[06 – 4121]

IV/IV B.E. DEGREE EXAMINATION.

First Semester

Electrical and Electronics Engineering

ELECTRICAL DRIVES AND TRACTION

(With Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Answer Questions No.1 and any FOUR from the remaining.

All questions carry equal marks.

1. (a) Name the different types of drives.

(b) Define the term transient state stability.

(c) Define the term duty cycle.

(d) Explain the term load equalization

(e) Name the factors, which affect the schedule speed of a train.

(f) What is the advantage of using a flywheel with industrial drives?

(g) What are the disadvantages of electric drives?

2. (a) Briefly explain the classification of electric drives.

(b) Derive the equations of steady state and transient stability of drives.

(a) Discuss in detail the various starting methods of 3 phase synchronous motor.

(b) A 220 volts D.C. series motor driving a constant load torque runs at 200 radians / second and draws a current of 20 Amps from the supply. The total resistance of the armature and field is 10 hm. The moment of inertia of the motor together with the load is 5 kg – m^2. Calculate the total energy dissipated in the armature circuit, if the motor starts from rest and attains the steady state speed of 200 radians / second within a time of 2.5 seconds.

4. (a) What are the different electrical braking methods? Explain them with reference to a dc series motor.

(b) A 40 H.P, 400 volts, 3 phase, 4 pole induction motor has a full load slip of 5 percent. If the ratio of stand still reactance to resistance per phase is 4, estimate the plugging torque at full speed.

5. Write short notes on :

(a) Accelerating time

(b) Load methods of starting.

6. (a) Briefly explain the term 'effect of load inertia'.

(b) Explain the loading conditions and classes of duty.

7. (a) From the speed-time curve, obtain a relation between acceleration, retardation, maximum speed and distance traveled.

(b) A train runs at a average speed of 50 kmph between stations situated 2.5 km apart. Train accelerates at 2 kmphps and retards at 3 kmphps. Find its maximum speed assuming simplified (Trapezoidal) speed time curve. Calculate also, the distance travelled by it before the brakes before the brakes are applied.

8. Write short notes on :

(a) Methods to reduce energy losses starting

(b) Track equipment and collection gear.

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EEE

IV/IV B.E. DEGREE EXAMINATION.

First Semester

Electrical and Electronics Engineering

Elective – ELECTRICAL DRIVES AND TRACTION

(Common with Dual Degree Programme in EEE)

(Effective from the Admitted Batch of 2006-2007)

Time : Three hours Maximum : 70 marks

First question is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) (i) Explain different types of loads giving one example for each type.

(ii) Name the different types of drives.

(b) (i) Draw any two modified characteristics of D.C. shunt motor.

(ii) Name the different types of starters used for 3-phase slipring induction motor.

(c) Compare dynamic braking with regenerative braking.

(d) Define :

(i) Specific Energy Consumption (SEC) and

(ii) Schedule speed of an electric train.

(e) Define :

(i) Heating time constant

(ii) Continuous rating

(iii) Short-time rating

(iv) Short-time intermittent rating.

(f) Why is a starter used for a d.c. shunt motor when it is self starting? Give the merits and demerits of the different starters used for it.

(g) What are the different systems of track electrification? Which one is being commonly used in India?

(b) A motor fitted with a flywheel supplies a load torque of 150 kg-m for 15 seconds. During the no load period, the flywheel regains its original speed. The motor torque is required to be limited to 65 Kg-m. Calculate the moment of inertia of the flywheel. The no load speed of the motor is 500 rpm and full load slip is 10%.

(a) Defined and explain :

(i) Adhesive weight

(ii) Tractive effort

(iii) Schedule speed

(iv) Coefficient of adhesion.

(b) A train is required to run between two stations situated 2.5 kms apart with an average speed of 50 kmph. Acceleration and retardation are respectively 2 kmphps and 3 kmphps. Find its maximum speed assuming simplified (Trapezoidal) speed-time curve. Calculate also the distance travelled by it before the brakes are applied.

2. (a) Describe the methods of modifying the torque-speed characteristics of D.C. shunt motor.

(b) Explain steady state and transient stability of a drive and explain what factors affect them.

(c) What do you understand by four quadrant operation? Explain briefly.

3. (a) What are the different types of speed control of 3-phase induction motor? Discuss one method with circuit diagram in detail.

(b) A d.c. series motor runs at 500 rpm while taking a current of 60 Amps at 460 volts. The resistance of armature circuit is 0.2 ohm and of field winding is 0.1 ohm. Calculate the speed when 0.15 ohm diverter is connected in parallel to field winding. Assume that the torque is unchanged and flux is proportional to the field current.

4. (a) Discuss the various methods of starting of 3-phase synchronous motor.

(b) A 50 KW, 400 Volts, 50 HZ, 3-phase slipring induction motor has a rotor impedance of (0.05 + j 0.4) ohms per phase at 50 HZ. The standstill rotor e.m.f. is 100 volts and the rotor current is kept constant at 100 Amps per phase. Calculate the speed of the motor, when

(i) 20 volts per phase is injected in phase opposition to the rotor e.m.f and

(ii) 20 volts per phase is injected in phase with the rotor e.m.f.

5. (a) Derive the expression for time to attain change in speed from ω_1 to ω_2 from the equation of motion.

(b) A six pole, 50 HZ squirrel cage induction motor has rotor resistance and standstill rotor reactance referred to stator of 0.2 ohm and 1 ohm per phase respectively. With rated voltage and rated frequency, it runs at full load with 4% slip. Neglect rotor resistance and rotational losses. Determine the operating speed of the motor, when the stator voltage impressed is reduced to $\frac{1}{\sqrt{2}}$ times the rated voltage, frequency remaining the same if the load torque remains constant at the rated motor torque.

6. (a) Discuss in detail counter current and dynamic braking operations of D.C. shunt motors.

(b) An induction motor rated 10 H.P., 4 poles, 1450 rpm, 50 HZ, 3-phase, delta connected, 400 volts has the following parameters per phase.

X_m = 150 ohms; $X_1 = X_2^1$ = 15 ohms; R_1 = 4 ohms; R_2^1 = 5 ohms. While running at its rated speed, the motor is switched over for dynamic braking with d.c. connected to two of its stator terminals, the other being left open. Assume the D.C. supply is equivalent to 5 amps. Determine the maximum torque and the speed at which it occurs.

7. (a) Explain how ratings of the motors are selected from the view point of heating depends on load conditions and duty to which it is subjected.

7. (a) What are the advantages using flywheel in some industrial drives? Derive the expression for the torque developed by the motor when a flywheel is fitted to it under different load conditions.

(b) Determine the 1/2 hour rating of a 20 kW motor having a heating time constant of 1.5 hours. Assume that the motor cools down completely between each load and iron losses which remain constant are 80% of the copper losses at full load.

8. (a) From a rectilinear speed - time curve, obtain a relation between acceleration, retardation, maximum speed and distance travelled.

(b) Two d.c. series motors each 1500 volts and armature resistance 0.25 ohm take 500 Amps during starting. If the effective weight of the train is 150 tonnes and dead weight of 120 tonnes, track resistance of 45 N/tonne, tractive effort/motor 40 kW, speed at the end of starting period 40 kmph, find

(i) duration of starting period and

(ii) the speed of the train at transition.

2014

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First Semester

Electrical and Electronics Engineering

ELECTRICAL DRIVES AND TRACTION

(Common with Dual Degree)

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) What is an electric drive? What are the merits and demerits of individual and group drives?

(b) Explain Four Quadrant of operation.

(c) How do you classify the torque-speed characteristics of electric drive motors? Give one example for each.

(d) What is the impact of braking on energy relations of a motor?

(e) Define Heating Time constant. Should it be of small or high in value? Give the reason.

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(f) Name the factors, which affect the schedule speed of an electric train.

(g) What is load equilisation? How is it achieved?

2. (a) Classify various types of loads and load torques. Explain the effect of each type of the characteristics of the load torques and the selection of proper motor drive for the same.

(b) A motor having suitable control circuit develops a torque given by $T_m = a\omega + b$ and drives a load whose torque may be expressed as $T_L = c\omega + d$, where a, b, c and d are constants. Determine the relations among these constants in order that the motor can start together with the load and run to equilibrium speed and also, estimate this speed.

a) Describe briefly the methods of modifying the speed-torque characteristics of d.c. series motors.

A 240 volts unsaturated d.c. shunt motor has an armature resistance of 0.04 ohm and a field resistance of 100 ohms.

(i) What resistance must be inserted in the shunt field circuit to increase the speed from 1200 rpm to 1500 rpm when the supply current is 200 Amperes and

ii) With field resistance found in (i), find the speed when the supply current is 100 Amps.

4. (a) Discuss stability criteria of possible combination of joint speed-torque characteristics of motor and load.

(b) A 3- phase, 4 pole, 400 volts, 50 Hz squirrel cage induction motor develops a maximum torque of 2.5 times the full load torque at 1200 rpm at rated voltage and frequency. If the motor is connected to 440 volts, 3-phase, 50 Hz supply, find the new value of the maximum torque in terms of full load torque neglect stator resistance.

5. (a) What are the methods of reducing losses of a motor during starting? Explain them briefly.

(b) A 220 volts d.c. series motor driving a constant load torque runs at 200 rad/s and draws a current of 20 Amps from supply. The total resistance of the armature and the field is 1 ohm. The moment of inertia of the motor together with the load is 5 kg-m^2. Calculate the total energy dissipated in the armature circuit if the motor starts from rest and attains the speed of 200 rad/s within a time of 2.5 seconds.

6. (a) What are the different electrical braking methods? Explain them with reference to a d.c. series motor.

(b) A 40 H.P., 400 volts, 3-phase, 4 pole induction motor has full load slip of 5%. If the ratio of standstill reactance to resistance per phase is 4, estimate the plugging torque at full speed.