



Gyanmanjari
Innovative University

Course Syllabus
Gyanmanjari Institute of Technology
Semester-7

Subject: Electrical Machine Design - BETEE17332

Type of course: Professional Core and Professional Elective Courses.

Prerequisites: Electrical Machine, magnetic circuits, and Engineering Mathematics.

Rationale:

Electrical Machine Design enables students to understand the principles and methods required to design efficient, reliable, and economical electrical machines such as transformers and motors. It develops skills in selecting materials, determining dimensions, and analyzing performance, preparing students for practical industrial applications.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
CI	T	P		C	Theory Marks		Practical Marks		
			ESE		MSE	V	P	ALA	
4	0	2	5	60	30	10	20	30	150

Legends: CI-Classroom Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Unit No.	Course content	Hrs	% Weight age
1.	General design aspects The design aspects include specific electric loading and specific magnetic loading, the output coefficient, output equations for transformers and rotating machines, factors affecting the size of machines, criteria for selecting specific loadings, and the heating and cooling of electrical machines and transformers.	10	10%



2.	<p>Design of a Three-phase Transformer Types of transformers, Position of HV and LV windings and its importance, The relation between core and yoke cross-section area and its significance: Different types of transformer windings; Different positions of taping; Window space factor: Factors affecting window space factor: Relation between EMF per turn and transformer rating; stacking factor. Main Dimensions: Design specifications for window dimensions, yoke dimensions, and overall core dimensions, along with numerical examples. Design of Windings: Design of HV and LV windings (number of turns and area of cross section); selection of type of winding. Performance Parameters Estimation: Primary and secondary winding resistance and leakage reactance calculation; calculation of no-load current, losses, and temperature rise of transformers. Design of tank with tubes: Calculation of dimension of tank: Numerical examples. Variation of output and losses in transformers with linear dimensions; Basic design aspects of dry transformers and high-frequency transformers. Basic design aspects of welding transformers and instrument transformers.</p>	20	40%
3	<p>Design Parameters of Induction Motors Three-phase induction motor (no calculation)—Basic consideration for the design frame. Rating. Duty and rating. Temperature rises. Output equation, choice of specific electric loading. The relation between L and D for the best power factor. Procedural steps for the design of a 3-phase squirrel cage induction motor.</p>	15	25%
4	<p>Design of D.C. 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.</p>	15	25%

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	<p>Case Study (Transformer Design) Students analyze the design parameters of a small distribution transformer. Identify core material, winding type, and cooling method. Upload the report on GMIU web portal. (No. of students per group - 02)</p>	10



2	Design Analysis Students analyze the basic design parameters of a 3-phase induction motor. Discuss stator, rotor, and slot design . Upload report on GMIU web portal. (No. of students per group - 02)	10
3	Real-life Application Students have to prepare a study of any electrical machine used in industry (motor or transformer). Identify design considerations and performance factors Upload report on GMIU web portal. (No. of students per group - 02)	10
Total		30

Suggested Specification table with Marks (theory): 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	30 %	30%	10%	15%	15%	-

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course, the students should be able to:	
CO1	Identify suitable design parameters based on application requirements and machine ratings.
CO2	Develop designs of AC electrical machines as per given specifications and standards.
CO3	Analyze and assess performance characteristics using derived design parameters.
CO4	Formulate designs of DC electrical machines according to specified operational requirements.

List of Practical:

Sr. No	Descriptions	Unit No	Hrs
1.	General design-based solved problems as given data.	1	4
2.	Design a three-phase transformer as per prescribed design data and draw a drawing design sheet.	2	10



3.	Design the three-phase induction motor of given specifications and draw a design sheet drawing.	3	10
4.	Design the DC machine of given specifications and draw a design sheet.	4	6
Total			30

Instructional Method:

The course delivery method will depend upon the requirements of the content and the needs of students. The teacher, in addition to conventional teaching methods by blackboard, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory

The internal evaluation will be done on the basis of the active learning assignment.

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

- [1] A. K. Sawhney, A Course in Electrical Machine Design. New Delhi, India: Dhanpat Rai and Sons, 2010.
- [2] R. K. Agarwal, Principles of Electrical Machine Design. New Delhi, India: S. K. Kataria and Sons, 2009.
- [3] M. G. Say, Theory, Performance, and Design of A.C. Machines. New Delhi, India: CBS Publishers, 2005.
- [4] S. K. Sen, Principles of Electrical Machine Design with Computer Programmes. New Delhi, India: Oxford and IBH Publishing, 2006.
- [5] K. M. V. Murthy, Computer Aided Design of Electrical Machines. Hyderabad, India: B.S. Publications, 2015.
- [6] Ansoft Corporation, Maxwell 2D Machine Design Package: Electrical Machines and Equipment Design Exercises.

