R20 Regulation *Subject code:3E5BA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech V Semester Supplementary Examinations, July 2024

ELECTRICAL MACHINE DESIGN

(Professional Elective-I)

(EEE)

Maximum Marks: 70 Date:24.07.2024 Duration: 3 hours

Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

	Part-A	CO	Bloom Tx
All the following questions carry equal marks (10x2M=20 Marks)			
1	Why does an electrical machine get heated up while operating?	1	1
2	Define Specific Electrical and Magnetic Loadings	1	1
3	List different methods to cool a transformer	2	1
4	Why does a transformer take a finite current under no-load conditions also?	2	
5	State any two rules for selecting the number rotor slots in squirrel Cage Induction Motors	3	1
6	Does an induction motor runs at Synchronous Speed? Why?	3	1
7	What is use of Damper Bars in Synchronous Machines?	4	1
8	Why the air gap of a Salient Pole Machine is kept non-uniform?	4	2
9	What is the need of CAD analysis of electrical machine?	5	1
10	What are the advantages of SRM?	5	1
	Part-B		
Answer All the following questions. (5X10M=50Marks)			Bloom Tx level
11	Briefly discuss about the factors to be considered for effective Electrical Machine Design. [10]	1	3
	OR		
12.a	Discuss how the rating of electrical machines is fixed. [5]	1	3
b	What are the different engineering materials used for manufacturing the electrical machines? Highlight their significance. [5]	1	3
13	Determine the dimensions of core and yoke for a 150 kVA, 50 Hz single phase core type transformer. A cruciform core is used with distance between adjacent limbs equal to 1.6 times the width of core laminations. Assume voltage per turn 13V, maximum flux density 1.22 Wb/m^2, windows space factor 0.32, current density 3.75 A/mm^2, and stacking factor 0.9. The net iron area is $0.52d^2$ in a cruciform core where d is the diameter of circumscribing circle. Also, the width of largest stamping is 0.82d. [10]	2	4

	OR		
14.a	Explain the main steps in sizing of a transformer. [5]	2	3
b	Why the temperature rise in a transformer needs to be maintained below the guaranteed limits? Explain in detail. [5]	2	3
15	Determine the main dimensions of a 10 kW, three phase, 400V, 50 Hz, 2810 rpm. squirrel cage induction motor having an efficiency of 0.9 and a full load power factor of 0.89. Assume specific magnetic loading = 0.6 Wb/m2, specific electric loading = 20000 A/m. Take the rotor peripheral speed as approximately 15 m/sec at synchronous speed. [10]	3	4
	OR		
16.a	Explain the step-by-step procedure for constructing a Circle Diagram of a three-phase induction motor. [5]	3	3
b	Explain how the leakage reactance of a polyphase induction motor is calculated. [5]	3	3
17.a	Compare Salient pole type and Cylindrical type Synchronous Generators. [5]	4	3
b	Explain the importance of Short Circuit Ratio (SCR) of Synchronous Generator. [5]	4	3
	OR		
18	Determine the main dimensions of a 75 MVA,10 kV, 50 Hz, 150 rpm, three phase water wheel generator. The average gap density is 0.6Wb/m2 and ampere conductors per meter are 30000. The peripheral speed should not exceed 60m/sec at normal running speed in order to limit the runaway peripheral speed. [10]	4	4
19.a	Explain the assumptions of traditional design of electrical machines. [5]	5	3
b	Explain the construction and operation of BLDC. [5]	5	3
	OR		
20	Briefly discuss on different methods of optimizing the electrical machine designs. [10]	5	3