Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

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S.E. (Mech./Prod./SW) (II Sem.) EXAMINATION, 2010

ELECTRICAL TECHNOLOGY

(2003 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answers to the two Sections must be written in separate answer-books.

(*ii*) From Section **I** attempt *one* question each from the pairs of Q. Nos. **1** and **2**; Q. Nos. **3** and **4**; Q. Nos. **5** and **6**. From Section **II** attempt one question each the pairs of Q. Nos. **7** and **8**; Q. Nos. **9** and **10**; Q. Nos. **11** and **12**.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of non-programmable scientific pocket calculator is allowed.

(*vi*) Assume suitable data, if any.

SECTION I

1. (*a*) From first principle, derive the emf equation of a d.c. generator. [4]

(*b*) Sketch Speed-Armature current characteristic of D.C. shunt motor and D.C. series motor. [4]

P.T.O.

(c) The armature of a 12 pole d.c. shunt generator has 50 slots and is wave wound with 12 conductors per slot. The generator is running at a speed of 625 rpm and supplies a resistive load of 15 ohm at a terminal voltage of 300 volt. The armature resistance is 0.5 ohm and field resistance is 300 ohm. Find the armature current, the generated emf and the flux/pole. [8]

Or

2. (a) With a neat circuit diagram explain the speed control methods for D.C. series motor. [8]

(b) Why is starter necessary for D.C. shunt motor ? With neat diagram explain three point starter. [8]

3. (a) Draw a neat circuit diagram and relevant phases diagram, explain how two single phase wattmeters can be used to measure total active power in a three-phase balanced star connected load with lagging p.f. ?

How is the total reactive power calculated using the readings of the two wattmeters ? [10]

(b) What are the requirements of good lighting scheme. [6]

Or

4. (*a*) Three identical impedances each of (3-4*j*) ohm are connected in star across a three-phase, 400 V, 50 Hz A.C. supply. A wattmeter is connected with its current coil in line Y. Calculate the wattmeter reading when voltage coil is connected across lines :

(*i*) Y and R

(*ii*) Y and B

(*iii*) R and B. [9]

(*b*) State laws of illumination. [3]

(*c*) Explain why power factor improvement is necessary and state methods used for it. [4]

5. (*a*) State advantages of using rotating field over rotating armature in case of three-phase alternator. [4]

(*b*) Compare salient pole and non-salient pole rotor construction for three-phase A.C. generator. [5]

(*c*) Draw and explain significance of all parameters of an exact equivalent circuit of a single-phase transformer. Also derive the approximate equivalent circuit from this by stating the rules of transfer of various parameters from one side to the other. [9]

Or

6. (*a*) The following readings were obtained from O.C. and S.C. tests on a 10 kVA, 450 V/120 V, 50 Hz single-phase transformer :

O.C. Test : 120 V, 4.2 A, 80 W on L.V. side

S.C. Test : 9.65 V, 22.2 A, 120 W on H.V. side

Calculate :

(*i*) The approximate equivalent circuit parameters ref. to primary.

(*ii*) Efficiency and voltage regulation at 0.8 p.f. lagging. [10]

(*b*) A 3-phase, 16 pole synchronous generator has a resultant air gap flux of 0.06 Wb per pole. The flux is distributed sinusoidally. The stator has 2 slots per pole per phase and 4 conductors per slot. The coil span is 150°. Calculate the phase and line induced emfs when the machine runs at 375 rpm. [8]

SECTION II

7. (*a*) Explain the working principle of three-phase induction motor. State its types and their applications. [6]

(*b*) The rotor resistance of a 4 pole, 50 Hz 3-phase induction motor is 0.4 ohm per phase and standstill reactance per phase is 4 ohm per phase. Calculate the speed at maximum torque and the ratio of maximum torque to starting torque. [4]

(c) Why is starter necessary for the three-phase induction motor ? With neat diagram explain working of STAR-DELTA Starter. [7]

Or

8. (a) State the torque equation of three-phase induction motor and hence sketch the Torque Slip characteristic and show on it effect of charge in rotor resistance/phase. [6]

(b) Compare Squirrel cage and Slip ring type rotor construction for three-phase induction motor. [4]

(c) A 33.73 kW, 4-pole, 3-phase 50 Hz star connected motor delivers full load output at 1440 rpm with a p.f. of 0.8 lagging. If the mechanical losses are 1.3 kW and stator losses are 1.4 kW, calculate :

(i) Slip at full load

(ii) Frequency of rotor induced emf

(iii) Rotor Cu loss

(iv) Efficiency of motor at full load. [7]

9. Write short notes on :

(i) Universal motor [5]

(ii) Stepper motor [6]

(iii) Reluctance motor. [5]

Or

10. Write short notes on :

(*i*) Hysteresis motor [5]

(*ii*) D.C. Servo motor [6]

(*iii*) Capacitor start and run induction motor. [5]

11. (*a*) Classify various types of electric drives and discuss their merits and demerits. [7]

(*b*) Explain the working principle and state applications of dielectric heating. [6]

(*c*) Write a short note on Arc Welding. [4]

Or

12. (*a*) State and explain advantages of electric heating. [5]

(*b*) Explain the procedure for designing circular cross-section heating element of a resistance furnace. [6]

(*c*) State any *two* applications of :

(*i*) D.C. shunt motor

(*ii*) D.C. series motor

(*iii*) 3-phase slip-ring induction motor. [6]