Total No. of Questions : 10] [Total No. of Printed Pages : 4

Roll No. .....

EE/EX–401(O)

B. E. (Fourth Semester) EXAMINATION, Dec., 2009

(Old Scheme)

(Common for EE & EX Engg. Branch)

E. M. E. C.–I

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt any *one* question from each Unit. Assume suitable data if necessary.

Unit–I

1. (a) Explain how the power is transferred from primary to the secondary circuit of the transformer as the load is increased on the secondary circuit. Also explain how the voltage regulation of transformer can be found out using S. C. and O. C. test results. 10

   (b) A 20 kVA, 50 Hz, 2000/200 V, 1-phase transformer has the following test results : 10

   O. C. Test → 200 V, 4 A, 120 W

   (with HV side open)

   S. C. Test → 60 V, 10 A, 300 W

   (LV side shorted)

   Draw the equivalent circuit referred to LV side.

P. T. O.

Or

2. (a) Explain how the three single phase transformers can be converted into three-phase transformer with Dy 11 connection ? 10

(b) (i) State the necessary conditions for the parallel operation of 3-phase transformers. 4

(ii) State different cooling methods of transformer. Explain in brief any *one* method. 6

Unit–II

3. (a) Describe and compare the various methods of speed control of DC motors. 10

(b) A 220 V shunt motor has an armature circuit resistance of 0·2 ohm and field resistance of 110 ohm. At no-load the motor takes 5 A and runs at 1500 r. p. m. If the motor draws 52 A at rated voltage and rated load, calculate the motor speed and its rated shaft torque in Nm. The rotational losses at no-load and full-load are the same. Neglect armature reaction. 10

Or

4. (a) (i) Explain the commutation process in the DC machines. 6

(ii) Explain various losses occuring in a DC machine. 4

(b) A 4-pole d. c. motor runs at 600 r. p. m. on full-load taking 25 Amps at 450 V. The armature is lap wound with 500 conductors and flux per pole is given by $\phi = 0 \cdot 016 \sqrt{I}$ Wb where I is the motor current. If supply voltage and torque, both are halved, calculate the speed at which motor will run. Ignore stray losses. 10

Or

2. (a) Explain how the three single phase transformers can be converted into three-phase transformer with Dy 11 connection ? 10

(b) (i) State the necessary conditions for the parallel operation of 3-phase transformers. 4

(ii) State different cooling methods of transformer. Explain in brief any *one* method. 6

Unit – II

3. (a) Describe and compare the various methods of speed control of DC motors. 10

(b) A 220 V shunt motor has an armature circuit resistance of 0·2 ohm and field resistance of 110 ohm. At no-load the motor takes 5 A and runs at 1500 r. p. m. If the motor draws 52 A at rated voltage and rated load, calculate the motor speed and its rated shaft torque in Nm. The rotational losses at no-load and full-load are the same. Neglect armature reaction. 10

Or

4. (a) (i) Explain the commutation process in the DC machines. 6

(ii) Explain various losses occuring in a DC machine. 4

(b) A 4-pole d. c. motor runs at 600 r. p. m. on full-load taking 25 Amps at 450 V. The armature is lap wound with 500 conductors and flux per pole is given by $\phi = 0 \cdot 016 \sqrt{I}$ Wb where I is the motor current. If supply voltage and torque, both are halved, calculate the speed at which motor will run. Ignore stray losses. 10

Unit – III

5. (a) Develop the phasor diagram of a three-phase induction motor. Explain why the no-load current in case of induction motor is larger as compared to transformer. 10

(b) Explain the construction of circle diagrams of poly-phase induction motor. How it is used for performance evaluation of induction motor ? 10

Or

6. (a) Deduce the relation between torque and slip of poly-phase induction motor. Draw torque versus slip characteristics for slip from 1 to 2 and indicate various modes of operation. 10

(b) Develop the equivalent circuit of induction motor and compare with equivalent circuit of transformer. 10

Unit – IV

7. (a) Explain star-delta and autotransformer starting methods of polyphase induction motors. 10

(b) Explain speed control of polyphase induction motor by $\left(\frac{v}{f}\right)$ ratio control. Draw the schematic diagram using solid state devices. 10

Or

8. (a) (i) Explain in brief the cogging and crawling phenomenon in induction motor. 5

(ii) Discuss why deep bar rotors are used in induction motors ? 5

(b) A 10 kW, 400 V, three-phase, 4-pole, 50 Hz delta connected induction motor is running at no-load with

a line current of 8 A and an input power of 660 watts. At full-load, the line current is 18 A and the input power is 11·2 kW. Stator effective resistance per phase is 1·2 ohm and friction, windage loss is 420 watts. For negligible rotor ohmic losses at no-load, calculate the internal torque, shaft torque and efficiency of the motor. 10

Unit – V

9. (a) Explain the double revolving field theory of single phase induction motor. 10

   (b) List the methods of starting of single phase induction motors and explain any *one* in detail. 10

Or

10. A 230 V, 6-pole, 50 Hz, single phase induction motor has the following constants and losses : 20

    $r_1 = 2 \cdot 3\ \Omega$, $x_1 = 3 \cdot 2\ \Omega$, $r_2 = 4 \cdot 2\ \Omega$, $x_2 = 3 \cdot 2\ \Omega$, $X_m = 74\ \Omega$

    core loss = 98 W; Friction and windage loss = 30 watts. If this motor is running with a slip 0·05 at rated voltage and frequency, then compute the stator current, p. f., power output, torque and efficiency with its auxiliary winding open.