Name : ………………………………………………………

Roll No. : ………………………………………………………

Invigilator's Signature : ……………………………………

CS/B.Tech (EE-N)/SUPPLE/SEM-7/EE-701/2010
2010
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)　If the stator voltage of an induction motor is decreased by 50% then maximum torque

　　　　a)　will increase by 75%

　　　　b)　will decrease by 75%

　　　　c)　will remain constant

　　　　d)　none of these.

　　ii)　The method of speed control using three phase voltage controller is suitable for loads

　　　　a)　whose torque is proportional to speed

　　　　b)　having constant torque

　　　　c)　whose torque is proportional to $\sqrt{N}$

　　　　d)　whose torque is proportional to N^2.

SE-67　　　　　　　　　　　　　　　　　　　　[Turn over

iii) During DC dynamic braking operation of an induction motor the relative speed between stator and rotor field is

a) ω

b) $\omega_s - \omega$

c) $\omega - \omega_s$

d) $\omega + \omega_s$.

where ω_s = synchronous speed

ω = rotor speed.

iv) Speed control by varying the field circuit resistance offers

a) constant power drive

b) constant torque drive

c) variable power drive

d) variable torque drive.

v) The selection of an electric motor for any application depends on which of the following factors ?

a) Electrical characteristics

b) Mechanical characteristics

c) Size and rating of motors

d) All of these.

vi) For a motor-generator set which of the following motors will be preferred ?

a) Synchronous motor

b) Slip ring induction motor

c) Pole changing induction motor

d) Squirrel cage induction motor.

vii) In series motor which of the following methods can be used for changing the flux per pole ?

    a)   Tapped field control   b)   Diverter field control

    c)   Series-parallel control   d)   Any of these.

viii) Which of the following methods is preferred when smooth and precise speed control over a wide range is used ?

    a)   DC motor

    b)   Squirrel cage induction motor

    c)   Wound rotor induction motor

    d)   Synchronous motor.

ix) Plugging in hoist application in DC drive is a

    a)   first quadrant operation

    b)   second quadrant operation

    c)   third quadrant operation

    d)   fourth quadrant operation.

x) Duty cycle of a step-up chopper is

a) $\delta = \dfrac{T_{on} + T_{off}}{T_{off}}$

b) $\delta = \dfrac{T_{on}}{T}$

c) $\delta = \dfrac{T}{T_{on}}$

d) $\delta = \dfrac{T_{on}}{1 - T_{off}}$.

xi) What is the step angle of a permanent magnet stepper motor having 8 stator poles and 4 stator poles ?

a) 60°

b) 45°

c) 30°

d) 15°.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

3 × 5 = 15

2. Describe main features and limitations of

   i) plugging

   ii) rheostatic braking.

3. Deduce the expression for loss of energy during counter current braking operation of an induction motor operating under no load.

4. Discuss the methods for dynamic braking operation of an induction motor.

5. State the factors which govern the size and rating of the motors.

6. Explain characteristics and applications of universal motors.

GROUP – C

(Long Answer Type Questions)

Answer any *three* questions. 3 × 15 = 45

7. a) What are the advantages of electrical drives ? 4

   b) Explain with suitable example, multiquadrant operation of DC drive. 4

   c) A 200V, 950 rpm, 97·5 A dc separately excited motor has an armature resistance of 0·05 Ω, is braked by plugging from an initial sped of 1000 rpm. Calculate

      i) braking resistance

      ii) breaking torque and

      iii) torque when speed is fallen to zero. 7

8. a) Explain a suitable system of speed control below rated speed (base speed). 4

   b) Explain the principle and operation of step-up chopper used in dc drive. 4

   c) A 230 V, 1200 rpm, 15 A separately excited dc motor has an armature resistance of 1·2 Ω, motor is operated under dynamic breaking resistance has a value of 20 Ω.

      i) Calculate duty ratio of chopper for motor speed of 1000 rpm and braking torque equal to 1·5 times rated motor torque.

      ii) What will be the motor speed for duty ratio of 0·5 and motor torque equal to its rated torque ? 7
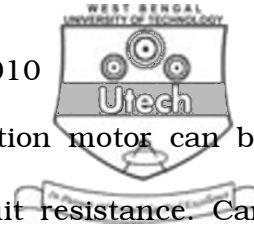
9. a) Explain how the speed of an induction motor can be varied by controlling the rotor circuit resistance. Can this process be applied for squirrel cage induction motor ? Justify your answer. 7

b) A three-phase, 400V, 50 Hz, six pole, 960 rpm, star-connected wound rotor induction motor has the following constant referred to the stator :

$$r_1 = 0 \cdot 5 \ \Omega \qquad r_2 = 0 \cdot 7 \ \Omega \qquad x_1 = x_2 = 1 \cdot 5 \ \Omega$$

The motor drives a fan load at 960 rpm. The stator to rotor turns ratio is 2. Calculate the resistance required to be connected in each phase of the rotor circuit to reduce the speed to 600 rpm. 8

10. a) Explain the torque-speed characteristics of an induction motor operating under variable frequency supply. 3

b) How speed of an induction motor can be controlled by changing the number of poles of the machine ? 7

c) Deduce the speed – time characteristics for starting of a dc shunt motor under transient condition. 5

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

    a)   Static Scherbius drive

    b)   PWM inverter fed induction motor drive

    c)   Dual converter

    d)   Brushless dc motor

    e)   Stepper motor and 'microstepping'.

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