Course Name: Electric Machines-I

COURSE OUTCOMES (COs):

At the end of this course students will demonstrate the ability to:

1. Able to learn and analyze the various principles & concepts involved in Electromechanical Energy conversion.
2. Acquire the knowledge and demonstrating the constructional details of DC machines as well as transformers.
3. Acquire the knowledge of working of transformers
4. Acquire the knowledge of working of DC machines
5. Acquire the knowledge of performance of transformers, individually and in parallel operation

Time: Three Hours MM: 100

Q1. Attempt any four parts out of five. (4X5= 20 Marks)

a) Describe principle of operation in a single-phase transformer. **CO3 ,L1**
b) Explain open delta connection in a transformer. **CO3,L2**
c) Explain Yd11 phasor group in a three-phase transformer. **C05, L3**
d) Explain singly excited systems. **CO1, L1**
e) Explain working principle of DC Generator. **CO2 ,L1**

Q2. Attempt any four parts out of five. (4X5= 20 Marks)

a) Explain working principle of DC motor. **CO4, L1**
b) Explain starting methods for DC motor. **CO4,L2**
c) Explain commutator action in DC machines. **CO2,L2**
d) Describe armature reaction in DC machines. **CO2, L1**
e) Explain parallel operation in transformer. **CO5,L2**

Each question contains three parts a, b & c. Attempt any two parts of choice from each question.

Q3. (10X2= 20 Marks)

a. Explain construction features of DC machine with the help of neat diagrams.**CO2 ,L1**
b. A 220 V shunt motor has armature and field resistance of 0.2 Ω and 220 Ω respectively. The motor is driving a constant load torque and running at 1000 rpm drawing 10 A current from the supply. Calculate the new speed and armature current if an external armature resistance of value 5 Ω is inserted in the armature circuit. Neglect armature reaction and saturation. **CO4,L2**
c. A 220 V DC series motor has armature and field resistances of 0.15 Ω and 0.10 Ω respectively. It takes a current of 30 A from the supply while running at 1000 rpm. If an external resistance of 1 Ω is inserted in series with the motor, calculate the new steady state armature current and the speed. Assume the load torque remains constant. **CO4 ,L3**

Q4. (10X2= 20 Marks)

a. Explain different phasor groups in a three-phase transformer. **CO5,L2**
b. The O.C and S.C test data are given below for a single phase, 5 kVA, 200V/400V, 50Hz transformer. O.C test from LV side: 200V 1.25A 150W S.C test from HV side: 20VV 12.5A 175W Draw the equivalent circuit of the transformer (i) referred to LV side and (ii) referred to HV side inserting all the parameter values. **CO5, L1**
c. Three single phase ideal transformers, each of rating 5kVA, 200V/400V, 50 Hz are available. The LV sides are connected in star and HV sides are connected in delta. What line to line 3-phase voltage should be applied and what will be the corresponding HV side line to line voltage will be? Also calculate and show the line and phase current magnitudes in both LV & HV sides corresponding to rated condition. **CO5, L3**

Q5. (10X2= 20 Marks)

a. Explain open circuit and short circuit test in transformers.**CO3 ,L2**
b. Draw a phasor diagram of practical transformer operating at lagging load condition.**CO3 ,L3**
c. A four-pole generator having wave-wound armature winding has 25 slots, each slot containing 80 conductors. What will be the voltage generated in the machine when driven at 1500 rpm assuming the flux per pole to be 9.0 m Wb.**CO4, L1**