NIRMA UNIVERSITY

Institute:	**Institute of Technology, School of Engineering**
Name of Programme:	**B. Tech. in Electrical Engineering**
Semester:	**VII**
Course Code:	4EE101CC25
Course Title:	**Electrical Design**
Course Type:	**Core**
Year of Introduction:	**2025 – 26**

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Course Learning Outcomes (CLOs):

At the end of the course, students will be able to -

1. apply theoretical concepts in designing conventional electrical machines & magnetic components (BL4)
2. select appropriate material for designing electrical machines & magnetic components (BL4)
3. estimate the machine performance based on the design outcome by data interpretation (BL5)
4. design and demonstrate the equipment, component by appropriate drawings (BL6)

Unit	Contents	Teaching hours: (Total 45)
Unit-I	**General Aspects** Design considerations, electrical loading & magnetic loading, output co-efficient, factors affecting size of machines, heating & cooling of electrical machines	02
Unit-II	**Design of Three Phase Transformers** Introduction, design equations, selection of design variables, calculation of main dimensions of magnetic circuit, mechanical forces in transformers, transformer windings, design of windings, performance estimation, cooling system design, performance improvement and related economic considerations	12
Unit-III	**Design of Three Phase Induction Motors** Introduction, output equation, selection of design variables, calculation of main dimensions, design of stator winding, single layer and double layer winding, integral and fractional pitch winding, fractional slot winding, flux density in stator tooth, depth of stator core, selection of length of air gap, selection of number of rotor slots, design of squirrel cage rotor, design of wound rotor, depth of rotor core, performance estimation, dispersion coefficient, performance improvement and related economic considerations	15
Unit-IV	**Design of Magnetic Components** Magnetic materials and cores for inductors and high frequency transformers, core shapes, core loss calculations, conductor winding	08

	design and loss considerations, inductor design, high frequency transformer design, design considerations for loss reduction in inductors and high frequency transformers	
Unit-V	**Design of DC Machines** Introduction, output equation, selection of design variables, selection of number of poles, calculation of main dimensions of armature, length of air gap, design of armature, design of armature winding, simplex lap and simplex wave winding, design of the field system, application of permanent magnets	08

Self-Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Laboratory Work:

Design Sheets / Computer Aided Drawings: Students are required to submit at least three design sheets (hand drawn or computer software) in full size as term work.

Sketch Book / Computer Aided Drawings: Sketches of components, windings and parts of designed machines are to be drawn in sketchbook / prepared using computer software.

Suggested Readings:

1. M. G. Say, *Performance and design of A.C. machines*, CBS Publishers.
2. A.K. Sawhney, *A Course in Electrical Machine Design*, Dhanpat Rai and Sons.
3. Ned Mohan, Tore M. Undeland and William P. Robbins, *Power Electronics: Converters, Applications and Design*, John Wiley & Sons, Inc., New York
4. V. N. Mittal, *Design of Electrical Machines*, Standard Publishers.
5. Colonel Wm. T. McLyman, *Magnetic Core Selection for Transformers and Inductors: A User's Guide to Practice and Specifications*, CRC Press
6. L. Umanand, *Design of Magnetic Components for Switched Mode Power Converters*, New Age Publishers
7. E. Clayton, *Performance and Design of D.C. Machines*, CBS Publishers.
8. Indrajit Dasgupta, *Design of Transformers*, Tata McGraw Hill.
9. Martin J. Heathcote, *The J & P Transformer Book*, Newnes Publishers.
10. Recent publications from referred journals and relevant standards.