2.5   [4]

b) A 6-pole, 50Hz induction motor has a flywheel of 1200 kg-m² moment of inertia. Load torque is 100 kg-m for 10 seconds. No load period is long enough for the flywheel to regain its full speed. Motor has a slip of 6% at a torque of 50 Kg-m. Calculate

    i)   Maximum torque exerted by motor

    ii)   Speed at the end of the deceleration period.   7

8. Write short notes on: 14

   a)   General consideration in selection of drive for industrial applications.

   b)   Three-phase synchronous motor for adjustable speed drives.

   c)   Speed-torque characteristics of ac drives under braking conditions.

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Total No. of Questions : 8]   *[Total No. of Printed Pages : 4*

Roll No ....

MEPE-105
M.E./M.Tech., I Semester
Examination, June 2016
Electric Drive

Time : Three Hours

Maximum Marks : 70

Note: Attempt any five questions. All questions carry equal marks.

1. a) Compare the speed-torque characteristics of cumulatively - Compounded D.C. motor and a three-phase slip-ring induction motor.   4

   b) What are the drawbacks associated with the operation of induction motor with unbalanced rotor impedances?   3

   c) A 400V, 750rpm, 70A dc shunt motor has an armature resistance of 0.3Ω. When running under rated conditions, the motor is to be braked by plugging with armature current limited to 90A. What external resistance should be connected in series with the armature? Calculate the initial braking torque and its value when the speed has fallen to 300 rpm. Neglect saturation.   7

2. a) Field control is employed for getting speeds higher than rated and armature voltage control is employed for getting less than rated. Why?   3

   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

c) A 4-pole, 50Hz, three-phase slip-ring induction motor when fully loaded runs with a slip of 4%. Determine the value of the resistance to be inserted in series per phase in the rotor circuit to reduce the speed by 12% and the new slip.   7

3. a) A fully controlled rectifier is feeding a separately excited motor driving a friction load. Motor is operating in steady-state with a rectifier firing angle of 30°. Firing angle is now changed from 30° to 60°. Explain how the motor current and speed will change with time.   7

b) A three-phase, 440V, 50Hz, 6-pole, 960 rpm, Y-connected wound rotor induction motor has the following constants referred to the stator.

$R_s = 0.5\Omega$, $R'_r = 0.7\Omega$, $X = 1.5\Omega$, $X'_r = 1.6\Omega$.

The speed of the motor is reduced to 800 rpm at half load torque by injecting a voltage in phase with the source voltage into the rotor. Calculate the magnitude and the frequency of the injected voltage stator to rotor turn ratio is 2.2.   7

4. Two identical separately excited motor drive loads which are similar except for the fact that one has motor inertia than the other. It is desired that these two motors have similar transient response, so that they will accelerate together, with their speeds at any instant the same. Motors are not coupled mechanically and their armatures are supplied from the same

bus whose voltage is varied to change the speeds of tw machines. It is possible to vary any of the motor parameter so as to make the speed transient responses of the two motor identical.   1

5. A three-phase, delta connected, 6-pole, 50Hz, 400V, 925 rpm squirrel-cage induction motor having the following data:

$R_s = 0.2\Omega$, $R'_r = 0.3\Omega$, $X_s = 0.5\Omega$, $X'_r = 1\Omega$

Drives a centrifugal pump having a torque characteristic o the form $M_L = a + b\, W_m^2$, where a accounts for 25% of th load torque. Combined inertia of the motor and load referre to the motor shaft $= 10$ kg-m^2.

i) Draw speed-torque characteristics of the motor and loa and evaluate starting time gradually.

ii) Calculate energy loss in the motor during starting operation.

iii) What is thermally equivalent value of motor curren during starting as a ratio of the rated current?   1

6. a) What is meant by rating of motors? Discuss how the type and size of motors for intermittent loads is determined   7

b) The 15 minute rating of a motor is 400 Watts. The heating time constant is 60 minutes. Determine the continuous rating of the motor if the maximum efficiency occurs a 80% of the full load.   7

7. a) What is the function of a flywheel in rolling mill drive? Deduce an expression for the motor torque driving a rolling mill when equipped with a flywheel.   7