USN

Eighth Semester B.E. Degree Examination, Feb./Mar. 2022
Industrial Drives and Applications

Time: 3 hrs.

Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1   a. With basic block diagram, explain the essential elements of electric Drives. **(08 Marks)**
    b. Explain the speed torque conventions and multi-quadrant operations. **(08 Marks)**

OR

2   a. Explain the load equalization for fluctuating loads in Electric drives. **(08 Marks)**
    b. A drive has the following parameters: $J = 10kg\text{-}m^2$, $T = 100 - 0.1N(N\text{-}m)$, Passive load Torque $T_\ell = 0.05N(N\text{-}m)$ where N is the speed in rpm. Initially the drive is operating in steady state, now it is to be reversed. For this motor characteristics is changed to $T = -100 - 0.1N(n\text{-}m)$. Calculate the time of interval. **(08 Marks)**

Module-2

3   a. Mention the different types of classes of motor duty and explain each type in brief. **(08 Marks)**
    b. Obtain the thermal model of motor for heating and cooling. Also draw the heating and cooling curves. **(08 Marks)**

OR

4   a. Explain with a suitable circuit diagram and waveforms the single semi-controlled converter fed DC separated excited motor drive. **(08 Marks)**
    b. The speed of a 20HP, 210V, 1000rpm series DC motor is controlled by a 1ϕ full converter. The combined field and armature circuit resistance $= 0.25\Omega$, $K_{af} = 0.03N\text{-}m/A^2$ and $K_{res} = 0.075$ V-S/rad. The supply voltage is 230V. Assuming continuous and ripple free motor current, determine the following for firing angle $\alpha = 30°$ and speed $N = 1000rpm$.
    i)   Motor current
    ii) Motor Torque
    iii) Supply power factor. **(08 Marks)**

Module-3

5   a. Derive the expression for maximum torque of a three phase induction motor. **(08 Marks)**
    b. Explain in detail stator voltage control, also mention its advantages and disadvantages. **(08 Marks)**

OR

6   a. Explain with block diagram static Kramer Drive. **(08 Marks)**
    b. A 400V, 3ϕ, 50Hz, 6 pole cage induction motor has the following equivalent circuit parameters $R_1 = 0.2\Omega$, $X_1 = 0.5\Omega$, $R_2 = 0.2\Omega$, $X_2 = 0.5\Omega$ and $X_m = 15\Omega$. The motor operates on full load and slip $= 0.05$. When the two stator terminals are suddenly interchanged, calculate the primary current and the braking torque immediately after application of plugging. **(08 Marks)**

Module-4

7   a. With a neat sketch of waveform and circuit diagram. Explain cyclo converters.   (08 Marks)
    b. Write short notes on variable frequency control from a current source inverter.   (08 Marks)

OR

8   a. A 3ϕ 440V, 6 pole, 50Hz delta connected slip ring induction motor has rotor resistance of 0.3 Ω and leakage reactance of 1Ω per phase referred to stator. When driving a fan load, it runs at full load at 3% slip. What resistance must be inserted in rotor circuit to obtain a speed of 800rpm? Neglect stator impedance and parameter. The stator to rotor turns ratio is 2.2.   (08 Marks)
    b. Write a short note on synchronous operation from fixed frequency supply.   (08 Marks)

Module-5

9   a. Write short notes on :
        i)   Brushless DC motor drive   (04 Marks)
        ii) Sinusoidal PM AC motor drive.   (04 Marks)
    b. With a neat sketch, explain load commutated Thyristor inverter synchronous motor drives.   (08 Marks)

OR

10 a. Mention in detail the applications of drives in steel rolling mills.   (08 Marks)
    b. With a neat sketch, explain variable reluctance and permanent magnet stepper motor drive.   (08 Marks)

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