NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B.Tech. in Electrical Engineering**
Semester:	**VII**
Course Code:	**2EE702**
Course Title:	**Electrical Machine Design**
Course Type:	(√ **Core**/ □ Value Added Course / □ Department Elective/ □ Institute Elective/ □ University Elective/ □ Open Elective/ □ Any other)
Year of Introduction:	**2021 – 22**

Credit Scheme

L	T	Practical component				C
		LPW	PW	W	S	
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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
2. select appropriate material for designing electrical machines
3. estimate the machine performance based on the design outcome by data interpretation
4. demonstrate the design by appropriate drawings

Syllabus: **Total Teaching hours: 45**

Unit	Syllabus	Teaching hours
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.	**10**
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 Synchronous Machines** Introduction, output equation, selection of design variables, calculation of main dimensions, stator design, short circuit ratio and its consideration, air gap length, shape of pole face, armature design, armature winding, length of mean turn, calculation of armature	**08**

	resistance and reactance, design of rotor, design of pole and pole winding, short circuit characteristic, performance estimation.	
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.	**10**

Self-Study Component:
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/ References:

1. A. K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai and Sons.
2. V. N. Mittal, Design of Electrical Machines, Standard Publishers.
3. M. G. Say, Performance and design of A.C. machines, CBS Publishers.
4. E. Clayton, Performance and Design of D.C. Machines, CBS Publishers.
5. Indrajit Dasgupta, Design of Transformers, Tata McGraw Hill.
6. Martin J. Heathcote, The J & P Transformer Book, Newnes Publishers.
7. Recent publications from referred journals and relevant standards.

Suggested List of Designs / Simulations / Experiments:
1. Design of Three Phase Induction Motor.
2. Design of Distribution Transformer.
3. Design of Power Transformer.
4. Winding Design for Rotating Machines.
5. Components of Synchronous Machine.
6. Performance Analysis of Three Phase Induction Motor.
7. Analyze Effect of Stator Slot Shape on the Performance of Three Phase Induction Motor.
8. Sizing of DC Machine.

L = Lecture, T = Tutorial, P = Practical, C = Credit