BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
First Semester 2022-2023
EEE/INSTR/ECE F211: Electrical Machines
Mid Semester Test (Open Book)

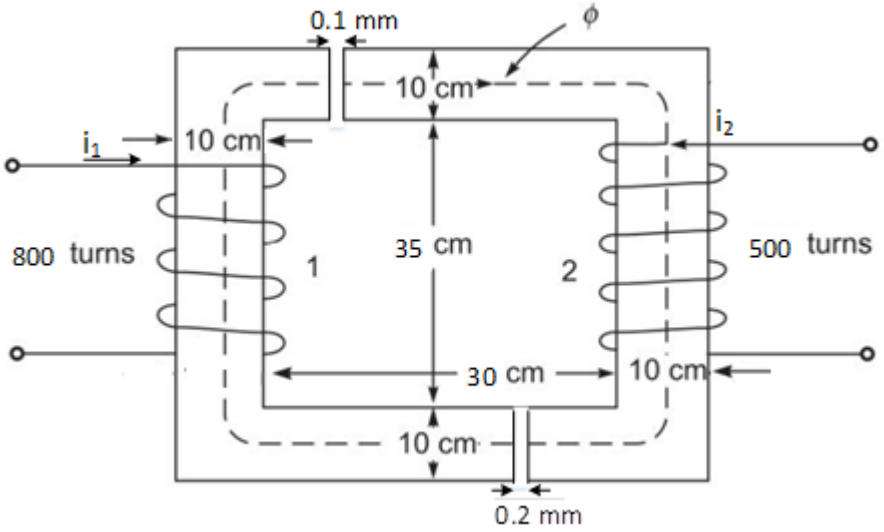
Max Marks: 75 **Time: 90 Min** **Date: 02-11-2022**

Note: There are 4 questions in total. Attempt all sub-parts of a question together.

Q1. A 4 pole, star connected alternator runs at 1500 rpm. The armature winding is of two-layer type. The coils are connected in such a way that the 5^{th} harmonic gets eliminated therefore short pitched by 3 slots. The flux/pole is 0.286 Wb and generated line voltage is 6000V. Calculate the number of conductors/slot/layer. [20]

Q2. The magnetic core in figure shown below is wound with two coils and has two air-gaps. If coil-2 carries 3 A current in the direction shown, then what should be the current in coil-1 to establish a flux density of 1.4 T in the air gaps? If the coil-2 carries 3 A current but in the opposite direction, then what will be the current in coil-1? The B-H curve data for the core material is as follows. [15]

H (AT/m)	100	300	600	900
B(T)	0.14	0.75	1.3	1.4



Q3(a). The maximum efficiency of a 500kVA, 3300/500 V, 50 Hz, single phase transformer is 97% and occurs at 75% of full load and unity power factor. If the leakage impedance is 10%, calculate the [15]

(i) full load copper loss
(ii) resistance and reactance in per unit and
(iii) voltage regulation at full load, and 0.8 pf lagging.

(b) Scott-connected transformers are supplied from 11 kV, 3-phase, 50 Hz mains. The secondaries of these transformers are connected in series to supply a two phase resistive load which draws 500 A at a voltage of $200\sqrt{2}$ V. Calculate the (i) turns-ratio of the teaser transformer and (ii) input line current I_B and I_c. [10]

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Q4. Two single phase transformers A and B when tested, provided the following short circuit test results:

Transformer A : 60 V; 26.83A; 288 W

Transformer B : 60 V; 33.28A; 664 W

These transformers are now connected in parallel for supplying a load of (5+j3) Ω. The no-load emf of transformer A is 510 V and that of transformer B is 500 V. Calculate the following:

(i) Circulating current at no load

(ii) Current output of each transformer and its power factor

(iii) Calculate the reactance to be connected in series with transformer B so that the magnitude of current is shared equally. [15]