Code: 15A02401 **R15**

B.Tech II Year II Semester (R15) Regular & Supplementary Examinations May/June 2018

ELECTRICAL MACHINES – II

(Electrical and 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) What current flows in three transformer primary when its secondary is open? What is its function?

(b) Distinguish between distribution and power transformers.

(c) In Sumpner's test the frequency of the voltage injected in the secondary circuit, may not be equal to the rated frequency. Why?

(d) Why is it preferable to install two or more transformers in parallel than one large unit?

(e) A property shunted centre-zero galvanometer is connected in the rotor circuit of a 6-pole, 50 hz wound rotor induction motor. If the galvanometer makes 90 complete oscillations in one minute, calculate the rotor speed?

(f) Why an induction motor at no-load operates at a very low power factor?

(g) Give the conditions for maximum torque of 3-phase induction motor.

(h) What do you mean by Cogging of induction motor?

(i) Why is it not advisable to start wound-rotor induction motors by the methods employed for starting cage induction motors?

(j) How is the induction motor operation affected if the external resistance in the rotor-circuit is not fully cut-off?

PART – B

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

UNIT – I

2 (a) A transformer is operated at rated frequency but at a voltage higher than its rated value. Explain how the following quantities would change? Explain how the following quantities would change.
(i) No-load current. (ii) Hystersisters. (iii) Eddy current loss.

(b) A 1-phase transformer has the following data:
Peak flux density in core = 1.4 T; Net core area = 0.012 m^2
Current density in conductors = 2.5 MA/m^2; Conductor dia = 2.0 mm
Primary voltage = 230 V, 50 Hz. Calculate the KVA rating of the transformer and the number of turns on the primary winding.

OR

3 (a) Develop the exact equivalent circuit of a single-phase transformer.

(b) The constants of a single-phase 50 Hz, 2200/220 V transformer are as follows:
HV side: $R_1 = 0.12\ \Omega$; $x_1 = 3.85\ \Omega$; $R_{C1} = 4800\ \Omega$, $X_{\varphi 1} = 3500\ \Omega$
LV side: $R_2 = 0.008\ \Omega$; $x_2 = 0.022\ \Omega$
Find the equivalent circuit parameters referred to (i) HV side. (ii) LV side.

UNIT – II

4 (a) What are Vee and tee-connections of transformer? Where are they used?

(b) It is desired to transform 2400 V, 5000 kVA three-phase power to 2-phase power at 600 V by Scott-connected transformers. Determine the voltage and current ratings of both primary and secondary of each transformer. Neglect the transformer no-load currents.

OR

5 (a) Explain the advantages of using a tertiary winding in a bank of star-star transformers.

(b) A load of 800 kW at a pf of 0.71 lagging is shared by two similar transformers connected in parallel. One has a resistive drop of 1.4% and reactive drop of 4.8% and the other has a resistive drop of 1.8% and reactive drop of 5%. Calculate the load shared by each transformer and their power factor.

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UNIT – III

6 (a) Draw and explain the power flow diagram of 3-phase induction motor.

(b) A 3-phase induction motor has a starting torque of 150% and a maximum torque of 250% of the full-load torque. Neglect stator resistance and assume constant rotor resistance. Compute: (i) The slip at a maximum torque. (ii) Full load slip. (iii) Rotor current at starting in terms of full-load rotor current.

OR

7 (a) For a 3-phase induction motor, maximum torque is twice the full load torque and starting toque is 1.6 times the full-load torque. In order to get a full load slip of 5%, calculate the percentage reduction in rotor circuit resistance. Neglect stator impedance.

(b) With the help of diagram, explain the operating characteristics of an induction motor.

UNIT – IV

8 (a) Explain how the equivalent circuit parameters of a 3-phase induction motor can be determined from no-load and blocked-rotor tests and per phase stator winding dc resistance.

(b) A 3-phase induction motor is designed to operate at rated voltage V and frequency f. In case both source voltage and frequency are respectively changed to: (i) V/2, f/2. (ii) V, 2f. Find the maximum and starting torques in terms of their rated values. Neglect all stator losses.

OR

9 (a) Explain, why the air-gap length is kept as small as is mechanically possible in case of induction motors.

(b) A 400 V, 3-phase, 8-pole, 50 Hz star connected induction motor gave the following test results.

No load test (line values): 400 V, 10 A, $\cos\theta_0 = 0.2$

Blocked rotor test (line values): 160 V, 30 A, $\cos\theta_{sc} = 0.35$

If at full load and rated voltage, the power factor is at its maximum, then calculate full load current, pf, speed, power output and efficiency. Stator and rotor ohmic losses are equal.

UNIT – V

10 (a) A 20 kW, 400 V, 3-phase induction motor has full-load p.f of 0.86 and full load efficiency of 0.88 with stator winding in delta, short circuit line current at 200 V is 70 A. If this motor is fitted with a star-delta starter, find: (i) The ratio of starting of full-load line current. (ii) The starting torque in terms of full-load torque for a full-load slip of 5%.

(b) Show that the starting torque per line ampere with auto transformer starting is more than that obtained by stator-reactor starting.

OR

11 (a) What is the drawback of star-delta starter? How can it be overcome?

(b) Calculate the values of resistance elements of a 4-step starter for a 3-phase, 400 V, wound rotor induction motor. The full load slip is 3% and the maximum starting current is limited to its full load value. Rotor resistance per phase is 0.015 Ω.

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