Electrical Machines-I (EEC402)

ASSIGNMENT-1

1. A 600 kVA, single-phase transformer has 600 turns on the primary and 120 turns on the secondary. The primary is connected to 200 V, 50 Hz supply. Calculate the following:(i) Secondary voltage on open-circuit (ii) Currents through the two windings at full-load (iii) Maximum value of flux. [(i) 400 V (ii) 30 A, 150 A (iii) 15 mWb]

2. A single-phase core type transformer has 400 primary turns. The net cross-sectional area of the core is 60 cm^2 and its magnetic length is 0.8 m. The primary voltage is 500 V, 50 Hz. What is the maximum flux density in the core? Assuming a relative permeability of 2000 at this flux density, calculate the magnetizing current. [0.938 Wb/m^2, 0.528 A]

3. A 200 kVA, 2000/440 V, 50 Hz, single-phase transformer gave the following test results:
O.C. test: 2000 V, 1.8 A, 1.75 kW (on HV side)
S.C. test: 13 V, 300 A, 1 kW (on LV side)
Determine the equivalent circuit parameters as referred to HV side.

[2286 Ω, 1274 Ω, 0.227 Ω, 0.868 Ω]

4. Calculate the % voltage regulation of a transformer in which the percentage resistance drop is 1% and percentage reactance drop is 5% when the power factor is (i) 0.8 lagging (ii) unity and (iii) 0.8 leading. [(i) 3.8% (ii) 1% (iii) -2.2%]

5. A 80 kVA, 2000/200 V, 50 Hz, single-phase transformer has impedance drop of 8% and resistance drop of 4%. Calculate the regulation of the transformer at full-load 0.8 pf lagging. Also find the pf at which voltage regulation will be zero. [7.35%, 0.5 leading]

6. A 1000 V, 50 Hz supply to a transformer results in 650 W hysteresis loss and 400 W eddy current loss. If both the applied voltage and frequency are doubled, find the new core losses. [1300 W, 1600 W]

7. In a 400 V, 50 Hz transformer, the total iron loss 2500 W. When the supply voltage and the frequency reduced to 200 V and 25 Hz respectively, the corresponding loss is 850 W. Calculate the eddy current loss at normal voltage and frequency. [1600 W]

8. A 500 kVA transformer has 250 W core losses and 1200 W copper losses at full-load. Find efficiency of the transformer at: (i) full-load and 0.8 pf lagging (ii) full-load and unity pf (iii) half-load and 0.8 pf lagging (iv) At how much load, the transformer will have maximum efficiency? (v) What is the value of maximum efficiency at unity pf and 0.8 pf lagging?

[(i) 99.6% (ii) 99.7% (iii) 99.726% (iv) 45.6% of full-load (v) 99.78% (vi) 99.73%]

9. A 500 kVA transformer has an iron loss of 5 kW and the maximum efficiency at 0.8 pf occurs when the load is 300 kW. Calculate (i) the maximum efficiency at unity pf (ii) the efficiency at full-load and 0.7 pf lagging. [(i) 97.4% (ii) 96.2%]

10. A single-phase transformer working at unity pf has an efficiency of 92% at both half-load and full-load of 500 kW. Determine the efficiency at 80% of full-load. [92.37%]