

Total Pages—6

2015

(Set-L)

B.Tech - 7th
Electric Drives and Traction

Full Marks : 70

Time : 3 hours

Answer any **six** questions including **Q. No. 1**
which is compulsory

The figures in the right-hand margin indicate marks

1. Answer the following questions : 2×10

(a) What are the component of frictional and load torque ?

(b) Explain the following :

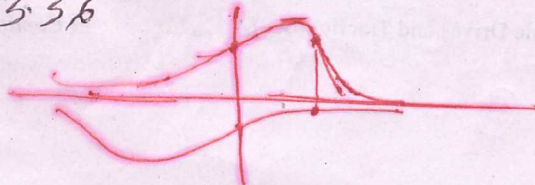
(i) Regenerative braking.

(ii) Plugging.

(c) Why is it essential to operate an induction motor between the synchronous speed and the breakdown speed when it is used to holding an active load by the regenerative braking ?

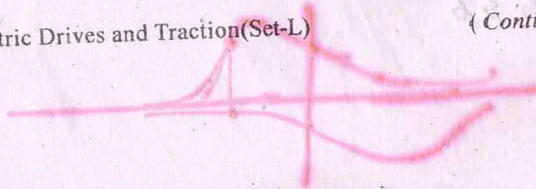
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(Turn Over)



(2)

- (d) Explain what do you understand by the steady state stability? What is the main assumption?
- (e) In the traction drive, why the torque required during free running is lower than the torque required during starting?
- P-256
Duty (f) Why a self controlled synchronous motor is free from hunting oscillations?
- P-246
Duty (g) How the operation of a synchronous motor shifts from motoring to regenerative braking?
- P-44 (h) State and explain the disadvantages of using a motor of wrong rating.
- (i) Describe relative merits and demerits of four quadrant dc drives employing noncirculating and circulating current dual converters.
- P-257
Duty (j) What type of closed-loop speed control schemes are used in multi-motor drives?



(3)

2. (a) Draw the circuit for chopper fed DC motor operating in motoring and braking modes. Write some advantages of chopper fed DC drives. 5

- (b) Derive the closed-loop transfer function of a separately excited DC motor. The transfer function is

$$\frac{w(s)}{V_r(s)} \text{ and } \frac{w(s)}{T_L(s)}$$

where w is the speed in rad/sec. V_r is the reference voltage in volts and T_L load torque. 5

- P-16
Quesy 3. (a) A motor drives two loads. One has rotational motion. It is coupled through a motor through a reduced gear with gear tooth ratio of 0.1 and efficiency of 90%. The load has moment of inertia 10 kg-m² and torque 10 N-m. Other load has translational motion and consists of 1000 kg weight to be lifted at uniform speed of 1.5 m/s. Coupling between this load and motor has an efficiency of

85%. Motor has inertia of 0.2 kg-m^2 and runs at a constant speed of 1420 rpm. Determine equivalent inertia to the motor shaft and power developed by the motor.

5

(b) A separated excited dc motor is running on no load with weak field. Now field current is increased. State and explain various operations (braking, motoring) the motor will have before it settles at a new steady state speed ?

5

4. (a) What happens to the performance of AC motor if the stator voltage control technique is adopted with frequency being constant ?

5

Answer (b) With neat diagram explain the slip power recovery schemes with rotor resistance control.

5

5. (a) Discuss using a block diagram the operation of a voltage source inverter fed synchronous motor in the true synchronous mode.

5

✓ (b) Give the design procedure of current controller. 5

6. (a) Show that the no load speed of the induction motor in the Kramer drive can be varied from near standstill to full speed as the firing angle α is varied from almost 180° degrees to 90° degrees ? 5

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Scherbuis system
(b) A 100 HP, 460 volts 60 Hz star connected squirrel cage induction motor has the equivalent circuit parameters $r_1 = 0.06 \Omega$, $x_1 + x_2 = 0.6 \Omega$, $r_2 = 0.35 \Omega$, $X_m = 8 \Omega$. The motor drives a fan which requires 100 HP at a speed of 1000 rpm. Determine the firing angles required for a speed range of 200 to 1000 rpm. 5

7. (a) Explain the multiquadrant operation of an electric motor driving a hoist load. 5

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acby (b) With neat diagram and explain the ac traction drive employing polyphase motors control. 5

8. (a) Explain using a diagram the working of a static Scherbuis system. Show that it can

(Kramer's)

(6)

operate in the synchronous, subsynchronous and super synchronous ranges. Bring out its advantages. 5

(b) Write short notes on the following : 5

(i) Power factor control of synchronous motor drive

(ii) True synchronous mode of operation.