Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKE UP/ GRADE IMPROVEMENT EXAMINATIONS, JULY/AUGUST 2021

SUBJECT: ELECTRICAL MACHINERY-1 [ELE 2154]

Time: 2 Hours **Date: 28 July 2021** **Max. Marks: 40**

Instructions to Candidates:

- Answer **any four** full questions.
- Missing data may be suitably assumed.

1A. No load test results of a single phase 50 kVA, 2200/110 V, 50 Hz transformer is given.

OC Test (LV side): 110 V, 10 A, 400 W;

SC Test (HV side): 90 V, 22.73 A, 808 W.

Obtain the equivalent circuit parameters of the transformer referred to high voltage side. ***(05)***

1B. Find the all-day efficiency of a 20 kVA distribution transformer with Core loss 150 W and FL Copper loss 325 W. The daily load cycle is as given below,

6AM-10AM 16 kW	0.95 pf lag
10AM-6 PM 10 kW	0.98 pf lag
6PM-12AM 18 kW	0.87 pf lag

(05)

2A. Sketch the complete torque-slip characteristics of induction motor explaining the modes of operation. ***(04)***

2B i. "The load that can be carried by the open-delta bank without exceeding the rating of the transformer is 57.7% of the original load carried by the delta-delta bank". Justify the statement with necessary derivations.

ii. A 100 kVA, 3-phase, 50 Hz 3300/400 V transformer is delta (Δ)-connected on the high voltage (h.v) side and star (Y)-connected on the low voltage (l.v) side. The resistance of the h.v. winding is 3.5 Ω per phase and that of the l.v winding 0.02 Ω per phase. Calculate the iron losses of the transformer at normal voltage and frequency if its full-load efficiency is 95.8% at 0.8 power factor (lag). ***(06)***

3A. Explain the reason why induction generators are not used as stand-alone generators. Explain this mode of operation of an induction machine. What are its applications? ***(04)***

3B. From the following test data given for a three phase 100HP, 3.3kV, 27A, 6pole 50Hz squirrel cage induction motor with star connected stator, develop the approximate equivalent circuit of the machine referred to stator side.

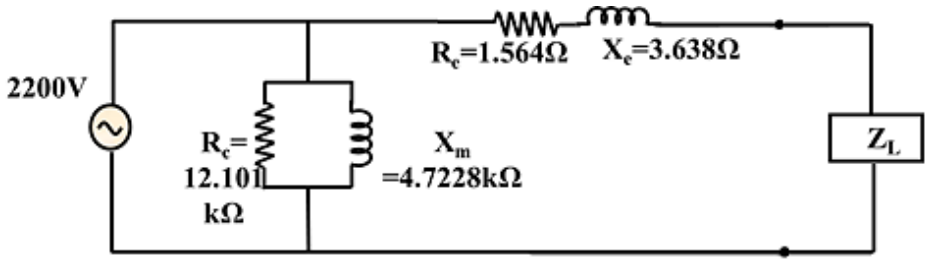
No Load test (line values): 3.3kV, 6A, 24kW

Blocked Rotor test (line values): 400V, 25A, 14kW

DC resistance per phase: 3.75Ω.

Also, Explain the reason why the rotor is blocked in the blocked-rotor test? ***(06)***

4A A 50kVA 2200/110V 50Hz single phase transformer with equivalent circuit as shown in figure below. Calculate the efficiency if a load impedance of (0.2+0.15j) Ω is connected at low voltage side.



(05)

4B. Consider a 415V, 4pole, 50Hz induction motor operating at 4% slip. The shaft power output is 1.2 kW. The machine has stator losses of 50W and rotational losses of 70W. Draw the power flow diagram with power stages. ***(05)***

5A. Consider a 415 V, 6-pole, 50 Hz induction motor with delta connected rotor windings. The voltage measured between the slip rings at standstill is 60 V and when running at full load is 3 V. The rotor resistance and standstill rotor reactance are 0.6 Ω and 2.8 Ω respectively. Calculate at full load,

(a) Speed (b) Rotor current (c) Torque developed & (d) Power developed by the motor ***(05)***

5B. In a long-shunt compound generator, the terminal voltage is 200 V when generator delivers 50 A. Determine

(i) Induced e.m.f.

(ii) Total power generated

(iii) Distribution of this power

Given that shunt field, series field, diverter and armature resistances are 92 Ω, 0.015 Ω, 0.03 Ω and 0.032 Ω, respectively. ***(05)***

6A A 3ϕ, 50 Hz, 36 kW, 4 pole induction motor has a full load efficiency of 82 %. The friction & windage losses are one-fourth of no load losses and rotor copper losses equal the iron loss at full load. Determine (a) Total Losses (b) Stator Core Loss (c) Rotor Copper Loss (d) Friction & Windage Loss ***(05)***

6B Describe commutation in DC machines with the help of necessary diagrams. What are the methods available for improving commutation?

(05)