ENGINEERING & MANAGEMENT EXAMINATIONS, DECEMBER – 2008

ELECTRIC DRIVES

SEMESTER – 7

Time : 3 Hours] [Full Marks : 70

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) To get speed higher than the base speed of a D.C. shunt motor

a) armature voltage control is used

b) field control is used

c) armature resistance control is used

d) frequency control is used. ☐

ii) A typical passive load is

a) Hoist b) Friction

c) Blower d) Pump. ☐

iii) Intermittent duty rating of an electric motor

a) is equal to name plate rating

b) is less than name plate rating

c) is greater than name plate rating

d) has no bearing to its name plate rating. ☐

iv) In constant torque drive

a) power is proportional to the speed

b) power is proportional to the square of speed

c) power is inversely proportional to the speed

d) power is independent of speed. ☐

v) A drive has following parameters :

$J = 10$ kg-m ^{2}, $T_M = 100 - 0{\cdot}1$ N, N-m.

T_L (passive) = 0·05 N, N-m. where N is speed in rpm.

Then the steady state speed is

a) 700 rpm b) 800 rpm

c) 667 rpm d) 680 rpm.

vi) Regenerative braking is a

a) first quadrant (T-w) operation

b) second quadrant operation

c) multiquadrant operation

d) third quadrant operation.

vii) The slip of an induction motor during *d.c.* rheostatic braking is

a) s b) $2 - s$

c) $1 - s$ d) none of these.

viii) A three phase induction motor having a combination of diode rectifier & line commutated inverter in rotor circuit, can give

a) speed below synchronous speed only

b) speed above synchronous speed only

c) both sub-& super-synchonous speed

d) no change in speed.

ix) Which operation is not possible for semi-converter fed D.C. drive system ?

a) IInd quadrant (V-I) b) III quadrant

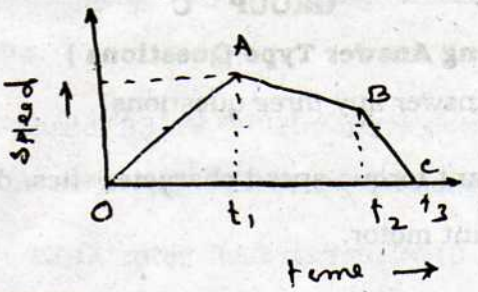
c) IVth quadrant d) All of these.

x) The value of co-efficient of adhesion will be high when rails are

a) greased b) wet

c) sprayed with oil d) none of these.

xi) The speed time curve for a local train is shown in figure below.



In this *AB* represents

a) coasting b) acceleration

c) braking d) regeneration.

xii) The common method of speed control used in 25 kV, 50 Hz, 1-phase traction system is

a) tap changing control b) reducing current method

c) series parallel method d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. What do you mean by group, individual & multimotor drives ?

3. Deduce the condition for steady state stability of a motor load combination. Can this condition be applied for synchronous motor ? 4 + 1

4. A drive has the following parameters :

   T = 150 – 0·1 N, N-m, where N is the speed in rpm.

   Load torque T_L = 100 N-m.

   Initially the drive is operating at steady state. The characteristics of the load torque are changed to T_L = – 100 N-m. Calculate the initial & final equilibrium speeds.

5. Deduce the expression of loss of energy during stating of a separately excited D.C. motor.

6. Explain the principle of operation of chopper fed drives.

GROUP – C

(Long Answer Type Questions)

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

7. a) With the help of relevant torque-speed characteristics, discuss different methods of braking of D.C. shunt motor.

   b) A 500 V D.C. shunt motor taking an armature current of 240 A, while running at 800 rpm, is braked by disconnecting the armature from the supply & closing it on a resistance of 2·02 Ω, the field excitation remaining constant. The armature has a resistance of 0·5 Ω. Calculate the initial braking current. 12 + 3

8. a) Deduce the relation necessary to obtain the heating & cooling curve of an electric motor.

   b) A motor has a thermal heating time constant of 50 minutes. When the motor runs continuously on full load, its final temperature rise is 80°C.

      i) What would be the temperature rise after 1 hour, if the motor runs continuously on full load ?

      ii) If the temperature rise on 1 hour rating is 80°C, find the maximum steady state temperature at this rating.

      iii) How long will the motor take for its temperature to rise from 50°C to 80°C, if it is working at its 1 hour rating ? 6 + 9

9. a) State the advantages & disadvantages of Word-Leonard drive system.

   b) Discuss with relevant diagrams, the principle of speed control of induction motor, above & below synchronous speed by feeding energy to the source.

   c) The rotor of an 8-pole, 50 Hz, 3-phase induction motor has a resistance of 0·2 Ω per phase & runs at 730 rpm. If the load torque remains unchanged, calculate the additional rotor resistance that will reduce its speed by 10%. Neglect stator impedance. 3 + 7 + 5

10 a) Explain the principle of Variable voltage variables frequency (VVVF) control of induction motor.

b) A 400 kW, 3-phase, 33 kV, 50 Hz, unity power factor, 4-pole, star connected synchronous motor has the following parameters :

$\Omega_a = 0$, $X_s = 13\ \Omega$, rated field current = 10 A. The machine is controlled by variable frequency control at a constant $\frac{v}{f}$ ratio.

Calculate the torque & field current for rated armature current, 900 rpm & 0·8 leading power factor. 8 + 7

11. Write short notes on any *three* of the following : 3 × 5 = 15

a) Series parallel control of D.C. motor

b) Self-controlled synchronous motor drive

c) 3-phase fully controlled rectifier fed D.C. motor

d) EMU.

END