# Module 3: Transformers

1. Explain different types of Magnetic material with examples. Draw & explain Hysteresis curve for a magnetic material showing Residual magnetism, Coercive force and Magnetic saturation.
2. Discuss operating principle of a single phase Transformer and Derive the EMF equation of a transformer.
3. What is ideal Transformer. Discuss its properties. Also draw and explain phasor diagram of an ideal Transformer at no load.
4. Draw and explain phasor diagram of a Transformer at no load. What are the components of no load currents. Also explain why Copper losses are neglected at no load condition.
5. Draw and explain phasor diagram of a single phase Transformer carrying (i) Resistive load (ii) Inductive load and (iii) Capacitive load.
6. Draw equivalent circuit of a Transformer and simplify it by shifting all the parameters (i) on Primary side (II) on Secondary side.
7. What is Voltage regulation of a Transformer. Find the condition of Zero Voltage regulation. What should be the value of Voltage regulation for an ideal Transformer.
8. Discuss various types of Transformer losses. Also find the condition for maximum Efficiency of a Transformer.
9. Give the Analogy between Electrical circuits and Magnetic circuits.
10. Write a short note on an Autotransformer. Discuss it’s advantages, disadvantages and applications.
11. Discuss various types of Three phase Transformer connections with neat diagrams.
12. A voltage V=200sin314t is applied to a transformer at no load the the winding current is given by I=3sin(314t-60̊ ). Determine Core losses and No-load parameter of approximate equivalent circuit.
13. A 440/110V Transformer takes a no load current 4A at pf 0.2. If the secondary winding supplies a current of 100A at a power factor 0.8 lagging then determine (I) current and power factor of primary under loaded condition and (II) Magnetizing reactance and core loss resistor.
14. A 50KVA, 4400/220V Transformer has R1=3.45Ω, R2=0.009 Ω. The value of reactances are X1=5.2 Ω and X2=0.015Ω. Calculate for the Transformer
    1. Equivalent resistances, reactance and impedance referred to primary.
    2. Equivalent resistances, reactance and impedance referred to secondary.
    3. Rated current of each winding
    4. Total copper loss, first using individual resistance of the two windings and secondly using equivalent resistance as referred to each side.
15. A 10KVA transformer with 2000/400 V has primary resistance of 5.5Ω and primary reactance of 12Ω. The corresponding values for the secondary side are 0.2Ω and 0.45Ω

respectively. Determine Secondary terminal Voltage at full load (i) with 0.8 pf lagging and

1. with 0.8 pf leading.
2. Calculate the Voltage regulation of a Transformer in which Omhic losses are 1% and Reactance drop is 5%. Consider power factor To be (i) 0.8 lagging, (ii) 0.8 leading and
3. Unity.
4. A 40 KVA Transformer has Iron loss of 500 watts and full load Copper loss of 800 watts. If the power factor of the load is 0.6 lagging then calculate .(i) Full load efficiency (ii) The load at which maximum efficiency occurs and (iii) The maximum efficiency.
5. The primary and secondary windings of a 500KVA, single phase Transformer have resistances of 0.4Ω and 0.0015Ω respectively. The primary and secondary voltages are 6000V and 400V respectively and the Iron loss is 3.2KW. Calculate the Efficiency at (i) Full load and (ii) Half load. Assuming the power factor of the load to be 0.8 at all loads.
6. The efficiency of a 400 KVA single phase Transformer is 98.77% at full load with 0.8 power factor and 99.13 % at half load with unity power factor. Find Iron and Copper losses at Half load.
7. A 150 KVA Transformer working at unity power factor has an Efficiency of 96% both at 70 % of Full load and at Full load. Find the load at which Maximum efficiency occurs and also find the value of Maximum efficiency.
8. The Maximum efficiency of a 500 KVA, 3000/500V, 50 Hz 1-phase Transformer is 98% and occurs at 3/4th of full load at unity power factor. If the impedance drop is 10% then calculate the Full load Voltage regulation of Transformer at 0.8 power factor lagging.
9. A 20 KVA 2200/220V, 50 Hz Transformer gave the following results:

OC Test(LV Side) : 220 V, 4.2A, 148 watt and SC Test(HV Side) : 86V, 10.5A , 360 watt. Find (i) Core losses at full load (ii) Cu losses at full load. , (iii)Equivalent resistance and reactance on primary, (iv) Equivalent resistance and reactance on secondary, (V) Efficiency at Full load with 0.8 pf, (vi) Efficiency at half load with 0.8 power factor lagging and (vi) Full load Voltage regulation at 0.8 power factor.

# Module 4: Electrical Machines

1. Explain in detail the construction of a D.C machine with suitable diagrams.
2. Discuss the operating principle of a DC Generator. Explain its working with single turn generator.
3. Derive the expression of Generated EMF for a DC Generator. How we can change the polarity of Generator brushes.
4. Classify various types of DC Generators. Also draw their line diagram showing relationship between various parameters.
5. What is Back EMF in DC motors. Discuss is significance. Also find the condition for Maximum Back EMF developed in Motor armature.
6. Find the relation between Torque and Power for a rotating body. Also find expression for Armature torque and Shaft torque of a DC Motor.
7. Draw & Explain various Characteristics of DC Shut and Series Motor. Also discuss application of different types of DC motors.
8. Explain Working principle of a Three phase Induction motors. Also define Slip of an induction motor
9. Discuss Slip-Torque characteristics of a Three phase Induction motors showing various operating regions. Also discuss the Effect of rotor circuit Resistance on Slip-Torque Characteristics of the Motor.
10. Single phase Induction motors are not Self starting in nature. Explain on the basis of Double field revolving theory. Discuss various methods of Starting of Single phase Induction motors.
11. Write the Operating principle of a Synchronous Motor. Discuss various methods of Starting and Applications of a Synchronous Motor.
12. An 8 pole, 3phase Induction motor of frequency 50Hz has rotor frequency of 2Hz at full load. Find full load slip and full load speed.
13. A 3phase, 6 poles, 50Hz induction motor has a slip of 1% at no load and 3% at full load. Determine the Synchronous Speed, No-load Speed, Frequency of Rotor current at Standstill and frequency of Rotor current at full load.
14. A 50Hz, 8-pole induction motor has full load slip of 4%. The Rotor resistance and Standstill reactance are 0.01 ohm and 0.1 ohm per phase respectively. Find the speed at which maximum torque occurs.
15. A 3-phase 50Hz Induction motor has 6 poles and operates with a slip of 5% at certain load. Determine
    1. The Speed of Rotor with respect to Stator.
    2. The Frequency of Rotor current.
    3. The Speed of Rotor magnetic field with respect to Stator.
    4. The Speed of Rotor magnetic field with respect to Rotor.
    5. The Speed of Rotor magnetic field with respect to Stator magnetic field.
16. A 3-phase, 50 Hz, Induction motor has a full load speed of 1460 rpm. Calculate Slip, no. of Poles, and Frequency of rotor induced Emf..
17. A DC Shunt Generator running at 1200rpm supplies a load of 60KW at 250V. Find the Speed at which it runs as a Shunt motor when taking 60KW from 250V supply. Take Armature resistance as 0.1Ω and Field winding resistance of 50 Ω. Neglect brush drop.
18. A 250V DC Shunt motor having an Armature resistance of 0.25Ω carries an Armature current of 50A and runs at 750rpm. If the flux is reduced by 10%, find the new Speed assume that the motor Torque remains same.
19. A DC Shunt machine connected to 230V supply has Armature resistance 0.115Ω and Shunt field resistance is 115Ω. Find the ratio of speed of generator to motor if line current is 100A.
20. A 120V DC Shunt motor has an Armature resistance of 0.2Ω and Field resistance of 60 Ω respectively. If the Full load Current of motor is 60A and Speed is 1800 rpm find motor Speed at Half load. Consider Brush drop to be 3 volts.
21. A 220V Compound generator has armature, series and shunt field resistance of 0.3Ω , 0.2Ω and 60Ω respectively. If the load consists of 80 lamps of 60Watt and 220V then find Armature current and Generated EMF assume machine to be (i) long shunt and (ii) short shunt respectively.