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MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

III SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOVEMBER 2017

SUBJECT: ELECTRICAL MACHINERY-I [ELE 2103]

REVISED CREDIT SYSTEM

Time: 9.00 – 12.00 **Date: 23 November 2017** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Use of scientific calculator is permitted.
- Graph sheet will be provided.

1A. The following data pertain to OC and SC tests on a single-phase, 200/400V, 50 Hz, 4 kVA transformer.

OC Test: 200V, 0.9A, 45W

SC Test: 15V, 9A, 80W.

Determine

a) equivalent circuit parameters as referred to the secondary side
b) full load voltage regulation at 0.6 leading power factor
c) full load efficiency at 0.8 lagging power factor. ***(06)***

1B. A 120 kVA, 2,400/240 V, 50 Hz, single-phase two-winding transformer is to be connected as an auto-transformer with additive polarity. For a constant input voltage of 2,400 V, determine

a) supply current
b) load current
c) KVA rating
d) Percentage of copper saving ***(04)***

2A. 2 single-phase transformers A and B are connected in parallel to the same load. Determine the current delivered by each transformer and circulating current, given open circuit EMF of 6,600 V for A and 6,400 V for B. Equivalent leakage impedance in terms of the secondary is (0.3+j3) Ω for A and (0.2+j1) Ω for B. The load impedance is (8+j6) Ω. ***(06)***

2B. A 400 kVA load at 0.8 pf lag is supplied by three 1 phase transformers connected in Delta-Delta configuration. Each of the transformer is rated at 200 kVA, 2300 / 230 V. If one transformer is removed for service, then determine

a) Percentage increase in load on each transformer
b) Available kVA rating. ***(04)***

3A. A 3 phase, 415V, 50Hz, 6pole, star connected induction motor has a rotor resistance and stand still reactance of 0.12 Ω and 0.85Ω per phase respectively. The ratio of stator to rotor turns is 1.8. The full load slip is 4%. Calculate the full load torque and the power output. ***(05)***

3B. A 6 pole 3 phase Induction motor supplying 20 HP shaft power has total mechanical losses of 2 HP at a speed of 950 RPM on 415 V, 50 Hz mains. The power factor is 0.88. Calculate for this load

a) The rotor copper loss
b) Power input if the stator losses are 2000 W
c) The efficiency
d) Supply current ***(05)***

4A. Draw the circle diagram for a 3 phase, 6 pole, 50 Hz, 400V star connected induction motor from the following test data.

No-load test: 400 V, 10 A, 1400 W.

Short circuit test: 200 V, 45 A, 7000 W.

The stator loss at standstill is 60% of the total copper losses and full load current is 45 A. From the circle diagram determine:

a) Power factor, slip, output, efficiency and torque at full load.
b) Starting torque. ***(06)***

4B. Explain the inherent non-self-starting nature of single phase induction motors. What is the role of capacitor in these motors? ***(04)***

5A. Describe the process of commutation in DC machines with suitable neat sketches. ***(04)***

5B. Write technical notes on,

a) Double cage induction motors
b) Crawling of induction motors ***(06)***