CRASH COURSE

USN ☐☐☐☐☐☐☐☐☐☐   **10EE74**

Seventh Semester B.E. Degree Examination, May 2017
Industrial Drives and Applications

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions, selecting*
atleast TWO questions from each part.

PART – A

1   a.   What are the advantages of electrical drives?   **(06 Marks)**
    b.   Explain the steady state stability in the drive system.   **(06 Marks)**
    c.   A drive has following parameters: J = 10 kg-mt^2, T = 15 + 0.05N, N-mt and T_L = 5 + 0.06N, N-mt, where N is the speed in rpm. Initially the drive is in steady state. Now the drive is braked by electrical braking. Torque of the motor in braking is given by T = – 10 – 0.04N, N-mt. Calculate time taken by the drive to stop.   **(08 Marks)**

2   a.   Derive an expression to determine power rating of electric motor using the method of equivalent current for variable load.   **(06 Marks)**
    b.   Determine the expression of over loading factor 'K' for short time duty.   **(06 Marks)**
    c.   The temperature rise of a motor when operating for 25 min on full load is 25°C and becomes 40°C when the motor operates for another 25min on the same load. Determine heating time constant τ and the steady state temperature rise.   **(08 Marks)**

3   a.   With speed-torque characteristics, explain the plugging operation of a separately excited DC motor.   **(04 Marks)**
    b.   With a neat circuit diagram and waveforms, explain the operation of a discontinuous conduction mode for a single-phase fully controlled rectifier of separately excited DC motor. Also derive expression for speed.   **(10 Marks)**
    c.   A 220V, 1500rpm, 10A separately excited DC motor is fed from a single-phase fully controlled rectifier with an AC source voltage of 230V, 50Hz. R_a = 2Ω, conduction can be assumed continuous. Calculate firing angles for,
         i)   Half the rated motor torque and 500rpm.
         ii) Rated motor torque and -1000rpm.   **(06 Marks)**

4   a.   Explain the multi quadrant operation of separately excited DC motor fed from fully controlled rectifier for the following schemes.
         i)   Single fully controlled rectifier with reversing switch.
         ii) Dual convertor.   **(10 Marks)**
    b.   Explain the chopper control of separately excited DC motor for regenerative braking.
                                                                          (05 Marks)
    c.   A 220V, 24A, 1000rpm, separately excited DC motor has an armature resistance of 2Ω. Motor is controlled by a chopper with frequency of 500Hz and source voltage of 230V. Calculate the duty ratio for 1.2 times rated torque and 500rpm.   **(05 Marks)**

PART – B

5 a. What is single-phasing? Explain the operation of a 3-phase induction motor with unbalanced voltages. **(08 Marks)**

b. Explain regenerative braking of 3-phase induction motor. **(06 Marks)**

c. A 2200V, 50Hz, 3-phase, 6 pole, y-connected squirrel cage induction motor has following parameters. $R_s = 0.075\Omega$, $R_r^1 = 0.12\Omega$, $x_s = x_r^1 = 0.5\Omega$, the combined inertia of motor and load is 100kg-mt^2. Calculate time taken and energy dissipation in the motor during starting. **(06 Marks)**

6 a. Explain the static rotor resistance control. **(05 Marks)**

b. A y-connected squirrel-cage induction motor has the following ratings and parameters 400V, 50Hz, 4 pole, 1370 rpm, $R_s = 2\Omega$, $R_r^1 = 3\Omega$, $X_s = X_r^1 = 3.5\Omega$, $X_m = 55\Omega$. It is controlled by a current source inverter at a constant flux. Calculate:
   i) Motor torque, speed and stator current when operating at 30Hz and rated slip speed.
   ii) Inverter frequency and stator current for rated motor torque and motor speed of 1200 rpm. **(10 Marks)**

c. Explain how a voltage source inverter-fed induction motor is operated in dynamic braking. **(05 Marks)**

7 a. Explain pull in process in synchronous motor operation from fixed frequency supply. **(06 Marks)**

b. Explain dynamic braking operation of the synchronous motor. **(06 Marks)**

c. Explain the modes of variable frequency control of synchronous motor. **(08 Marks)**

8 a. Explain the operation of self controlled synchronous motor drive employing load commutated thyristor inverter. **(10 Marks)**

b. With a neat sketch, explain paper mill drive system. **(10 Marks)**

* * * * *