Reg. No.									

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

IV SEMESTER B.TECH. (ELECTRICAL & ELECTRONICS ENGINEERING)
MAKEUP EXAMINATIONS, JUNE 2024

ELECTRICAL MACHINERY-II [ELE 2225]

REVISED CREDIT SYSTEM

Time: 3 Hours **26 June 2024** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. With the aid of EMF-MMF diagram, explain the effect of armature reaction when an alternator is connected to

(a) capacitive load

(b) Inductive load

(c) Lagging load **3**

1B. A 3-phase alternator has 2 slots per pole per phase and a coil span of 5 slot pitch. The flux density wave of alternator consists of a fundamental and a 25% third harmonic. Calculate the percentage increase in the phase voltage due to harmonic. **3**

1C. A three-phase, 20 MVA, 11 kV, 50 Hz star-connected alternator has Xd = 4 Ω and Xq = 3 Ω. Armature resistance is negligibly small. At full load, 0.8 lagging power factor, determine:

(a) Direct and quadrature axes components of the armature current.

(b) Excitation emf. **4**

2A. An industrial load of 500 kW, 0.707 pf lagging is required to be improved to 600 kW, 0.95 pf lagging by connecting a synchronous motor in parallel. Determine the kVA rating and power factor at which it operates. **4**

2B. What is the significance of synchronizing power coefficient for a non-salient pole alternator? **2**

2C. A 3 phase, 20 MVA, star connected alternator with an impedance of (0.5+j 6) Ω per phase is operating in parallel with constant voltage 11 kV bus bars. The field current is adjusted to give a line excitation voltage of 12 kV. With constant excitation, calculate (a) Maximum power output from the alternator

(b) Armature current and power factor under maximum power condition. **4**

3A. Two identical 2000 kW alternators operate in parallel. The governor of the first machine is such that the frequency drops uniformly from 50 Hz on no-load to 48 Hz on full load. The corresponding uniform speed drop of the second machine is 50 Hz to 47.5 Hz.

(a) How will the two machines share a load of 3000 kW?

(b) What is the maximum load at upf that can be delivered without overloading either machine? **3**

3B. List the necessary conditions to be satisfied while synchronizing 3 phase alternators. With neat connection diagram, explain "Two Bright One Dark Lamp method" of synchronization. **3**

3C. How is BLDC motor different than a conventional DC motor? Explain. **4**

4A. Bring out the similarities / differences between a synchronous reluctance motor and a conventional synchronous motor. Give one application for each of the motors **3**

4B. Explain the construction, working and control of switched reluctance motor. **3**

4C. How is reversing and speed control achieved in a BLDC motor. Explain with neat diagrams. **4**

5A. Can a PMSM replace a three-phase induction motor driving a pump? Explain. **3**

5B. What is the need for special electrical machines in the present age? Explain. **3**

5C. Explain the control of stepper motors using neat diagram. **4**