Code No. : 18321

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD
Accredited by NAAC with A++ Grade
B.E. (E.E.E.) VIII-Semester Main & Backlog Examinations, June-2022
Electrical Machine Design (PE-V)

Time: **3 hours**   Max. Marks: **60**

*Note: Answer all questions from **Part-A** and any FIVE from **Part-B***

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Gross core length of an electrical machine is 0.35 m. Calculate the thickness of laminations neglecting air presence in stacking. Assume stacking factor as 0.95	2	3	1	1,2,3,4
2.	A machine using copper conductors has a rating of PkW. If the conductor are replaced by Aluminum conductors. What is the rating of machine? Assume same temperature rise.	2	1	1	1,2,3,4
3.	Calculate the window space factor of a 75 kVA, 11/33 kV, 3 phase transformer	2	3	2	1,2,3,4
4.	If the diameter meter of the circumscribing circle is 0.32m then the width of window for maximum output is_____	2	3	2	1,2,3,4
5.	A 11 kW, 3phase, 6 pole , 50 Hz, 220 V , Star connected induction motor has 50 slots, each containing 10 conductors. Rotor mmf is 85% of stator mmf. If there are 66 rotor bars. Determine the current in end rings is (The machine has an efficiency of 0.86 and a power factor of 0.85)	2	3	3	1,2,3,4
6.	Justify the statement that larger length of air gap in induction machine results in reduced tooth pulsation losses and reduced Noise.	2	2	3	1,2,3,4
7.	Write the output equation of synchronous machine in terms of its peripheral speed	2	1	4	1,2,3,4
8.	Determine the field current required to drive short circuit current of a synchronous machine if short circuit ratio is 1.2 and the field current required to drive open circuit voltage is 5 A.	2	3	4	1,2,3,4
9.	Draw the flow chart of analytic method of Electric machine design.	2	2	5	1,2,3,4
10.	Enumerate the advantages of claw pole motor.	2	1	5	1,2,3,4

Part-B (5 × 8 = 40 Marks)

11. a)	Explain the classification of insulating materials with examples.	4	1	1	1,2,3,4
b)	The existing coil of an electromagnet has a cross section of 120X50 mm^2 and a length of mean turn of 0.8 m. It dissipates 150 W continuously. It's cooling surface is 0.125 m^2 and specific heat dissipation is 30 W/m^2-^{0}C. Calculate the final temperature rise of coil surface.	4	3	1	1,2,3,4

			M	L	CO	PO
12.	a)	Determine the main dimensions of the core and window for a 500 kVA, 6600/400V, 50Hz, Single phase core type, oil immersed, self cooled transformer. Assume: Flux density = 1.2 T, Current density = 2.75 A/mm^2, Window space factor = 0.32, Volt / turn = 16.8, type of core: Cruciform, height of the window = 3 times window width. Also calculate the number of turns and cross-sectional area of the conductors used for the primary and secondary windings.	4	3	2	1,2,3,4
	b)	Explain the calculation of number of tubes required to maintain a specified temperature in transformer.	4	2	2	1,2,3,4
13.	a)	Determine the main dimensions, turns per phase, number of slots, conductor cross section and slot area of a 250 HP, 3 phase, 50 Hz, 400 V, 1410 r.p.m slip ring induction motor. Assume B_{av}=0.5 Wb/m^2, ac=30000 A/m, efficiency =0.9 and power factor =0.9, winding factor =0.955, current density =3.5 A/mm^2. The slot space factor is 0.4 and the ratio of core length to pole pitch is 1.2. The machine is delta connected.	4	3	3	1,2,3,4
	b)	Discuss the design of Squirrel cage Induction machine rotor.	4	2	3	1,2,3,4
14.	a)	Derive the output equation of Synchronous machine.	4	1	4	1,2,3,4
	b)	Determine a suitable number of slots and conductor per slot, for the stator winding of a 3 phase 3300 V, 50 Hz, 300 rpm alternator. The diameter is 2.3 m and the axial length of core is 0.35 m. The maximum flux density in the air gap should be approximately 0.9 wb/m^2. Slot pitch is nearly 40mm for 3.3 kV.	4	3	4	1,2,3,4
15.	a)	With the help of a neat sketch explain the working principle of BLDC motor and construction.	4	1	5	1,2,3,4
	b)	Write short notes on general procedure for optimization in computer aided design.	4	2	5	1,2,3,4
16.	a)	An Induction motor has to perform the following duty cycles 75kW for 10 minutes, No load for 5 Minutes, 45 kW for 8 minutes, no load for 4 minutes. Which is repeated indefinitely. Determine a suitable capacity of continuously rated motor. Motors of standard ratings of 45, 55 and 75 kW are available. The ratio of maximum torque to nominal torque should be less than 1.8.	4	3	1	1,2,3,4
	b)	Derive the condition for window width for optimum output of transformer.	4	2	2	1,2,3,4
17.		Answer any *two* of the following:				
	a)	Calculate a) diameter b) length c) number of turns per phase d) cross section of stator conductors for a 3 phase 120 kW,220 volt, 50 Hz,750 rpm delta connected slip ring induction motor with the following data B=0.48 Tesla, ac=26000/m η= 0.92 pf=0.88, L=1.25τ and K$_w$=0.955 current density 5 A/mm^2.	4	3	3	1,2,3,4
	b)	Discuss the effect of Short Circuit Ratio on various synchronous machine performance specifications.	4	2	4	1,2,3,4
	c)	Explain the use of Finite element method in Electrical Machine design.	4	2	5	1,2,3,4

M : Marks;   L: Bloom's Taxonomy Level;   CO; Course Outcome;   PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	21%
ii)	Blooms Taxonomy Level – 2	35%
iii)	Blooms Taxonomy Level – 3 & 4	44%

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