

Complex Engineering Problem/Activity

Course Code and Title: EE450 High Voltage Engineering

Semester: 8th semester (Spring 2023)

Instructor: Engr.M.Ahsan ul haq

Total Marks: 10

1. CLOs and PLOs for Complex Engineering Problem

Please state CLOs and PLOs addressed in the complex engineering problem along with domain and level. These are the CLOs from the theory/lab course which are already defined.

CLOs		Description	Domains & Levels	PLOs, Levels
CLO1	Theory	Evaluate electric field distribution in a high voltage bushing using finite element method.	Cognitive, 4,6	PLO6 High

Problem Statement

Analysis of electric field and voltage distribution for an 11 kV bushing using finite element method.

Brief Description of Problem

Bushing is an important component that is fitted to electrical equipment such as switchgear and transformer etc. The primary purpose of this complex engineering problem is to apply the knowledge obtained in EE451: High Voltage Engineering for the visualization of electric field and voltage distribution in an 11 kV bushing. The finite element method (FEM) will be employed to develop a two-dimensional (2D) model of bushing. From this study, the locations of high electric stress across the transformer bushing may be evaluated.

Complex Engineering Problem Attributes

WP1: Depth of knowledge WP2: Range of conflicting requirements WP3: Depth of analysis WP4: Familiarity of issues WP5: Extent of applicable codes WP6: Extent of stakeholders WP7: Interdependence	<ul style="list-style-type: none"> • WP1: Depth of Knowledge Requires knowledge of electrostatic field calculation (WK3), design of high voltage bushing (WK5), use of simulation tools (WK6) and engagement in research literature (WK8). • WP3: Depth of analysis Requires in depth knowledge to apply numerical methods for the analysis of electric field distribution. 	
	Rubrics	
	Development of simulation model (CLO1)	WP1, WP3,
	Analysis of results (CLO1)	,WP3
	Conclusions (CLO1)	WP1

EA1: Range of resources EA2: Level of interaction EA3: Innovation EA4: Consequences for society and environment EA5: Familiarity	<ul style="list-style-type: none"> • EA1: Range of resources The design involves resources, such as, money, information and technology. 	
	Rubrics	
	Literature review (CLO1)	EA1

Complete Evaluation Rubrics

	Unsatisfactory	Satisfactory	Good	Comprehensive
Literature Review	No apparent literature review, (0)	Mediocre research which may or may not contain required data, (0.5)	Adequate research, (1)	Contains all the information needed for solving the problem (2)
FEMM implementation	Model was not implemented, (0)	Model was implemented with approximations, (1-2)	Model was adequately implemented with reasonably accuracy, (3)	Model was comprehensive implemented with high accuracy, (4)
Analysis of Results	The relationship between the variables is not discussed, (0)	The relationship between the variables is discussed but no patterns, trends or predictions are made based on the results, (0.5)	The relationship between the variables is discussed and trends/patterns logically analyzed, (1)	The relationship between the variables is discussed and trends/patterns logically analyzed. Predictions are made based on results, (2)
Conclusions	Conclusions were not written or entirely wrong, (0)	Conclusions were presented but not adequately, (0.5)	Conclusions were presented in a good manner, (1)	Conclusions were reasonably presented, (2)