Electrical Machines-I (EEC402)

ASSIGNMENT-2

1. A 10 kVA, 2000/200 V, 50 Hz, single-phase transformer has the following test results:

O.C. test: 200 V, 0.8 A, 60 W (on LV side)

S.C. test: 40 V, 4 A, 70 W (on HV side)

Find the efficiency of the transformer (i) at full-load and 0.8 pf lagging (ii) at half-load and 0.8 pf lagging. [(i) 97.93% (ii) 97.86%]

2. A 25 kVA, 240/2400 V transformer has the following parameters referred to the LV side: total series impedance $(0.1 + j1.0)\ \Omega$, shunt conductance 0.012 mho, shunt susceptance 0.09 mho. Determine its maximum efficiency and the corresponding unity pf load when the transformer is operating at 240 V. [92%, 63.7% of full-load]

3. A transformer has an maximum efficiency of 98% at 15 kVA and unity pf. During the day, it is loaded as under:

12 hours: 2 kW at pf 0.5 lagging

6 hours: 12 kW at pf 0.8 lagging

6 hours: 18 kW at pf 0.9 lagging

Find the all-day efficiency. [96.98%]

4. An auto-transformer supplies a load of 4 kW at 100 V and 0.8 pf.If the primary supply voltage is 200 V, determine (i) number of turns in the secondary if primary number of turns is 400 (ii) secondary current (iii) primary current (iv) power transformed (v) power conducted directly (vi) percentage of copper saved as compared to a two-winding transformer used to transform 200 V to 100 V.

[(i) 200 (ii) 50 A (iii) 25 A (iv) 2000 W (v) 2000 W (vi) 50%]

5. A 50 kVA, 1000/100 V, single-phase two-winding transformer is to be connected to work as 1000/1100 V auto-transformer. Find kVA rating of the auto-transformer. [550 kVA]

6. The full-load efficiency of a 50 kVA, 250/500 V, single-phase, two-winding transformer is 95% at unity pf. Find full-load efficiency at unity pf when the same transformer is reconfigured as a 500/750 V auto-transformer. [98.276%]

7. Two single-phase transformers with equal voltage ratios have impedances of (0.819 + j2.503) Ω and (0.8 + j2.31) Ω with respect to the secondary. If they operate in parallel. how will they share a total load of 2000 kW at 0.8 pf lagging? [956.6 kW, 1043.4 kW]

8. Two transformers A and B are connected in parallel to a load of (2 + j1.5) Ω. Their impedances in secondary terms are Z_A = (0.15 + j0.5) Ω and Z_B = (0.1 + j 0.6) Ω. Their no-load terminal voltages are $E_A = 207\angle 0^o$ V and $E_B = 205\angle 0^o$ V. Find the power output and pf of each transformer. [6548 W, 4932 W, 0.818 lag, 0.776 lag]

9. Three identical single-phase transformers are connected in delta-delta. Each transformer is rated at 20 kVA, 2300/230 V and the bank supplies a 40 kVA load at 0.7 pf lagging. If one transformer becomes defective and is removed for repair, calculate for the V-V connecction- (i) the kVA laod carried by each transformer (ii) percentage rated load carried by each transformer (iii) total kVA rating of the transformer bank in V-V (iv) ratio of V-V to delta-delta bank transformer ratings (v) percentage increase in the load on each transformer when one transformer is removed. Comment on the results.

[(i) 23.1 kVA (ii) 115.5% (iii) 34.62 kVA (iv) 0.577 (v) 173.2%]

10. Resistive loads of 5 Ω and 10 Ω are connected, respectively, across the teaser and main transformer secondaries of a Scott-connected transformer arrangement, fed from a three-phase, 230 V supply mains. If the main transformer primary to secondary turns ratio is 2, then determine the supply line currents. Neglect the magnetizing current and internal impedance drops. [13.28 A, 8.784 A, 8.784 A]