Total No. of Questions : 11] **SEAT No. :**

P727 **[Total No. of Pages : 3**

[4458] - 533

B.E. (Electrical) (Semester - II)

INDUSTRIAL DRIVES AND CONTROL

(2008 Course)

Time : 3 Hours] ***[Max. Marks :100***

Instructions to the candidates:

1) ***Answer 3 questions from Section - I and 3 questions from Section - II.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***

SECTION - I

Q1) a) Explain speed torque conventions and multiquadrant operation of drives. **[8]**

b) A drive has following parameters: J = 1 kg - m^2, T = 15 - 0.01 N, N-m and passive load torque, Te = 0.005 N, N-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 characteristic is altered such that T = –15-0.01N. N-m for positive as well as negative values of N. Calculate the reversal time. **[8]**

OR

Q2) a) What is an Electric drive? Discuss, essential parts of Electric Drive with the help block diagram. **[8]**

b) Write a brief note on, speed-torque characteristics of drive operated in all four quadrants. Use the example of hoist load. **[8]**

Q3) a) Explain Regenerative braking principle for dc motors. Write all the necessary equations for motoring and braking actions. Discuss merits and disadvantages associated with this braking method. **[10]**

b) A 220V dc shunt motor has an armature resistance of 0.062 Ω and with full field, has an emf of 215 V at a speed of 960 rpm. The motor is driving an overhauling load with a torque of 172 N-m. Calculate the minimum speed at which motor can hold the load by means of regenerative braking. **[8]**

P.T.O.

OR

Q4) a) Explain d.c. dynamic braking of 3 phase induction motor along with speed torque curves. **[8]**

b) A 3-phase, 440V, 50Hz, 10 pole star connected induction motor has the following parameters: Rl = 0.15 Ω, R2 = 0.45 Ω, Xl = 0.6 Ω, X2 = 1.8 Ω, Sf = 0.05 and the ratio of effective stator to rotor turns 13. The motor is to be braked at rated speed and an external resistance of 1.75 Ω / phase (referred to stator) has been inserted into the rotor circuit. Determine the initial braking torque for the following two cases of braking. **[10]**

i) dc rheostatic braking.

ii) reverse current braking.

Q5) a) Explain with necessary diagram, full converter fed dc separately excited motor. Also write the output voltage equations with a sketch of voltage and current waveforms available at the armature terminals of dc motor. **[8]**

b) A 230 V, 650 rpm 100 A separately excited dc motor has armature circuit resistance and inductance of 0.08Ω and 8 mH respectively. Motor is controlled by a single-phase half-controlled rectifier with source voltage of 230 V, 50 Hz. Identify the modes and calculate speeds for **[8]**

i) $\alpha = 60°$ and torque = 1000 N-m

ii) $\alpha = 120°$ and torque = 1000 N-m.

OR

Q6) a) Draw the circuit diagram of 3 phase half controlled converter. Explain switching sequence of the devices. Draw switching pulses output voltage waveform. **[8]**

b) A 200V, 875rpm, 150A separately excited dc motor has an armature resistance of 0.06 Ω. It is fed from a single phase fully controlled rectifier with an ac source voltage of 220V, 50Hz. Assuming continuous conduction, calculate **[8]**

i) firing angle for rated motor torque and 750 rpm.

ii) firing angle for rated motor torque and (–500) rpm.

iii) motor speed for $\alpha = 160°$ and rated torque.

SECTION - II

Q7) a) Why is it that the variable frequency requirement is always accompanied by a variable voltage requirement in a.c. machines. **[8]**

b) A 3 phase, 400 V, 50 Hz, six pole, 925 rpm star-connected, induction motor has the following parameters.

$r1 = 0.2\Omega$ $r'2 = 0.3\ \Omega$, $x1 = 0.5\Omega$ $x'2 = 1.0\Omega$

The motor is fed from a voltage source inverter with a constant voltage to frequency, V/f ratio. Calculate the maximum torque Tm and the corresponding speed Nm for 50 Hz and 20 Hz. **[8]**

OR

Q8) a) Compare CSI and VSI for induction motor drive. **[8]**

b) Justify variable frequency control of induction motor is more efficient than stator voltage control. **[8]**

Q9) a) Explain different classes of motor duty and how it affects the choice of selection of motor rating. **[8]**

b) A motor has a heating time constant of 60 min and cooling time constant of 90 min. When run continuously on full load of 20kW, the final temperature rise is 40°C. **[8]**

i) What load motor can deliver for 10 min if this is followed by a shut down period long enough for it to cool.

ii) If it is on an intermittent load of 10 min followed by 10 min shut down, what is the maximum value of load it can supply during the on load period.

OR

Q10)a) Explain how the variable speed drives allows saving of energy in pump drives. **[8]**

b) The temperature rise of an electric motor is 40°C after hour and 60°C after 2 hours. The motor current is 100A. Determine approximately its final temperature rise when it works on load cycle of 4 minutes working, 8 minutes rest with a current of 125A. Neglect the effects of iron losses. **[8]**

Q11)Write short notes on any three: **[18]**

a) Drives used in Sugar mill.

b) Drives used in Machine tools.

c) Drives used in machine tool application.

d) Commutator less D.C. motor.

e) Drives used in Rolling mills.

☆☆☆