Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

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

END SEMESTER EXAMINATIONS, MAY 2024

ELECTRICAL MACHINERY-II [ELE 2225]

REVISED CREDIT SYSTEM

Time: 3 Hours **09 May 2024** **Max. Marks: 50**

Instructions to Candidates:

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

1A. 'The inherent nature of synchronous machines is to rotate in synchronism with the supply frequency while that of induction motors is to rotate with a slip'.

Differentiate the above two machines. Use necessary schematic diagrams to justify your answer. **3**

1B. A 3-phase, 32-pole, 50Hz alternator used in a hydro-generating station has a star-connected winding with 288 slots and 8 conductors per slot. The coil is short pitched by 40°. The flux per pole is 0.08 Wb. Estimate the phase and line values of induced emfs. Assume the total turns per phase are series connected. **4**

1C. 'Unlike asynchronous machines, Synchronous machines can be operated at different power factors'. Justify this statement with the help of necessary characteristics. **3**

2A. A 3-phase, star-connected alternator is rated at 1,600 kVA, 13.5 kV. Its per-phase effective armature resistance & synchronous reactance are 1Ω & 40Ω respectively.

a) Calculate the percentage voltage regulation for a load of 1,250 kW at 0.8 pf lagging.
b) Draw the phasor diagram for the given load condition.
c) Suggest a method to improve the voltage regulation, without any active power loading. **4**

2B. A sugarcane industry is supplied with 92.5 kW of electrical power at 0.83 pf lagging from a three-phase, 50 Hz, 11 kV substation. A synchronous motor of rating 30 kVA operating at a leading power factor of 0.63 is added during the expansion.

a) Calculate the real and reactive supplied by the substation, after expansion.
b) Will the overall power factor of the industry improve after the addition of the synchronous motor? Justify your answer. **3**

2C. A 5 MVA slow speed 3 phase synchronous generator rated at 11 kV has 32 poles. Its direct and quadrature axis reactances are 10 Ω and 4 Ω respectively. Neglecting armature resistance, determine the voltage regulation when supplying a rated load at 0.8 p.f lagging. **3**

3A. Differentiate the power-angle characteristics of cylindrical rotor and salient pole synchronous generator. **3**

3B. Mention any present-day application of Switched Reluctance Motors (SRM) assisting in sustainable development of the world. Explain the additional advantages obtained with the selection of SRM over conventional rotating machines. Also, explain the constructional features and working of SRM with the help of neat schematic diagrams. **4**

3C. Explain the construction, working principle and control of stepper motors. **3**

4A. "Brushless DC motors are replacing the conventional single phase induction motor fans". Justify. **3**

4B. 'Permanent magnet synchronous motors and brushless DC motors have similar constructional features'. Justify this statement mentioning the similarities. Also, differentiate the working of these machines mentioning the advantages and disadvantages. **3**

4C. Describe the working principle of synchronous reluctance motor. How is this motor different than stepper motor? **4**

5A. Write any one application of stepper motor and justify its suitability for the suggested application. **3**

5B. Bring out the differences/similarities between Brushless DC motor and DC shunt motor. **3**

5C. How is permanent magnet synchronous motor suitable for electric vehicle application? Elaborate. **4**