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TED (15) – 5031

(REVISION — 2015)

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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE — APRIL, 2019

INDUCTION MACHINES

[*Time* : 3 hours

(Maximum marks : 100)

[*Note:*— A4 size graph sheet to be supplied.]

PART — A

(Maximum marks : 10)

Marks

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. List the two types of transformers based on construction.
2. Define all day efficiency of a 1ϕ transformer.
3. Define the slip of a 3ϕ induction motor.
4. List any two losses in a 3ϕ induction motor.
5. State the two tests in a 3ϕ induction motor for drawing the circle diagram. (5×2 = 10)

PART — B

(Maximum marks : 30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. Explain the concept of an ideal transformer.
2. Explain the construction of a 1ϕ transformer.
3. Draw the approximate equivalent circuit of a 1ϕ transformer and identify the various terms.
4. Explain the parallel operation of 1ϕ transformers.
5. Draw the power flow diagram of a 3ϕ induction motor.
6. Explain the effect of supply voltage on torque and speed in 3ϕ induction motor.
7. Describe the starting of a 3ϕ slip ring induction motor. (5×6 = 30)

PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks.)

UNIT — I

III (a) Derive the emf equation of a 1ϕ transformer. 7

(b) Draw and explain the vector diagram of a transformer with resistance and leakage reactance on inductive load. 8

OR

Marks

IV (a) Explain the effect of voltage and frequency variation in a 1ϕ transformer. 7

(b) A 1ϕ transformer has 400 primary and 1000 secondary turns. The net cross-sectional area of the core is 60cm². If the primary winding is connected to a supply of 520V, 50 Hz, Calculate: (i) the turns ratio, (ii) the maximum flux density in the core, (iii) emf induced in the secondary. 8

UNIT — II

V (a) Derive the condition for maximum efficiency in a 1ϕ transformer. 7

(b) Obtain the approximate equivalent circuit of a 200/400V, 50Hz 1ϕ transformer from the following test data :

OC test : 200V, 0.7A, 70W — on L.V side

SC test : 15V, 10A, 85W — on H.V side 8

OR

VI (a) Explain the construction and working of an auto transformer. 7

(b) Explain the construction and working of any one instrument transformer. 8

UNIT — III

VII (a) Explain how rotor rotates in a 3ϕ induction motor. 7

(b) A 4 pole, 3ϕ induction motor operates from a supply whose frequency is 50 Hz.

Calculate : (i) the speed of the stator magnetic field, (ii) rotor speed at 4% slip,

(iii) frequency of rotor currents when the slip is 3%. 8

OR

VIII (a) Derive the condition for maximum torque in a 3ϕ induction motor. 7

(b) A 100 kW (output), 3300 V, 50Hz, 3ϕ star connected induction motor has a synchronous speed of 500 rpm. The full load slip is 1.8% and full load power factor 0.85. The stator copper loss = 2440 W. Iron loss = 3.5 kW. Rotational losses = 1200 W

Calculate : (i) the rotor copper loss, (ii) the line current, (iii) full load efficiency. 8

UNIT — IV

IX (a) Draw the equivalent circuit of a 3ϕ double cage induction motor. 6

(b) Explain any one method of starting of a 3ϕ squirrel cage induction motor with a neat diagram. 9

OR

X (a) List the three methods of electrical braking of poly phase motors. 3

(b) A 3ϕ , 4-pole, 50Hz, 200V, 3.73 kW star connected induction motor gave the following test data. No load : line voltage 200V, line current 5A, total input 350W. Blocked rotor : line voltage 100V, line current 26A, total input 1700W. Draw the circle diagram and estimate the following for full load conditions. (i) the line current, (ii) power factor, (iii) the maximum torque in terms of the full load torque.

The rotor copper loss at standstill is half the total copper loss. 12
