Roll No. .....

EX/EE–404(N)

B. E. (Fourth Semester) EXAMINATION, Dec., 2010

(New Scheme)

(Common for EE & EX Engg. Branch)

ELECTRO MECHANICAL ENERGY CONVERSION – I

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt any *five* questions. Attempt *one* question from each Unit. Assume suitable missing data.

Unit – I

1. (a) Describe how the primary current adjust itself as the load on transfer is increased. 5

   (b) Explain the basic purpose of tertiary winding of transformer. 5

   (c) An ideal 3-phase step down transformer connected Δ/Y delivers power to a balanced 3-ϕ load of 120 kVA at 0·8 p. f. The input line voltage is 11 kV and the turn ratio of transformer phase to phase is 10. Determine the line voltage, line current, phase current and phase voltage on both the sides of transformer.10

Or

2. (a) What are the vector phase group for three-phase transformer ? What is their importance ? 10

(b) Two 110 V single phase furnace take loads of 500 kW and 800 kW respectively at a power factor of 0·71 lagging and are supplied from 6600 V, 3-ϕ main through Scott connected transformer combination. Calculate the current in the 3-ϕ line. 10

Unit – II

3. (a) Explain the voltage built up phenomenon in D.C. shunt generator. 6

(b) Define the following : 2 each

(i) Critical shunt field resistance

(ii) Critical speed

(c) In a 110 V compound generator the armature shunt and series windings are 0·06 Ω, 25 Ω and 0·04 Ω respectively. The load consists of 200 lamps each rated 55 W, 110 V. Find the total e. m. f. and armature current, when the machine is connected (i) long shunt, (ii) short shunt. 10

Or

4. (a) What is armature reaction ? What are the effects of armature reaction in d. c. machine ? How the armature reaction is minimized ? 10

(b) A 4 pole D. C. machine has lap connected armature having 60 slots and 8 conductors per slot. The flux per pole is 30 mWb. If the armature is rotated at 1000 R.P.M., find the e.m.f. available across its armature terminal. Also calculate the frequency of e.m.f. in the armature coil. 10

Unit – III

5. (a) Explain the Hopkinson's test for d. c. machine. 10

(b) Explain the different types of braking system for d. c. motor. 10

Or

6. (a) Justify that the d. c. series motor has high starting torque. 6

(b) A 200 V shunt motor has $R_a = 0{\cdot}1\ \Omega$, $R_f = 240\ \Omega$ and rotational loss = 236 W. On full load the line current is 9·8 A with the motor running at 1450 R.P.M. Determine : 14

(i) Machine power developed

(ii) Power output

(iii) Full load efficiency

(iv) Load torque

Unit – IV

7. A 6 pole 440 V, 3-ϕ, 50 Hz induction motor has the following parameters of its circuit model : 20

$r_1 = 0{\cdot}0\ \Omega$ (stator copper loss negligible)

$x_1 = 0{\cdot}7\ \Omega$, $r_2' = 0{\cdot}3\ \Omega$, $x_2' = 0{\cdot}7\ \Omega$, $x_m = 35\ \Omega$

Rotational losses = 750 W.

Calculate the net mechanical power output, startor current and p.f. when the motor runs at a speed of 950 R.P.M.

Or

8. (a) Derive an expression for rotating magnetic field in 3-phase system. Hence explain the operation of 3-phase induction motor. 10

(b) The power input to the rotor of a 440 V, 50 Hz, 3 ϕ, 6 pole induction motor is 60 kW. It is observed that the rotor e.m.f. makes 90 complete cycles per minute. Calculate : 10

(i) Slip

(ii) Rotor speed

(iii) Rotor copper loss

(iv) Mechanical power developed

Unit – V

9. (a) Describe briefly the phenomenon of cogging and crawling in induction motor. 10

(b) Describe the method of controlling the speed of an I. M. by varying the frequency of applied voltage. 10

Or

10. (a) Explain the different starting methods of 3-ϕ induction motor. 10

(b) Describe with diagram Kramer system of speed control of 3-ϕ induction motor. 10