

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**  
**(MID-SEMESTER EXAMINATION)**

**CLASS: B.TECH.**  
**BRANCH: EEE**

**SEMESTER: IV**  
**SESSION: SP/2024**

**SUBJECT: EE251 DC MACHINES AND TRANSFORMER**

**TIME: 02 Hrs.**

**FULL MARKS: 25**

**INSTRUCTIONS:**

- 1 The total marks of the questions are 25.
2. Candidates attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

		CO	BL
Q1	(a) While drawing a phasor diagram of an ideal transformer, the flux vector is drawn 90° out of phase (lagging) to the supply voltage. Why?	[2] 1, 2, 3	2
	(b) A power transformer has 1000 primary turns and 100 secondary turns. The cross-sectional area of the core is 6 cm <sup>2</sup> , and the maximum flux density while in operation is 10000 Gauss (= 1 tesla). Calculate turns per volt for the primary and secondary windings when the frequency is 50Hz.	[3] 1, 2, 3, 4, 5	4
Q2	(a) Even at no load, a transformer draws current from the mains. Why?	[2] 1, 2, 3, 5	2
	(b) Explain, "The main flux in a transformer remains practically invariable under all load conditions."	[3] 1, 2	2
Q3	When the OC Test and SC Test were performed on a 50 kVA transformer, the following results were obtained: Open circuit tests: Primary voltage 3300 V, Secondary voltage 415 V, Power 430 W Short circuit test: Primary voltage 124 V, Primary current 15.3 A, Primary Power 525 W, Secondary Current at full load value. Calculate: (a) The efficiency at full-load and half-load for 0.7 power factor. (b) The voltage regulation for power factor 0.7: (i) lagging, (ii) leading (c) The secondary terminal voltages corresponding to (i) and (ii).	[5] 1, 2, 3, 4, 5	4
Q4	(a) What is the difference between a 3-phase transformer bank and a 3-phase transformer unit? What are the advantages of a three-phase unit transformer over three single-phase transformer bank of the same kVA rating?	[2] 1, 2, 3, 5	2
	(b) What is meant by three-phase transformer groups? What are the possible connections for a 3-phase transformer bank?	[3] 1, 2, 3, 5	1
Q5	(a) What are the conditions for satisfactory parallel operation of a 3-phase transformer?	[2] 1, 2, 5	1
	(b) A load of 500 A, at 0.8 power (lagging), at a terminal voltage of 400 V, is supplied by two transformers that are connected in parallel. The equivalent impedances of the two transformers referred to the secondary side are (2 + j3) ohm and (2.5 + j5) ohm, respectively. Calculate the current and kVA supplied by each transformer and the power factor at which they operate.	[3] 1, 2, 3, 4, 5	4

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