



Paper ID : 261590

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Subject Code:BEE062

Roll No:

BTECH
(SEM. VI) THEORY EXAMINATION 2025-26
ELECTRICAL MACHINE DESIGN

TIME: 3 HRS**M.MARKS: 70****Note:** Attempt all Sections. In case of any missing data; choose suitably.**SECTION A****1. Attempt all questions in brief.****02 x 7 = 14**

Q no.	Question	CO	Level
a.	Explain the objectives and factors involved in machine design.	1	K3
b.	Classify insulating materials based on thermal capability and applications.	1	K3
c.	Why are laminated cores used in transformers?	2	K2
d.	Differentiate between specific electric loading and current density.	3	K3
e.	Explain the importance of ampere-turns in field system design.	4	K2
f.	Draw a simple flow chart for transformer design calculations.	5	K2
g.	Why are iterative techniques used in machine design programs?	5	K3

SECTION B**2. Attempt any three of the following:****07 x 3 = 21**

a.	Explain the limitations encountered in electrical machine design and suggest methods to overcome thermal and magnetic constraints.	1	K3
b.	Explain voltage regulation in transformers and derive the expression for approximate voltage regulation under lagging and leading power factor conditions.	2	K3
c.	Compare the core design requirements of DC machines and 3-phase AC machines with respect to flux distribution, losses, ventilation and manufacturing complexity.	3	K3
d.	A 15 kW, 400 V, 50 Hz, 4-pole, three-phase induction motor operates at a slip of 4%. Determine the rotor frequency, rotor emf frequency and synchronous speed. Estimate the effect of slip variation on rotor copper losses.	4	K4
e.	Discuss the concept of optimization in electrical machine design. Explain the general optimization procedure with suitable examples related to transformer or induction motor design.	5	K5

SECTION C**3. Attempt any one part of the following:****07 x 1 = 07**

a.	Compare various classes of insulating materials used in electrical machines and justify their suitability for high-temperature applications.	1	K3
b.	A magnetic circuit is designed using two different core materials. Evaluate the effect of material selection on total MMF requirement, magnetizing current and overall machine efficiency.	1	K5

4. Attempt any one part of the following:**07 x 1 = 07**

a.	Explain the design considerations of transformer windings with respect to insulation, leakage reactance, cooling and mechanical strength.	2	K4
b.	A 100 kVA, 50 Hz, single-phase transformer is to be designed with a maximum flux density of 1.3 Wb/m^2 and emf per turn of 12 V. Determine suitable core area and number of turns for primary and secondary windings for 2200/220 V operation.	2	K6



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5. Attempt any one part of the following: 07 x 1 = 07

a.	Discuss the various factors affecting the size of rotating electrical machines. Explain how thermal, magnetic and mechanical considerations influence the selection of machine dimensions.	3	K5
b.	Critically examine the selection criteria of frame size in rotating machines with respect to cooling, vibration, mechanical strength and cost considerations.	3	K6

6. Attempt any one part of the following: 07 x 1 = 07

a.	Design the field system of a DC shunt generator rated 20 kW, 250 V, operating at 1000 rpm using suitable assumptions for ampere-turns and current density.	4	K6
b.	Explain the design procedure of rotor construction in three-phase induction motors. Discuss the effects of slot shape, rotor resistance and leakage reactance on motor performance.	4	K5

7. Attempt any one part of the following: 07 x 1 = 07

a.	Write a 'C' program for determining the main dimensions of a DC machine using given output specifications and design constants. Explain the logic of the program using a flow chart.	5	K3
b.	Develop a flow chart for the computer aided design of a single-phase transformer and explain each step involved in the algorithm.	5	K6