Seventh Semester B.E. Degree Examination, June/July 2019
Industrial Drives and Applications

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define electric drives? Briefly explain essential parts of an electric drive system with a neat block diagram. **(06 Marks)**

   b. With the help of the quadratal diagram, explain the four–quadrant operation of a motor driving a hoist–load. **(10 Marks)**

   c. Obtain an expression for the equivalent load torque and equivalent moment of inertia for loads with translational motion. **(04 Marks)**

2 a. Obtain the thermal model of motor for heating and cooling. Also briefly explain heating and cooling curves. **(10 Marks)**

   b. Determine the expression of over loading factor 'K' for short time duty. **(05 Marks)**

   c. Half hour rating of a motors 100 KW. Heating time constant is 80 min and the maximum efficiency occurs at 70% full load. Determine the continuous rating of the motor. **(05 Marks)**

3 a. With a net 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)**

   b. A 220V, 960rpm, 12.8A separately excited Dc motor has armature circuit resistance and inductance of 2ohm and 150mH respectively. It is fed from a single–phase half–controlled rectifier with an AC source voltage of 230V, 50Hz. Calculate :
   i) Motor torque for $\alpha = 60°$ and speed = 600 rpm
   ii) Motor speed for $\alpha = 60°$ and T = 20 N–m. **(10 Marks)**

4 a. With a neat circuit diagrams and waveforms explain three phase fully controlled rectifier control of DC separately excited motor. **(10 Marks)**

   b. A 220V, 70A DC series motor has combined resistance of armature and field of 0.12Ω running on no load with the field winding connected to a separate source if given following magnetization characteristic at 600 rpm.

Field current, A	10	20	30	40	50	60	70	80
Terminal voltage, V	64	118	150	170	184	194	202	210

   Motor is controlled by a chopper with a source voltage = 220V. Calculate :
   i) Motor speed for a duty ratio of 0.6 and motor current of 60A
   ii) Torque for a speed of 400 rpm and duty ratio of 0.65. **(10 Marks)**

PART – B

5 a. What is single phasing? Explain the operation of a 3-phase induction motor with unbalanced voltages. **(07 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 parameter : $R_s = 0.075\Omega$, $R_r' = 0.12\Omega$, $X_s = X_r' = 0.5\Omega$
The combined inertia of motor and load is 100 kg-m^2
i) Calculate time taken and energy dissipated in the motor during starting
ii) Calculate time taken and energy dissipated in the motor when it is slopped by plugging. **(07 Marks)**

6 a. Explain the working of voltage source inverter (VSI) induction motor drives showing the waveform for stepped wave inverter and PWM inverter along with VSI controlled IM driver. **(10 Marks)**

b. A 3-phase, 400V, 6-pole, 50Hz, delta – connected, slipring induction motor has rotor resistance of 0.2Ω and leakage reactance of 1Ω per phase referred to stator. When driving a fan load it runs at full load at 4% slip. What resistance must be inserted in the rotor circuit to obtain a speed of 850 rpm. Neglect stator impedance and magnetizing branch. Stator to rotor turns ratio is 2.2. **(10 Marks)**

7 a. What is meant by the term "pull 0 in" in case of synchronous motor? Bring out the difference between true synchronous mode and self –controlled mode. **(04 Marks)**

b. With relevant circuit diagram and equation explain the type of braking utilized for synchronous motor. **(06 Marks)**

c. With neat circuit diagram, explain the self controlled synchronous motor drive, employing the load commutated thyristor inverter. **(10 Marks)**

8 a. Explain with diagram :
i) Reversing hot rolling mills
ii) Reversing cold rolling mills. **(10 Marks)**

b. Explain the process involved in textile mills. **(10 Marks)**

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