Electric Machines
(Tutorial 2- Transformer)

QN1 A 50 kVA, 50 Hz single phase transformer has 500 turns on primary winding and 100 turns on secondary winding. The primary winding is supplied by 3000V, 50 Hz ac voltage with full resistive load connected on secondary side. Calculate:

i) Emf induced in secondary winding
ii) Primary and secondary windings currents
iii) Maximum flux in the core.

Assume that it is an ideal transformer. **[Ans: 600V, 16.66A, 83.33A, 27.02mwb]**

QN2 A 230V/ 2300V single-phase transformer is excited by 230V ac voltage. The equivalent resistance and reactance referred to primary side are 0.1 ohm and 0.4 ohm respectively. Given that R0 = 500 ohms and X0 = 200 ohms. The load impedance is (400 + j600) ohm. Calculate: a) Primary current b) Secondary terminal voltage c) Input power factor.

QN3 A 25 kVA, 6600V/ 250V single phase transformer has the following parameters:

R_1 = 8 ohm, X_1 = 15 ohm, R_2 = 0.02 ohm, X_2 = 0.05 ohm.

Calculate the full load voltage regulation at a power factor a) 0.8 lag b) unity c) 0.8 lead.

[2.7 %, 1.3 % and -0.782 %]

QN4 A 20 kVA, 250V/2500V, 50Hz single phase transformer gave the following test results:

No-load test (on L.V. side) : 250V, 1.4 A, 105 watts
Short circuit test (on H.V. side): 120V, 8 A , 320 watts

Calculate the equivalent circuit parameters referred to primary side and draw the equivalent circuit **[Ro = 595.2 ohm, Xo = 187.2 ohm, R_{01} = 0.05 ohm and X_{01} = 0.14 ohm]**

QN5 A single-phase 50 Hz transformer has 100 turns on primary and 400 turns on secondary winding. The net cross-section area of the core is 250 cm^2. If the primary winding is connected to a 230 V, 50 Hz supply, determine (a) the emf induced in the secondary winding and (b) the maximum and rms value of the flux density in the core. [**920 V, 0.414 Wb/m^2, 0.293 Wb/m^2]**

QN6 The no-load current of a transformer is 15 A at a p.f. of 0.2 when connected to a 460 V, 50 Hz power supply. If the primary winding has 550 turns, calculate :(a) the magnetizing and working component of no-load current. (b) iron loss (c) maximum and rms value of flux in the core. [**14.7 A, 3 A, 1380 W, 3.77 mWb, 2.66 mWb]**

QN7 A 2000V/400V, 50 Hz, single phase transformer draws 2 A at a p.f. of 0.2 lagging when it has no-load. Calculate the primary current and p.f when secondary current is 200 A at a p.f. of 0.8 lagging. Assume the voltage drop in the winding to be neglected. **[41.52 A, 0.78**]

QN8. A 100 KVA, 1100/230V, 50 Hz transformer has an HV winding resistance of 0.1Ω and a leakage reactance of 0.4 Ω. The low voltage winding has a resistance of 0.006Ω and a leakage reactance of 0.01 Ω. Find the equivalent winding resistance, reactance and impedance referred to HV and LV side. **[(0.237+j0.629) Ω, (0.0643+j0.0275) Ω]**

QN9 A 50 KVA, 2200/110V transformer when tested gave the following results:

OC test:	400 W	10 A	110 V
SC test:	808 W	20.5 A	90 V

Compute all the parameters of the equivalent circuit referred to HV and LV sides of the transformer. Draw the equivalent circuits also. **[HV side: 12120Ω, 4723.2Ω, 1.932Ω, 3.946Ω; LV side: 30.30Ω, 11.80Ω, $4.808*10^{-3}$Ω, $9.865*10^{-3}$Ω]**

QN10 With the secondary short circuited, if 200 V is applied to a 200 KVA, 1-phase, 3300/400 V transformer, the current through primary was the full load value and the input power was 1650 W. Calculate the secondary terminal voltage and percentage regulation when the secondary load is passing 300 A at 0.707 p.f. lagging with normal primary voltage. **[388.41 V, 2.896%]**

QN11 A 500 KVA, 50 Hz, 6600V/400V, 1- phase transformer have primary and secondary winding resistances are 0.4 Ω and 0.001 Ω respectively. If the iron loss is 3.0 KW, calculate the efficiency at (a) full load (b) half full load. **[98.64%, 98.438%]**

QN12. A 200 KVA transformer has an efficiency of 98% at full load. If the maximum efficiency occurs at three quarters of full load, calculate the efficiency at half load. Assume p.f. of 0.8 at all loads. **[97.9%]**

QN13. A 600 KVA, 1- phase transformer has an efficiency of 92% both at full load and half load at unity p.f. Determine its efficiency at 60% of full load at 0.8 p.f. lagging. **[85.9%]**

QN14 If a three phase star/delta, 33 KV/11KV, 50 Hz, transformer is loaded with a delta connected load of 100 Ω per phase, calculate the primary line current. **[63.5 A]**

QN15 A three phase delta/star, 11 KV/400V, 50 Hz, distribution transformer has a star connected balanced load of (4+j6) Ω per phase. Calculate the primary line current. **[1.16 A]**

QN16 A 300 KVA, 11 KV/400V, delta/Y, three phase transformer has star connected balanced load of 60 kW at power factor of 0.8 lagging in each phase. Calculate primary line current. **[11.81]**

QN17 An 11KV/400V delta/star 3-phase transformer has balanced star connected load of 60 KW at p.f. of 80% lagging per phase. Calculate the primary line current. If the transformer has iron loss of 1.0 KW, calculate the approximate efficiency of the transformer. Given that primary winding resistance and leakage reactance are 25Ω per phase and 30Ω per phase respectively. Secondary winding resistance and leakage reactance are 0.01Ω per phase and 0.02Ω per phase respectively. **[11.81A, 95.92%]**

QN18 A 500 KVA, 33/11 KV, 3-phase, 50 Hz delta/star transformer has resistances of 35 Ω per phase at high voltage side and 0.876 Ω per phases at low voltage side. If iron loss is 3050W, Calculate the efficiency at full load and one half of full load respectively (a) at unity p.f. (b) at 0.8 p.f. lagging. **[98.54%, 98.2%, 98.35%, 98%]**