Rotational & Translation Topic

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(Following Paper ID and Roll No. to be filled in your answer book)

Paper ID: Roll No

M.Tech

FIRST SEMESTER EXAMINATION, 2009-2010

FUNDAMENTALS OF ELECTRIC DRIVES

Time: 3hrs. *Max. Marks100*

Note: Attempt all questions. All questions carry equal marks.

Q1. Attempt any **Two** of the following:

(a) State and explain the functions of the various converters, also discuss the present status of the ac and dc drives.

(b) Derive the expressions for the equivalent values of the drive parameters, for the given conditions (i) Loads with Rotational Motion (ii) Loads with the Translational motion

(c) Define steady state stability and derive the condition between the load torque and the motor torque at the equilibrium point.

Q2. Attempt any **Two** of the following:

(a) Obtain an expression for short time duty rating of the motor for given values of the ratio of constant losses to copper losses at full load, heating time constant and load duration.
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 cycles: (i) Short-time periodic duty cycle consisting of 100Kw load for 10 minutes followed by no load period long enough for motor to cool down. (ii) Intermittent periodic duty cycle consisting of 100Kw load period of 10 minutes and no lead period of 10 minutes. Assume loss to be proportional to $(power)^2$.

Classification of electric Drive

(b) A 3-phase,100 Kw,6 pole,960rpm wound rotor induction motor drives a load whose torque varies such that a torque of 3000 Newton-meter of 10 seconds duration is followed by a torque of 500 Newton-meter of duration long enough for the motor to attain steady state speed. Calculate the moment of inertia of the flywheel, if motor torque should not exceed twice the rated value. Moment of the inertia of the motor is 10 kg-m^2.Motor has a linear speed torque curve in the region of the interest.

(c) Discuss the criteria of selection of a drive for a particular operation. Discuss the suitability of a specific drive for the following purposes. (i) Textile mills (ii) Sugar mills (iii) Paper mills

3. Attempt any Two of the following:

(a) Discuss the constructional features and working of linear induction motor in detail.

(b) Discuss the constructional features and working of two phase servo motor and also draw the equivalent circuit of the motor corresponding to positive and negative sequence supply voltage.

(c) Describe the principle of operation of a switched reluctance motor. What are the advantages of switched reluctance motor over the other ac motors.

4. Attempt any One of the following:

(a) Deduce an expression for : (i) The tractive effort for propulsion of a train on a level track.(ii) The tractive effort for propulsion of a train up and down gradient. The speed time curve for an electric train operating on a uniform up gradient of 1 in 100 comprises: (i) Uniform acceleration from rest for 40 seconds, raising the speed to 51.52 Km per hour. (ii) Steady speed at 51.52 Km per hour with power on for 20 seconds.(iii)Coasting with power cut off for 50 seconds. (iv)Braking at 3.2 Km per hour per second to stand still. Determine the watt hour consumption per tonne-Km. Tractive resistance is 45 Newton per tonne. Allow 10% for rotational inertia 10%.

(b) A 440 V, 50Hz, 6 pole Y connected wound rotor induction motor has the following parameters referred to stator :

$R_S = 0.5\,\Omega$. $R_r^I = 0.4\,\Omega$, $X_s = X_r^I = 1.0\,\Omega$, $X_m = 45\,\Omega$.

An external resistance is inserted into the rotor circuit so that maximum torque is produced at $s_m = 2.0$. The rotor which was initially operating on no load is being braked by 1-phase ac dynamic braking with three lead connection. Calculate the braking current and torque as a ratio of their full load values for 960 rpm.

Q5. Attempt any **Three** of the following:

(a) When operating in regenerative braking, the induction motor slip should not be allowed to exceed the breakdown slip, why?

(b) Effect of improper selection of motor rating for a job

(c) Why self-excited braking of an induction motor by using capacitor braking is not a recommended braking.

(d) Thermal model of the motor for heating and cooling