Problem Set (1)

1) A 4-pole 220V, 10 kVA synchronous generator is running at 1800 rpm. a. If the maximum flux per pole is 0.01 Weber and the armature has 100 turns per phase, neglecting the armature resistance and assuming that the synchronous reactance is 1 Ω, calculate,

a) The generator induced voltage.

b) How much power (active and reactive) can be delivered by this generator at rated terminal voltage and 0.8 power factor lagging? What is the power angle in this case?

2) A 100-kVA, 400/2000 V, single-phase transformer has the following parameters:

\[ R_1 = 0.01 \, \Omega \quad R_2 = 0.25 \, \Omega \]
\[ X_1 = 0.03 \, \Omega \quad X_2 = 0.75 \, \Omega \]

The transformer supplies a load of 80 kVA at 2000 V and 0.85 PF leading.

a) Calculate the primary voltage and current using the simplest equivalent circuit.

b) Find also the voltage regulation (V.R.) and efficiency for the transformer.

3) A 50-kVA, 2300/230-V, single-phase transformer draws 200 VA at power factor of 0.15 from a 230 V supply at no load. If the voltage drops due to resistance and leakage reactance are 12% and 18% of the rated voltage when the transformer is operated at rated load.

**1.** Draw the transformer equivalent circuit referred to the primary showing the numerical values of all the resistances and reactances.
2. Calculate the input power and power factor when the load is 30 kW at 0.8 PF lagging at rated voltage.

4) A 500 KVA, 2300/230 V single phase transformer delivers full rated KVA at 0.8 p.f lagging to a load at rated secondary voltage. The primary voltage magnitude is 2400 V under these conditions and the efficiency is 0.97. Find the equivalent circuit parameters of this transformer neglecting the no load circuit.

5) A 9375 kVA, 13,800 kV, 60 Hz, two pole, Y-connected synchronous generator is delivering rated current at rated voltage and unity PF. Find the armature resistance and synchronous reactance given that the filed excitation voltage is 11935.44 V and leads the terminal voltage by an angle 47.96°.

6) A 100-kVA, 400/2000 V, single-phase transformer has the following parameters

\[ R_1 = 0.01 \Omega \quad R_2 = 0.25 \Omega \]
\[ X_1 = 0.03 \Omega \quad X_2 = 0.75 \Omega \]
\[ R_C = 450 \Omega \quad X_M = 150 \Omega \]

The transformer supplies a load of 90 kVA at 2000 V and 0.8 PF lagging

1. Calculate the primary voltage and current using the approximate equivalent circuit.
2. Calculate the voltage regulation (V.R.) and efficiency for the transformer.
3. Determine the condition for maximum efficiency of this transformer and find the maximum efficiency.