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

CLASS: BTech **SEMESTER : VI**
BRANCH: EEE **SESSION : SP/2025**

SUBJECT: EE465 ELECTRICAL MACHINE DESIGN

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)	Outline in detail about electrical properties of insulating material.	[5]	1	1
Q.1(b)	Explain the effects of iron loss with number of poles in dc motor.	[5]	2	2
Q.2(a)	A 10 kW, 500 V, 4-pole, 1500 rpm DC shunt generator has the average flux density in the air gap as 1.2 Wb/m^2 and the specific electric loading is 20,000 A/m. Calculate the main dimensions of the machine if it has to be designed with square pole face. Assume the ratio of pole arc to pole pitch as 0.6 and full load efficiency as 80%.	[5]	2	3
Q.2(b)	Derive the volt/turn output equation of a single-phase transformer	[5]	3	3
Q.3(a)	Derive the condition for the design of minimum cost of single -phase transformer.	[5]	3	3
Q.3(b)	A three-phase, 50 Hz oil cooled core-type transformer has the following dimensions. Distance between core centres = 0.2 m, height of window = 0.24 m, diameter of circumscribing circle = 0.14 m. The flux density in the core = 1.25 Wb/m^2, current density in conductor = 2.5 A/mm^2. Assume a window space factor of 0.2 and core area factor of 0.56. The core is two stepped. Calculate the kVA rating of transformer.	[5]	3	3
Q.4(a)	Analyse the effect of length of air-gap on the performance of induction motor.	[5]	4	4
Q.4(b)	Calculate the main dimensions, turns per phase of a 250 h.p., 3 phase, 50 Hz, 400 V, 1410 r.p.m. slip ring induction motor. Assume Bav = 0.6 Wb/m^2, ac = 30000 A/m, efficiency = 0.9, power factor = 0.9, winding factor = 0.955, current density = 3.5 A/mm^2, slot space factor = 0.4, ratio of core length to pole pitch = 1.2. This machine is delta connected.	[5]	4	4
Q.5(a)	Outline the factors which influence the choice of specific loadings for synchronous motor.	[5]	5	5
Q.5(b)	Determine the main dimensions for a 1000 kVA, 50 Hz, 3 phase, 375 r.p.m. alternator. The average air gap flux density is 0.55 Wb/m^2 and the ampere conductors per meter are 28,000. Use rectangular poles and assume a suitable value for ratio of core length to pole pitch in order that bolted on pole construction is used for which the maximum permissible peripheral speed is 50 m/s. The run away speed is 1.8 times the synchronous speed.	[5]	5	6

::::::30/04/2025::::::M