NATIONAL INSTITUTE OF TECHNOLOGY, DELHI

Name of Examination: B. Tech (Mid-Semester)

Branch: Electrical & Electronics Engineering   **Semester: VII**

Title of Course: Solid State Drives   **Course Code: EE401**

Time: 2 Hrs   **Maximum Marks: 30**

Note: Attempt all Questions.

Q1.(A) Draw the block diagram of the electrical drive system and explain the working of each block in details. (2 **marks**)

   (B) Explain in details the factors that affect the selection of Electrical Drives? (**2 marks**)

Q2.   Derive the expression for equivalent torque and moment of inertia for loads with translational and rotational motion. (5 **marks**)

Q4.   A drive has following parameters: $J=10$ Kg-m^2, $T=15+0.05N$ N-m and passive load torque $T_l=5+0.06N$ Nm, where N is speed in rpm. Initially the drive is operating in steady-state. (A) If the drive is braked by electrical braking. Torque of the motor during braking is $T= -10-0.04N$ Nm. Calculate the time taken by the drive to stop. (B) If the drive is to be reversed, motor characteristics is altered such that $T= -15-0.01N$ N-m for positive as well as negative values of N. Calculate the time for reversal. (**6 marks**)

Q4.   Explain with the help of suitable Speed-Torque characteristics, the steady-state stability of the motor drive system around an equilibrium point. Also derive the inequality to be satisfied to attain stable operation. (**5 marks**)

Q5.(A) Derive the relationship between the (i) Torque-Armature current, (ii) Speed-Armature Current and (iii) Speed-Torque for (a) DC Shunt Motor, (b) DC Series Motor, and (c) DC Compound Motor. Also draw the characteristics for each case. (**3 marks**)

   (B) Explain regenerative braking in case of DC motors with suitable characteristics. Also explain dynamic braking and plugging. (**2 marks**)

Q6.(A) The motor rating is to be selected from a class of motors with heating and cooling time constants of 60 and 90 mins respectively. Calculate the motor rating for the following duty cycles:
(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 for 10 min and no load period of 10 min. Assume the losses to be proportional to square of power. (3 **marks**)

   (B) The 10 min rating of a motor used in a domestic mixer is 200 kW. The heating time constant is 40 min and the maximum efficiency occurs at full load (continuous). Determine the continuous rating. (2 **marks**)

****