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

CLASS: B.Tech **SEMESTER : V/ADD**
BRANCH: EEE **SESSION : MO/2025**

SUBJECT: EE301 AC ROTATING MACHINES

TIME: 02 Hours **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**

			CO	BL
Q.1(a)	Elaborate the statement "In synchronous machine why we keep AC on stator and DC on rotor" with proper diagrams.	[2]	1	2
Q.1(b)	Find the chording factor and belt factor for a 3-phase, 4-pole, 16-slot alternator if: i) The winding is short-pitched by 3 slots ii) The coil span is $11/12^{th}$ of pole pitch.	[3]	1	2
Q.2(a)	Discuss chording factor and belt factor and derive the expression of belt factor for fractional slot winding using emf polygon method for nth harmonic component.	[2]	1 & 2	2
Q.2(b)	A 3-phase, 6-pole, 72-slot alternator is designed with coils of span 5/6 of pole pitch. The machine is star-connected with double layer winding configuration where each coil has 12 turns, and the fundamental flux per pole is 0.03 Wb. (i) Find the distribution factor for the fundamental. (ii) Find the pitch factor for the fundamental and the 5th harmonic. (iii) Calculate the winding factor for both fundamental and 5th harmonic. (iv) Hence, compute the line emf at fundamental frequency (50 Hz) and also, comment on the presence of the 5th and 7^{th} order harmonic in the line voltage.	[3]	2 & 3	5
Q.3(a)	Discuss and develop the electrical equivalent model of a synchronous machine with the help of neat time phasor diagram.	[2]	2	3
Q.3(b)	A 5 MVA, 11kV (rated terminal voltage, L-L rms), 3-phase star connected alternator is synchronized to the bus bars and is operating with an induced EMF (per phase) of 125% of the rated voltage. If the load current is 500 A, what is the power factor of operation? The machine has a synchronous reactance of 5 Ω and resistance of 0.5 Ω per phase.	[3]	2 & 3	4
Q.4(a)	Discuss the effect on load angle, power factor, reactive power and stator current with increase in mechanical input under constant excitation condition for a synchronous machine connected to an infinite bus-bar with the help of time phasor diagram.	[2]	2	2
Q.4(b)	Evaluate the voltage regulation using MMF method for synchronous machine.	[3]	2	4
Q.5(a)	Define armature reaction and analyze the impact of armature reaction in an alternator at 0.8 p.f leading with the help of time phasor diagram.	[2]	2	4
Q.5(b)	Explain how the Open-Circuit (O.C.) and Short-Circuit (S.C.) tests are performed on a round-rotor synchronous machine. Using these tests determine the synchronous reactance in both the unsaturated and saturated regions, and evaluate the Short-Circuit Ratio (SCR).	[3]	2	4

:::::16/09/2025 M:::::