

CS/B.Tech/EE-New/SEM-7/EE-701/2013-14

**CS/B.Tech/EE-New/SEM-7/EE-701/2013-14**  
**2013**  
**ELECTRIC DRIVES**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

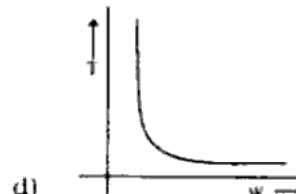
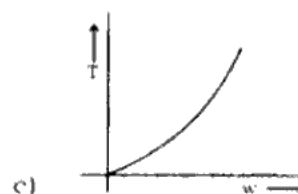
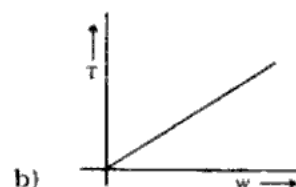
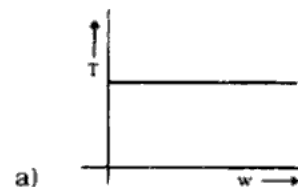
*Candidates are required to give their answers in their own words as far as practicable.*

**GROUP - A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any ten of the following questions : 10 × 1 = 10

- i) The speed-torque curve of a fan-type load is given by



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[ Turn over

- ii) For a constant torque drive, power will be
- directly proportional to the speed
  - inversely proportional to the speed
  - Independent of speed
  - Directly proportional to the square of the speed.
- iii) The slip  $s$  for reversal of any induction motor is
- $s - 1$
  - $1 - s$
  - $2 - s$
  - $1 - 2s$
- iv) A single motor which actuates several mechanisms or machines is called
- group drive
  - individual drive
  - multi-motor drive
  - active drive
- v) Stator voltage control of Induction motor is suitable for applications where
- torque demand reduces with speed
  - torque demand increases with speed
  - torque demand reduces with increase of speed
  - torque demand increases with reduction of speed.

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vi) For slip power recovery method for a positive  $P_r$  where  $P_r = P_g - P_m$ , the induction motor will run at a speed

- a) higher than the rated speed
- b) lower than the rated speed
- c) at the rated speed
- d) none of these.

vii) 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.

viii) A three-phase induction motor operates at a constant rotor frequency when the stator frequency is varied from zero to rated value. The torque developed by the motor is

- a) Constant from zero to rated speed
- b) Proportional to speed
- c) Proportional to square of speed
- d) Inversely proportional to speed.

ix) The advantage of PWM inverter over a Voltage Source Inverter is

- a) higher order harmonics are eliminated inherently
- b) lower order harmonics are eliminated inherently
- c) harmonics are not introduced into the circuit
- d) both higher and lower order harmonics are introduced.

x) When smooth and precise speed control over a wide range is desired, the motor preferred is

- a) synchronous motor
- b) squirrel cage induction motor
- c) wound rotor induction motor
- d) dc motor.

xi) The regenerative braking is not possible in case of

- a) dc series motor
- b) induction motor
- c) dc shunt motor
- d) dc separately excited motor.

xii) The characteristics of drive for crane hoisting and lowering is

- a) smooth movement      b) precise control  
c) fast speed control      d) all of these.

**GROUP – B**

**( Short Answer Type Questions )**

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

2. What are the advantages and disadvantages of group electric drive over individual electric drive ?
3. Discuss the effect of flywheel incorporated with an electric drive under shock loading condition.
4. Describe with a neat diagram four quadrant operation of a motor driving a hoist load.
5. How can a separately excited dc motor be controlled using a chopper ?
6. Describe the regenerative braking operation of an 3-phase induction motor.

**GROUP – C**

**( Long Answer Type Questions )**

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

7. a) Explain why VVVF control drive is better than either variable voltage or variable frequency control drive.      5  
b) Give a short description of different schemes of VVVF control drive.      4  
c) Describe the 180 deg conduction mode operation of 3-phase VSI.      6
8. a) Derive the heating characteristics of an electric motor. Define heating time constant.       $5 + 1$   
b) A motor has a thermal heating time constant of 45 minutes. When the motor runs continuously at full load, its final temperature rise is  $80^{\circ}\text{C}$ .  
(i) What would be the temperature rise after 1 hour, if the motor runs continuously on full load ?  
(ii) If the temperature rise in 1 hour rating is  $80^{\circ}\text{C}$ , find the maximum steady-state temperature at this rating.  
(iii) How long will the motor take for its temperature to rise from  $50^{\circ}\text{C}$  to  $80^{\circ}\text{C}$ , if it is working at its 1 hour rating ?      9
9. a) Draw the speed torque characteristic for dynamic braking operation of dc series motor. Why does torque become zero at finite speed ?      6

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- b) A 230 V separately excited dc motor takes 50A at a speed of 800 rpm. It has armature resistance of 0.4  $\Omega$ . This motor is controlled by a chopper with an input voltage of 230 V and frequency of 500 Hz. Assuming continuous conduction throughout, calculate the speed-torque characteristics for :
- (i) Motoring operation at duty ratios of 0.3 and 0.6
  - (ii) Regenerative braking operation at duty ratios of 0.7 and 0.4. 9
10. a) When plugging is employed for stopping an induction motor, why is it necessary to disconnect it from supply when speed reaches close to zero ? 3
- b) Explain the principle of slip power recovery scheme of controlling the speed of induction motor, using static Scherbius Drive. 8
- c) Explain the variable frequency control of synchronous motor drive. 4
11. Write short notes on any *three* of the following : 3 × 5
- a) Electrical drives and its components.
  - b) Buck-boost method of speed control of dc motor.
  - c) Solar and Battery powered drives
  - d) Drive for cement mill
  - e) Vector control of Induction motor.