Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. (ELECTRICAL &ELECTRONICS)

END SEMESTER EXAMINATIONS, MAY 2024

ENERGY CONVERSION TECHNOLOGIES [ELE 4305]

OPEN ELECTIVE

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: xx MAY 2024** **Max. Marks: 50**

Instructions to Candidates:

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

1A. Derive an expression for the emf induced in a transformer. Draw the equivalent circuit of transformer with primary parameters referred to secondary and hence write the equation for primary resistance, reactance and impedance referred to secondary. ***(04)***

1B. Explain auto transformers briefly using circuit diagram. ***(02)***

1C. A 10 KVA, 250/2500 V, single phase transformer has resistance and leakage reactance as follows:

r1= 4.8 Ω, r2=0.048 Ω

x1=11.2 Ω, x2=0.112 Ω

Subscripts 1 and 2 denote high voltage and low voltage respectively.

With primary supply voltage held constant at 2500 V, evaluate secondary terminal voltage, when the L.V winding is connected to a load impedance of 5+j2.5 Ω. ***(04)***

2A. Explain in detail with diagram, any three methods of starting a three phase induction motor. ***(03)***

2B. A three phase, 6 pole, 50 Hz induction motor has a slip of 1% at no load and 3% at full load. Solve for (i) synchronous speed, (ii) no load speed, (iii) full load speed (iv) frequency of rotor current at full load (v) frequency of rotor current at standstill. ***(04)***

2C. A three phase, 16 pole, star connected synchronous generator has an air gap flux of 0.06 wb per pole. The stator has 2 slots/pole/phase and 4 conductors per slot and are accommodated in 2 layers. The coil span is 150 degree. Solve for the generated ***(03)***

phase and line voltage in the machine when the machine runs at 375 rpm.

3A. With neat circuit and phasor diagram, explain the working of capacitor start single phase induction motor. ***(02)***

3B. With neat diagram, illustrate the working principle of practical AC generator (alternator) ***(03)***

3C. A 50 BHP, three phase induction motor has full load efficiency of 84 %. At full load, the rotor and stator cupper losses are both equal to the core losses, while mechanical losses are one third of the core loss. Evaluate the slip of the motor. ***(05)***

4A. With neat diagram, explain the working principle of DC motors. ***(03)***

4B. With neat diagram, write a short note on stepper motor. ***(03)***

4C. A 4 pole, 200 V DC series motor has a wave connected armature with 1260 conductors. The flux per pole is 25 mwb, when the motor is taking 40 A and friction losses amount to 700 W. Its armature resistance is 0.3 Ω and series filed resistance is 0.2 Ω. Calculate (i) the speed (ii) the BHP (iii) the shaft torque (iv) the efficiency at this load. ***(04)***

5A. With neat diagram, explain the working principle of synchronous motors. ***(04)***

5B. Write in brief about the power factor control of synchronous motors. ***(02)***

5C. A 50 HP, 3 phase 440 V, 6 pole star connected synchronous motor has an armature resistance per phase of 0.1 Ω and synchronous reactance per phase of 2.4 Ω. The motor is operating under excited with a power angle of 20° electrical. The generated emf is 240 V per phase. Evaluate the armature current, power factor, and hp (metric) developed. ***(04)***