A 400V, star connected, 3-phase, 6-pole, 50Hz induction motor has following parameters referred to

$$\begin{aligned} \text{the stator : } R_s &= R_r' = 1\Omega, \\ X_s &= X_r' = 2\Omega \end{aligned}$$

For regenerative braking operation of this motor determine :

i) maximum overhauling torque it can hold and range of speed for safe operation



- ii) speed at which it will hold an overhauling load with a torque of 100 N-M. 7 + 8
8. a) Explain the principle of self-controlled synchronous motor drive.
- b) Deduce an expression for energy lost in the armature of a d.c. separately excited motor during starting with no load. 7 + 8
9. Discuss different methods of braking of induction motor. Draw relevant torque speed characteristics. 15
10. a) Deduce heating and cooling curve of a machine.
- b) A motor operates on a periodic duty cycle in which it is clutched to its load for 10 min and declutched to run on no-load for 20 min. Minimum temperature rise is 40°C . Heating and cooling time constants are equal and have a value of 60 min. When load is declutched continuously the temperature rise is 15°C , Determine
- i) maximum temperature during the duty cycle
- ii) temperature when the load is clutched continuously

8 + 7



11. Write short notes on any three of the following : 3×5

- a) Stepper motor
- b) Switched reluctance motor drive
- c) Drives used in paper machine
- d) Drives used in cement making

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