Power Engineering - II
EE 238
Spring 2021
Quiz – 1

FM: 20

Q1. A single phase transformer having $N_1 = 100$ and $N_2 = 200$ is shown in Figure 1. Mention all the possible locations where (A and/or B and/or C and/or D) you can mark the dot(s). [2]

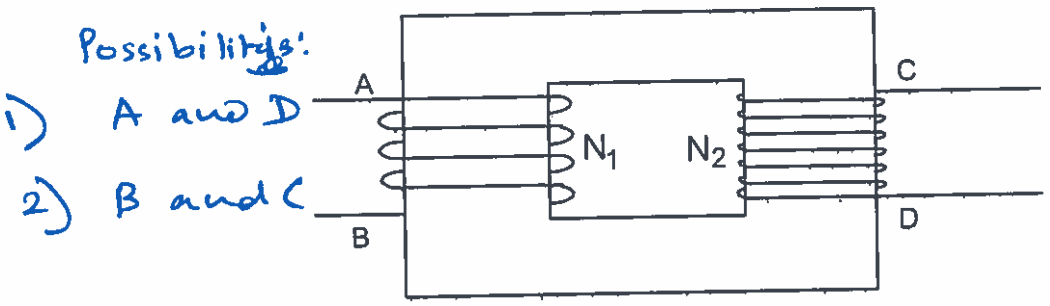


Figure 1

Q2. A 1 kVA, 50 Hz, 200V/800V single phase transformer is having $N_1 = 100$ and $N_2 = 400$ is shown in Figure 2. The LV side of the transformer is supplied from a 200 V, 50 Hz sinusoidal ac supply. The terminal B of the LV side is connected to the terminal C of the HV side. Determine the readings of the ac voltmeter, V_1 (ac voltmeters measure rms value of voltages) connected in the aforesaid circuit between the terminals, A and D. [3]

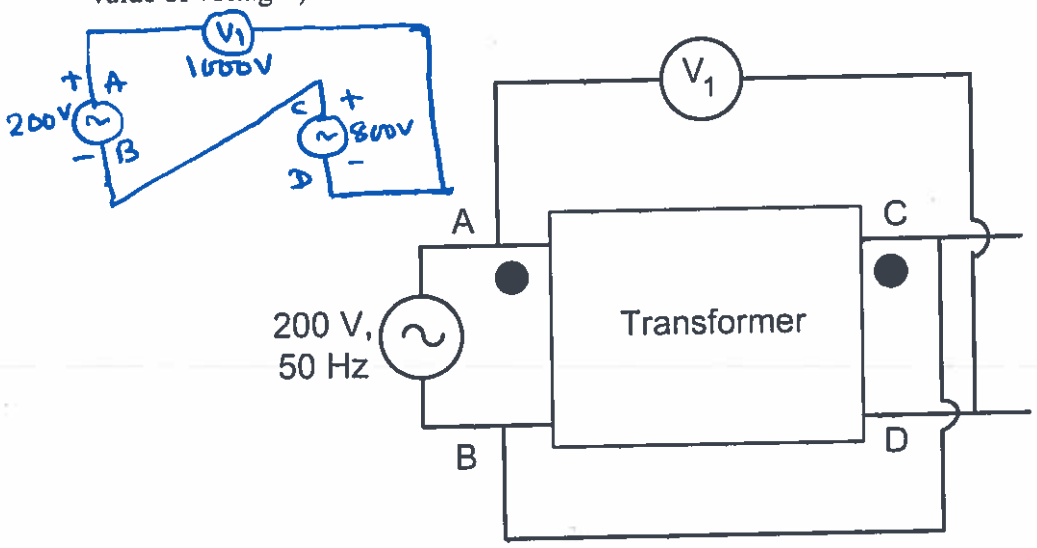


Figure 2

Q3) The mmf wave distribution in the air gap of an induction machine (from 0^0 to $+90^0$ and 0^0 to -90^0) due to only phase-A distributive winding is shown in Figure 1A. The mmf wave distribution from $+90^0$ to $+180^0$ and from $+180^0$ to -90^0 remains symmetric to that of the distribution shown between 0^0 to $+90^0$ and 0^0 to -90^0. The rotor conductors of the machine are removed. Each slot of the stator winding for phase-A of the machine shown in the figure 1B is having 5 conductors and each conductor is carrying 1 A of dc current. Indicate the current distribution (dots and/or crosses) in Figure 1B. **[5 marks]**

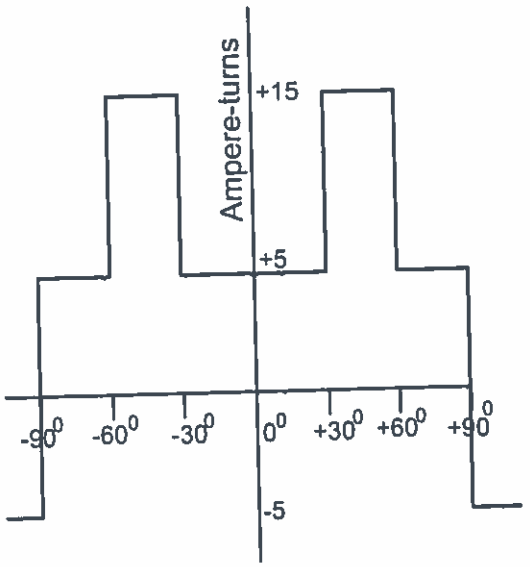


Figure 1A

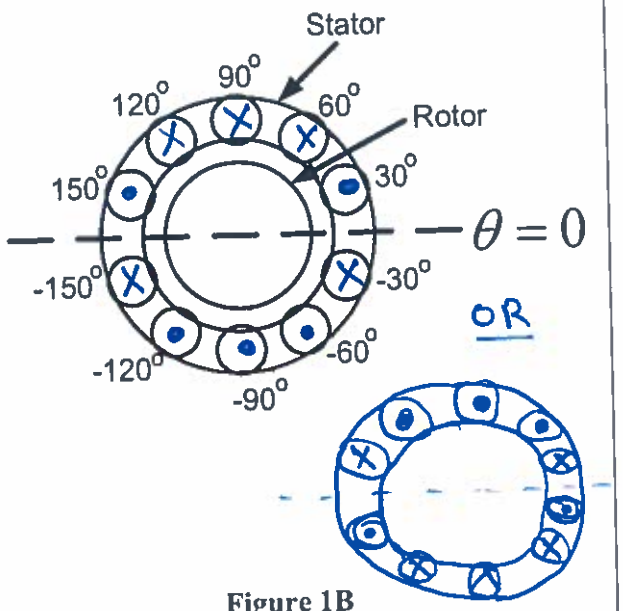


Figure 1B

Q4) The locations of Phase-A, Phase-B and Phase-C stator windings (they are distributed winding, however they are represented as concentrated one) of a three phase 2 pole induction machine is shown in Figure 2A and the location of the Phase-A windings of a three phase 4 pole induction machine is shown in Figure 2 B.

1) Indicate on the figure the mechanical angle that exists between 'a' and 'b/' in Figure 2A.

2) Indicate the location b_1, b_1' and b_2, b_2' (as concentrated winding) in Figure 2B with properly indicating the mechanical angles that exist between them with respect to a_1, a_1' and a_2, a_2'

[(2+5) marks]

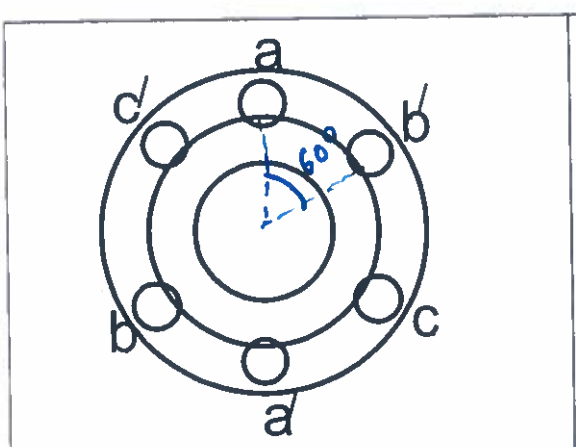


Figure 2A

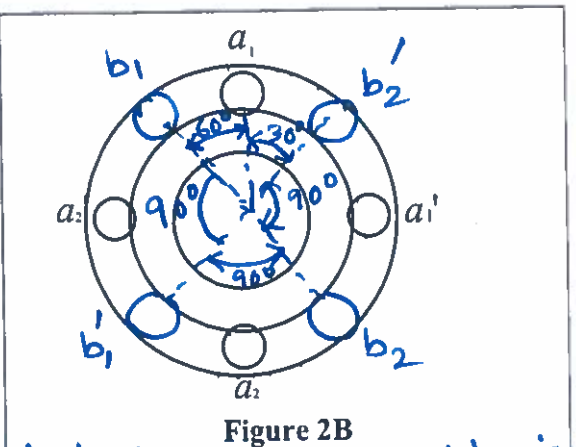
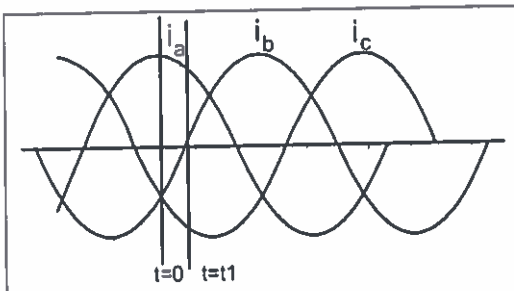


Figure 2B

Angle between a_1 and b_1 is 60^0

Q5) The stator of the 3 phase, 2 pole induction machine of Figure 2A is excited with three sinusoidal currents, i_a, i_b, and i_c as shown in Figure 3A. The mmf produced by each coil is sinusoidally distributed in space. The peak mmf produced by a phase winding while it is excited with its peak current is F_m. The magnetic axes of the three coils which are displaced in space from each other by 120^0 are indicated in Figure 3B (mmf is produced along theses axes when 'dot' currents are carried by a, b and c and 'cross' currents are carried by a', b' and c'. Indicate the location and magnitude of the resultant mmf at $t = t_1$

[3 marks]



$i_a = I_m \cos \omega t$

$i_b = I_m \cos(\omega t - 120^0)$ **Figure 3(A)**

$i_c = I_m \cos(\omega t - 240^0)$

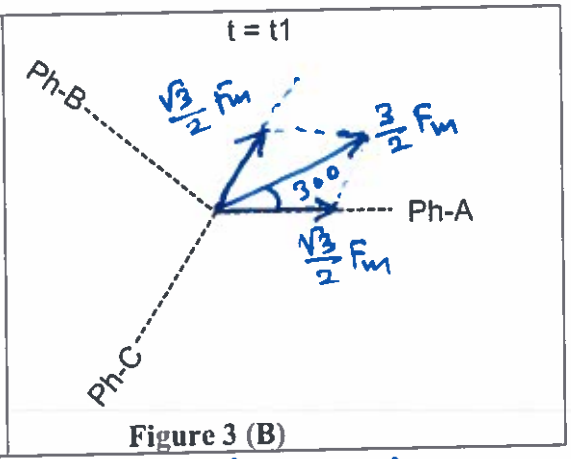


Figure 3 (B)

If the magnitude of resultant mmf is not correct or not provided, deduct 1 mark. If the location ~~was wrongly marked~~ of Ph-A magnetic axis is not marked to be 30° ahead but visually it appears to be correct deduct 0.5 mark.