MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (ELECTRICAL & ELECTRONICS ENGINEERING)
MAKE UP EXAMINATIONS, APRIL 2022

SUBJECT: ELECTRICAL MACHINERY-1 [ELE 2154]
REVISED CREDIT SYSTEM

Time: 3 Hours	26 April 2022	Max. Marks: 50

Instructions to Candidates:

❖ Answer **ALL** the questions.

❖ Missing data may be suitably assumed.

1A. Write a technical note on different types of core construction in transformers. **(02)**

1B. In a 30 kVA, 2,000 / 200 V transformer, the iron and full-load copper losses are 360 W and 420 W respectively. Calculate the transformer's efficiency for its operation with 75% of full load, at 0.8 lagging power factor. **(03)**

1C. At normal voltage and frequency, an 800 kVA single-phase transformer draws an input power of 7.5 kW on no-load. With reduced voltage applied and full-load current flowing in short-circuited secondary winding, it draws an input power of 14.2 kW. If the transformer operates on the following duty cycle in a day, calculate its all-day efficiency.

Duration (hours)	Load (kW)	Load power factor
6	500	0.8
4	700	0.9
4	300	0.95
10	Nil	

(05)

2A. A 150 kVA, 3000 / 500 V, single-phase transformer; when tested, gave the following results:

Open-circuit test: 500 V, 8 A, 900 W

Short-circuit test: 100 V, 50 A, 2,200 W

Draw the approximate equivalent circuit of the transformer as referred to its LV side and label all the parameters. **(05)**

2B. Draw and label the complete phasor diagram of a practical transformer, which is supplying a leading power factor load. Assume transformation ratio of 1. **(03)**

2C. Describe the importance and application of delta-star connection of three phase transformers **(02)**

3A. A three-phase, 4-pole, 60Hz, induction motor has its rotor induced current at 3Hz at a particular operating condition. Find the speed of rotating magnetic field and speed of the rotor, with respect to stator reference. **(02)**

3B. Explain how a slip ring induction motor can provide better starting torque compared to squirrel cage type. **(04)**

3C. Consider a 415V, 6pole, 50Hz induction motor operating at 4% slip. The useful power output is 1kW. The machine has stator losses of 60W and rotational losses of 65W. Calculate its efficiency at this operating condition. **(04)**

4A. Draw the power flow diagram of the motor in Q No. 3C. **(02)**

4B. Explain the slip-torque characteristics of a single-phase induction motor. Also, with the help of double field revolving theory, explain its non-self starting nature. **(05)**

4C. Technically compare the advantages and disadvantages of squirrel-cage and slip-ring construction of induction motor. **(03)**

5A. From the following test data given for a three phase 90HP, 3.3kV, 25A, 6pole 50Hz squirrel cage induction motor with star connected stator, develop the approximate equivalent circuit of the machine.

No Load test (line values): 3.3kV, 4.5A, 24000W

Blocked Rotor test (line values): 400V, 25A, 15000W

DC resistance per phase: 3Ω. **(05)**

5B. In a short-shunt compound generator, the terminal voltage is 220 V when generator delivers 100 A. Determine the total power generated.

Given that shunt field, series field, diverter and armature resistances are 90 Ω, 0.014 Ω, 0.02 Ω and 0.022 Ω, respectively. **(03)**

5C. Describe the process of commutation with the help of necessary diagrams in a DC machine? Explain the methods to improve commutation. **(02)**