Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent Institution of MAHE, Manipal)

III SEMESTER B. TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOVEMBER 2018

SUBJECT: ELECTRICAL MACHINERY-1 [ELE 2103]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 27, November 2018** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Use of graph sheet is permitted.

1A. In A 10 kVA 200/400V, 50Hz single phase transformer, core flux can be expressed as 0.023 sin ωt. Calculate the induced EMF/turn. Also calculate the number of turns in primary and secondary windings. ***(02)***

1B. A 200 kVA transformer has an efficiency of 98% at full load. If the maximum efficiency occurs at 80% of full load, calculate the efficiency at half load. Assume a power factor of 0.8 at all loads. ***(04)***

1C. A 100 kVA, 11,000/220 V single phase transformer when tested gave the following results:

OC test: 220 V, 45 A, 2 kW

SC test: 500 V, 9.09 A, 3 kW

Develop the approximate equivalent circuit of the transformer as referred to the HV side. ***(04)***

2A. A 100 kVA 11,500/2,300 two winding transformer is connected as auto transformer with additive polarity to 11.5 kV supply. Calculate the KVA rating of the autotransformer. ***(02)***

2B. With help of phasor diagrams, prove that the no-load secondary terminal voltages of 2 single phase transformers are at right angles to each other when connected in Scott arrangement. ***(04)***

2C. Write technical note on (a) Inrush current in transformers (b) Crawling in three phase induction motors ***(04)***

3A. Explain how the double cage induction motor is able to develop better starting torque compared with the conventional squirrel-cage induction motor. ***(03)***

3B. A 3 phase, 400 V, 6-pole, 50 Hz induction motor develops mechanical power of 20 kW at 985 rpm. The stator losses are equal to 1800 W. Neglect the mechanical losses. Calculate:

i) The rotor copper loss & rotor frequency

ii) The total input power. ***(03)***

3C. A 4-pole, 50 Hz, 3-phase induction motor, with star connected rotor, has a rotor resistance of 4.5 Ω/phase and a standstill leakage reactance of 8.5 Ω/phase. With no external resistance in the rotor circuit, the starting torque of the motor is 85 N-m. If 3 Ω resistance were added in each rotor phase, find the following.

i) The starting torque.

ii) The torque at a slip of 3 %. ***(04)***

4A. Discuss the variable frequency control strategies for the speed control of 3-phase induction motor. ***(02)***

4B. With necessary phasor diagram, explain how a capacitor can help in starting of a single-phase induction motor. ***(03)***

4C. A 3-phase, 400 V, 50 Hz, star-connected induction motor gave the following test results (line values):

No load test: 400 V, 10 A, 1.4 kW

Blocked rotor test: 150 V, 40 A, 4.2 kW

Construct the circle diagram to obtain the efficiency and speed of the motor when it draws 35 A.

Scale: 1 cm=5 A. Assume rotor copper losses to be same as stator copper losses. ***(05)***

5A. Develop a single layer wave winding table for the stator winding of a three phase AC machine with 36 slots and 4 poles. Assume RBY sequence. ***(04)***

5B. Explain the process of commutation in DC machines using relevant diagrams. What are the factors affecting commutation? ***(04)***

5C. What is the main function of compensating winding in DC generator? Where is it placed? ***(02)***