8. a) A fully-controlled rectifier-fed separately excited d.c motor is required to operate in motoring and breaking operations in the forward direction. Only one fully-controlled rectifier is available. What switching arrangement is required. Explain.

   b) A 220V, 24A, 100 rpm, separately excited d.c motor has an armature resistance of 2Ω. Motor is controlled by a chopper with frequency of 500 Hz and source voltage of 230 V. Calculate the duty ratio for 1.2 times rated torque and 500 rpm.

Unit - V

9. a) What are the main factors which decide the choice of electrical drives for a given application?

   b) What do you mean by Load equalization? Write its importance.

10. a) State and explain the disadvantage of using a motor of wrong rating.

    b) The motor rating is to be selected from a class of motors with heating and cooling time constants of 60 and 90 minutes respectively. Calculate the motor rating for the following duty cycle:

       i) Short-time periodic duty cycle consisting of 100 kW load for 10 minutes followed by no load period long enough for the motor to cool down.

       ii) Intermittent periodic duty cycle consisting of 100 kW load period of 10 minutes and no load period of 10 minutes.

******

Roll No .....

MEPE-105

M.E./M.Tech., I Semester

Examination, December 2014

Electric Drive

Time : Three Hours

Maximum Marks : 70

***Note*:** Attempt any one question from each unit. All questions carry equal marks. Parts of the questions should be attempted at one place.

Unit - I

1. a) Write the difference between group drives and individual drives?

   b) State essential parts of electrical drives. What are the functions of a power modulator?

   c) A squirrel-cage induction motor is to be fed from a non-sinusoidal supply. It is preferred to use a motor with a large leakage reactance. Why?

2. a) State and explain the important features of various breaking methods of d.c. motors.

   b) Explain four quadrant operation of motor driving system and multi quadrant operation of driving system?

Unit - II

3. a) What are the factor that affect the speed of a d.c motor. Explain? Also explain how the speed can be controlled above and bellow the normal speed?

b) For variable frequency control of induction motor. Explain the following points.
   i) For speeds below base speed (V/f) ratio is maintained constant, why?
   ii) For speeds above base speed, the terminal voltage is maintained constant, why?

4. a) When varying speed by field flux control, flux must be varied in small steps only. Why?
   b) A 220V, 200 A750 rpm separately excited motor has an armature resistance of 0.05 Ω. It is driving a load whose torque has an expression $T_l = 500\text{-}0.25\,N$ N-m. Where N is speed in rpm. Speeds below rated are obtained by armature voltage control (with full field) and speeds above rated are obtained by field control (with rated armature voltage).
      i) Calculate motor terminal voltage and armature current when the speed is 400 rpm.
      ii) Calculate values of flux as a percent of rated flux when the speed is 1500 rpm.

Unit - III

5. a) Develop an expression in terms of motor parameters for the time required to plug an induction motor to 0.95 of synchronous speed in the reverse direction. Develop an expression for the rotor resistance which will minimize this reversible time.
   b) Show that for an induction motor having negligible stator resistance and load torque, the acceleration time t_s from stand still to a slip s is given by the following expression

$$t_s = \frac{J\omega_{ms}}{T_{max}}\left[\frac{1-s^2}{4s_m} + \frac{s_m}{2}\log_e\frac{1}{s}\right]$$

6. a) Derive expression for the transient value of speed and current including the effect of armature inductance with the motor field flux at the rated value.
   b) A Y-connected, 3-Φ, 50 Hz, 6 pole, slip ring induction motor has following data :

   Rating : 400 V, 50 kw, 960 rpm

   $R_s = 0.08\Omega, R_r' = 0.1\Omega, X_s = X_r' = 0.3\Omega$

   moment of inertia = 10 kgm^2.

   Motor is to be stopped from its no load speed under reverse voltage breaking operation.
      i) Find the value of external resistance to be inserted in rotor circuit so that the breaking process will take minimum time. Also calculate breaking time.
      ii) With the rotor resistance as calculate in (i) find energy loss in the motor.

Unit - IV

7. a) What is done to shift the operation of an inverter-fed induction motor from motoring to breaking?
   b) Explain the following for variable frequency control of induction motor.
      i) The motor has higher η and better low speed performance when fed from a pulse-width modulated inverter instead of 6-step inverter.
      ii) The motor has excellent low speed performance when fed from a cycloconverter.
      iii) Cycloconverter control is suitable only for low voltage drives.