EE1100, Basic Electrical Engineering – HW 4 (part-1)

1.

(a) A practical transformer takes no power from the mains when it's secondary is open circuited. (True/False).

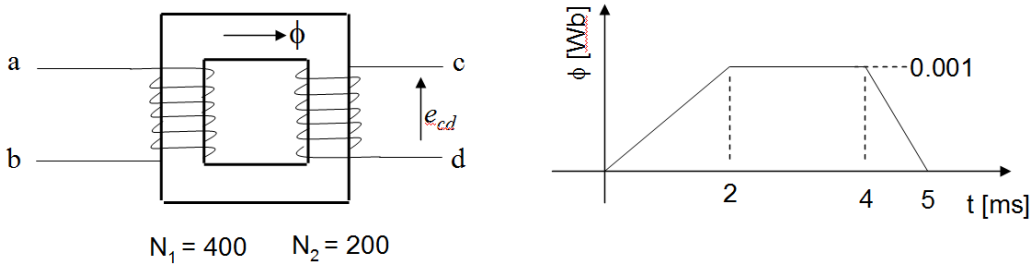
(b) An ideal voltage source of 1.5 V (dc) is connected across the primary of an ideal transformer with turns-ratio 10:1. What will be the secondary voltage?

(c) A transformer is a practical realization of the theory of mutual induction. (True/False)

(d) A transformer is often used for multiplying electric power. (True/False)

(e) Consider a step-down transformer with a voltage rating of 220V/110V. An impedance 'Z' is connected in the secondary of the transformer. What will be the equivalent value of 'Z' referred to the primary side of the transformer?

2. The core of a two winding transformer is subjected to a magnetic flux variation as indicated in figure below. Sketch the induced voltage e_{cd} in the secondary of the transformer as a function of time.



3. The design requirements for a 2200V/110V, 50 Hz, single phase, core type transformer are (a) volt/turn of 2.2 V and (b) peak flux density of 1.5 T. Find the suitable number of turns for the primary and secondary windings and the net cross-sectional area of the core.

4. An ideal transformer, connected to a 230 V mains, supplies a 5 V, 50W lamp. Calculate the transformer turns-ratio and current taken from the supply mains.

5. The secondary of a 220V/110V single phase transformer is connected to a purely resistive load. The no load current drawn is 1 A, and the secondary current is 2A. What will be the primary current, if core loss and leakage reactance are neglected?

6. The primary winding of an ideal 10 kVA, single-phase transformer (N_1 = 6000 turns and N_2 = 400 turns) is connected to a 3.3 kV, 50 Hz supply. Calculate (a) the secondary voltage on no-load, (b) values of the primary and secondary currents on full-load.

7. A 2200V/220V transformer draws 0.5A and absorbs 400W when no load is connected in the secondary (open circuit). Find the magnetising and iron loss currents. Draw the no-load phasor diagram for this transformer.

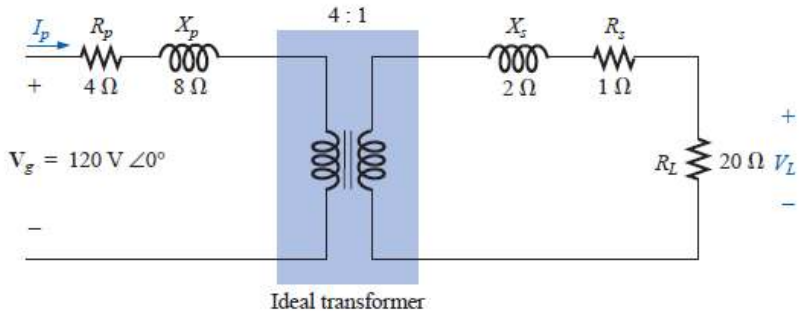
8. A single phase 440V/220V transformer draws no-load current of 5A at 0.3 p.f. lagging, when the primary is connected to a 440 V supply. If the secondary supplies a current of 120A at a power factor of 0.8 lagging, estimate the current taken by the primary. Draw a phasor diagram and indicate the no-load current, secondary load current and the total primary current. Draw the same for a secondary current of 120A, 0.8 leading.

9. The equivalent circuit of a transformer is given below. The core loss resistance and magnetising reactance are neglected (hence the shunt branch is not shown). Determine,

    (a) the equivalent resistance referred to primary

    (b) the equivalent reactance referred to primary

    (c) (draw) the equivalent circuit of the transformer referred to primary



10. In a 50 kVA, 11 kV/400V transformer, the iron and copper losses are 500 W and 600W respectively, under rated conditions. Calculate the efficiency on unity power factor at full load. Find the load current for maximum efficiency and the iron and copper losses corresponding to this load current.