[06 – 4121]

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?

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.

(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%.

8. (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.
