BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B.TECH **SEMESTER : IV/ADD**
BRANCH: EEE **SESSION : SP/2025**

SUBJECT: EE251 DC MACHINES AND TRANSFORMER

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Draw the exact equivalent circuit of a 1-phase transformer. Explain how the exact equivalent circuit gets simplified during short circuit and open circuit tests and draw these approximate simplified equivalent circuits under the above-mentioned two tests.	[5]	1,2	2
Q.1(b)	A short circuit test, when performed on the high voltage side of a single phase, 10 kVA, 2000/400 V transformer gave following data: 60 V, 4 A, 100 W. If the above-mentioned transformer delivers full load (rated) current at 0.8 power factor lagging and at 400 V (load voltage), find the voltage regulation and the applied voltage to the high voltage side (input supply voltage).	[5]	3,4	3
Q.2(a)	What is meant by phasor group 11 o'clock and 1 o'clock in 3-phase transformer. Draw one possible winding connection and corresponding phasor diagram for each of these two phasor groups to justify such naming of the phasor groups.	[5]	1,2	2
Q.2(b)	Show how 3-phase to 2-phase conversion is done using Scott connection with appropriate winding connection and phasor diagram.	[5]	2,3	3
Q.3(a)	Derive the emf and torque equation of DC machine.	[5]	1	2
Q.3(b)	A DC shunt generator delivers 50 kW at 250 V and 400 rpm. The armature and field resistances are 0.02 Ω and 50 Ω respectively. Calculate the speed of the machine running as DC shunt motor and taking 50 kW input at 250 V supply. Assume brush contact drop to be 1 V per brush and neglect armature reaction.	[5]	2,3	3
Q.4(a)	What is meant by armature reaction? Mention the effects of armature reaction on the operation of the DC machine. How is the armature reaction minimized?	[5]	1,3	4
Q.4(b)	Describe the voltage build up process in DC shunt generator. Also, explain why DC shunt generators are self-protective against accidental short circuit (of its supply terminals).	[5]	4,5	4
Q.5(a)	Draw torque-current and torque-speed characteristics of DC shunt and series motors and explain with appropriate equations.	[5]	2,3,4	4
Q.5(b)	A DC series motor takes 20 A at 400 V and runs at 250 rpm. The armature resistance is 0.6 Ω and field resistance is 0.4 Ω. The load torque varies as the square of the speed. The motor is running under armature voltage control method of speed control. Find the applied voltage and armature current to run the motor at 350 rpm. Neglect saturation and armature reaction.	[5]	3,4,5	5

::::::28/04/2025::::::M