Code: 15A02401 **R15**

B.Tech II Year II Semester (R15) Supplementary Examinations December 2018

ELECTRICAL MACHINES – II

(Electrical & Electronics Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Why the efficiency of a transformer is very high?

(b) Draw the phasor diagram of a single-phase transformer supplying a leading power factor load.

(c) Discuss the relative merits and demerits of an auto-transformer.

(d) Discuss the essential and desirable conditions to be fulfilled for the operation of two 3-phase transformers in parallel.

(e) The stator of a 3-phase, 4-pole wound rotor induction motor is connected to 50 Hz source, but its rotor is energized from 30 Hz source. Determine the two possible no-load speeds of the motor. Neglect al losses.

(f) Why the rotor of three-phase induction motor can never attain synchronous speed?

(g) Sketch the torque-speed curve of a conventional induction motor and indicate how this will change when the rotor resistance is doubled, keeping stator voltage and frequency unchanged.

(h) What does crawling of induction motor mean?

(i) Define asynchronous torque.

(j) List out the methods of speed control of cage type 3-phase induction motor.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Derive an expression for computing the per unit voltage regulation of a transformer both for lagging and leading power factors.

(b) A single–speed transformer has a regulation of 10% when delivering full load at unity pf and 15% when delivering the same load at 0.8 pf lagging. What would be the regulation if the transformer is delivering half-load at 0.8 pf leading?

OR

3 (a) Discuss the effect of frequency and voltage on the equivalent circuit parameters of a transformer.

(b) In a test for the determination of losses of 440 V, 50 Hz transformer, the total iron losses were found to be 2500 watts at normal voltage and frequency. When the applied voltage and frequency were 220 V and 25 Hz, the iron losses were found to be 850 watts. Calculate the eddy current and hysteresis losses at normal voltage and frequency.

UNIT – II

4 (a) Give the merits and demerits of a delta/star connected three-phase transformer.

(b) Two transformers connected in open delta supply a 400 kVA balanced load operating at 0.866 pf (lag). The load voltage is 440 V. What is the: (i) kVA supplied by each transformer. (ii) kW supplied by each transformer.

OR

5 (a) Explain the effect of third harmonics in phase voltages of three phase transformers.

(b) A 400/100 V, 5 kVA, 1-phase two winding transformer is to be used as an auto-transformer to supply 400 V from a 500 V voltage source. When tested as a two-winding transformer at rated load and 0.8 pf lagging, its efficiency was found to be 0.95. Determine its kVA rating as an auto-transformer. Also calculate the transformed kVA and conducted kVA.

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UNIT – III

6 (a) Explain how a rotating magnetic field is produced in a three-phase induction motor.

(b) A 3-phase, 400 V, 50 Hz induction motor takes a power input of 35 kW at its full-load speed of 890 rpm. The total stator losses are 1 kW and the friction and windage losses are 1.5 kW. Calculate: (i) Slip. (ii) Rotor ohmic losses. (iii) Shat power. (iv) Efficiency.

OR

7 (a) Draw and explain stator and rotor equivalent circuits of 3-phase induction motor.

(b) A 3-phae, star connected, 400 V, 50 Hz, 4-pole induction motor has the following per phase constants in ohms referred to stator.

$r_1 = 0.15\ \Omega$, $x_1 = 0.45\ \Omega$, $r_2 = 0.13\ \Omega$, $x_2 = 0.46\ \Omega$, $x_\phi = 28\ \Omega$, fixed losses = 400 watts.

Compute the stator current, rotor speed, output torque and efficiency when the motor is operated at rated voltage and frequency at a slip of 4%.

UNIT – IV

8 (a) A 3-phase required cage induction motor is designed to have rotor copper bars. If, instead of using copper, aluminium is used for rotor bars, explain what happens to its speed, efficiency etc under normal running conditions.

(b) A 400 V, 50 Hz, 3-phase star connected squirrel cage induction motor gone the following test results:

No-load test (line values): 400 V, 9 A, 560 W

Blocked rotor test (line values): 210 V, 36 A, 4820 W

The effective stator resistance is 0.72 Ω per phase. Calculate the equivalent circuit parameters.

OR

9 (a) Explain how the circle diagram for a poly-phase induction motor can be drawn from its test data.

(b) A 3-phase, 4-pole, 50 Hz induction motor, during the short circuit test, took 100 A and 30 kW. Incase stator resistance is equal to equivalent stands till rotor resistance, compute the starting torque.

UNIT – V

10 (a) What are the advantages of inserting external resistance in the rotor circuit of a wound-rotor induction motor at the time of starting?

(b) Calculate the relative values of starting currents and starting torques of a 3-phase squirrel cage induction motor, when it is started by: (i) Direct on line starter. (ii) Star-delta starter. (iii) Auto-transformer starter with 60% tapping.

OR

11 (a) Explain about the speed control of slip ring induction motor with different methods.

(b) Explain any two methods for performing the polarity test on a 3-phase induction motor.

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