BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID-SEMESTER EXAMINATION SP/2025)

CLASS: BTECH **SEMESTER: IV/ADD**
BRANCH: EEE **SESSION: SP/2025**

SUBJECT: EE251 DC MACHINES AND TRANSFORMER

TIME: 02 Hrs. **FULL MARKS: 25**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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Q1	(a)	Draw the phasor diagram of a practical single-phase transformer operating at no load condition. (Mention the name of each phasor component)	[2]	1, 2, 3	2
	(b)	What are the major losses that occur at no load operation of transformers? How do these no-load losses depend on supply voltage and frequency? Explain with appropriate equations.	[3]	1, 2, 3,	4
Q2	(a)	What do you mean by voltage regulation of a transformer? What is positive and negative voltage regulation?	[2]	1, 2, 3	2
	(b)	Derive the condition (load power factor) for zero voltage regulation of single-phase transformer.	[3]	1, 2	2
Q3		When the standard OC Test and SC Test were performed on a 15 kVA, 2300/230 V, 50 Hz single-phase transformer, the following results were obtained: Open circuit tests: Input voltage 230 V, Input current 2.1 A, Power 50 W Short circuit test: Input voltage 47 V, Input current 6 A, Power 160 W Calculate: (a) Calculate equivalent circuit parameters referred to low voltage side (b) Efficiency at half the rated load at unity power factor (c) Maximum efficiency and corresponding maximum output power at unity load power factor	[5]	1, 2, 3, 4, 5	4
Q4	(a)	What are different possible three-phase transformer connection groups? Draw the winding connections and phasor diagram of induced voltages of HV and LV sides for any one type of phasor group.	[2]	1, 2, 3	2
	(b)	Prove that for the delta-delta connection of 3-phase transformer, if any one phase gets disconnected, the output capacity becomes 57.7% of standard 3-phase capacity.	[3]	1, 2, 3, 5	1
Q5	(a)	What are the conditions for satisfactory parallel operation of single-phase transformers?	[2]	1, 2, 5	1
	(b)	A single phase 20 kVA, 440/220 V transformer with an equivalent impedance of 0.01 Ω is to operate in parallel with a single phase 15 kVA, 440/220 V transformer with an equivalent impedance of 0.015 Ω. The two transformers are connected in parallel to supply a load of 25 kVA. Calculate, the kVA supplied by each transformer and the secondary (low voltage side) currents of both the transformers. Assume both the impedances of the two transformers have the same angle. Neglect no load current.	[3]	1, 2, 3, 4, 5	4

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