



# GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3160918

Semester – VI

Subject Name: Element of Electrical Design

Type of course: Professional Elective Course

Prerequisite: NA

**Rationale:** This course is a preliminary course for design of various electrical equipments. The aim is to provide the basic principles useful for the subjects related to design in subsequent semesters. The course also includes basics of estimation and costing of house wirings and commercial wirings.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	<b>GENERAL DESIGN ASPECTS:</b> Basic principles of magnetic circuits – use of B-H curves in magnetic circuit; Calculations of MMF for air gap and teeth; Real and apparent flux density; Field Form; Air gap flux distribution factor (field form factor); Magnetizing current calculation; Leakage Reactance calculation for various types of slots, Iron loss calculation concepts; Application of FEM in calculation of force, torque, potential distribution and magnetic flux density; Insulating Materials & Classifications.	10
2	<b>DESIGN OF STARTERS AND FIELD REGULATORS:</b> Introduction and review of A.C. and D.C. starters; Schematic diagrams of control circuit and power circuit for starters with contactors and timers. Design of starters and Field regulators. <b>DESIGN OF SMALL TRANSFORMERS AND CHOKE COILS:</b> Design of Small single-phase transformers; Design of variable air gap single phase and three phase choke coil.	08
3	<b>Armature Windings:</b> <b>DC windings :</b> Simplex & Duplex windings; Lap & Wave windings; Applications; Basic terms related to armature windings; Dummy Coils; Equalizer connections; Split coils. <b>AC windings :</b>	08



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	Introduction; No. of phases; Phase spread; Concentric winding, Hemitropic winding; Whole coil winding; Mush winding; Double layer windings; Integral slot lap and wave winding; Fractional slot lap and wave windings; Performance analysis of various windings.	
<b>4</b>	<b>Estimation and Costing for Residential and Commercial wiring:</b> Preparation of schematic diagrams and estimation of cost of wiring for Tenaments, Row houses, Bungalows, Flats, Multi – Storied Buildings, Commercial Complexes like Offices, Hospitals, Hotels, Theatres.	<b>08</b>
<b>5</b>	<b>Design consideration of Electrical Installation:</b> Types of load, Electrical Supply Systems, Wiring systems, Load Assessment, Permissible voltage drops & Conductor size calculations, Design of Control panel. Estimation and costing for service connections.	<b>08</b>

**Suggested Specification table with Marks (Theory): (For BE only)**

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>20</b>	<b>20</b>	<b>20</b>	<b>10</b>	<b>0</b>	<b>0</b>

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyse and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

**(Question paper should include 40 to 60% numerical problems based on design or analysis)**

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.

### Reference Books:

1. A course in electrical machine Design – A. K. Sawhney
2. Electrical Machine Design – R. K. Agrawal
3. Design of Electrical Machine - V. N. Mittle
4. Elements of Electrical Design – J G Jamnani.
5. Electrical Design, Estimating and Costing – K. B. Raina
6. Residential, Commercial and Industrial Systems – H. Joshi
7. Principles of Electromagnetics, 6<sup>th</sup> edition – Matthew N. O. Sadiku & S. V. Kulkarni
8. Finite Element Analysis of Electrical Machines – Sheppard J Salon (chapter-6)

### Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Explain the basic principles of electrical machine design with relevant applications	20%



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CO-2	Design the electrical equipments like small transformers, choke coils, starters and field regulators	20%
CO-3	Develop the winding diagrams for AC and DC machines as per specifications	20%
CO-4	Compute the cost of wiring for residential and commercial premises	20%
CO-5	Design the supply systems for residential and industrial applications	20%