

EPE 817 High Voltage Engineering -3

Course Code EPE 817	Credit Hours (Th-Pr) 3.0-0	High Voltage Engineering	Contact Hrs/Week (Th-Pr) 3.0-0	Total Contact Hrs (Th-Pr) 45-0
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Background

1. To maximize power transmission and distribution high voltages are adopted which not only minimize losses and cause efficient power transmission but also avoid many complications such as design of conductors etc.

Rationale

2. High voltage is not only important for efficient power delivery to consumers; but also vital for cost effective installation and operation of power system. In order to generate, transmit and handle power at high voltages need special expertise and knowledge. Therefore, this course is designed to give knowledge and expertise to graduate students about high voltage systems and engineering with problem solving approach.

Educational Objectives

3. The objectives of “High Voltage Engineering” course are:
- a. Familiarization with High Voltage Systems
 - b. Concepts of generation and measurement of high voltages, electrostatic fields, and electrical breakdown in gases, liquids and solid dielectrics
 - c. To study opportunities and challenges in modern high voltage systems
 - d. To be familiar with research gaps in modern high voltage components and systems

Input Obtained from Industry/Corporate Sector/Subject Specialists/Academia

4. Relevant input will be obtained in CRC from subject/Academia specialist from Industry. Feedback obtained from following is incorporated
- a. NTDC High Voltage and Short Circuit Lab, Rawat
 - b. Rastek Technologies
 - c. Dr Junaid Ikram, COMSATS University Islamabad
 - d. Dr Kashif Imdad, Hitech University, Taxila

International Practice

5. Specify the universities of repute where the proposed course is being conducted.
- a. KTH Royal Institute of Technology-Stockholm, Sweden
 - b. University of Sydney, Sydney-Australia
 - c. Cardiff University, UK

Proposed Timeframe of Commencement

6. Specifying semester with year.

Fall-2018

Course Contents

7. Give details of the course, on the following lines:

a. Course Code: EE867

b. Title: High Voltage Engineering

c. Credit Hours: 03

d. Objectives (Repetition: Same as educational objectives)

8. The objectives of “High Voltage Engineering” course are:

a. Familiarization with High Voltage Systems

b. To develop concepts of generation and measurement of high voltages, electrostatic fields, and electrical breakdown in gases, liquids and solid dielectrics

c. To study opportunities and challenges in modern high voltage systems

d. To be familiar with research gaps in modern high voltage components systems

Outcomes

9. By the end of this course students will be able for following.

a. Understanding principles for generation and measurement of high voltage

b. Application of techniques to calculate electrostatic fields and the process of partial discharge and dielectric breakdown

c. Analyses of Partial discharge and corona on HV System

d. State current challenges in modern HV power components

10. **Contents with suggested contact hours**

No.	Topics	Book	Contact Hours
1	Introduction <ul style="list-style-type: none">• Overview of High Voltage Engineering• Importance of High voltage• High Voltage in industry and research• High Voltage System' components	FH1	3
2	Electric Field	KE	3

	<ul style="list-style-type: none"> • Calculation methods • Practical Implications in insulation • System design 		
3	Generation and measurement of High Voltage High Voltage AC, HVDC and Impulse	FH1	9
4	Dielectrics and Insulators <ul style="list-style-type: none"> • Selection of dielectrics and insulators • Fabrication and Testing • Breakdown processes in liquids , gases and solids • Aging and Life expectancy models • Dielectric stress calculations • Leakage Current measurements 	KE	6
5	Over voltage phenomenon <ul style="list-style-type: none"> • Lightning • AC overvoltage • Overvoltage Transient • Sources and protection of overvoltage transients 	KE	6
6	High Voltage testing of cables <ul style="list-style-type: none"> • Materials, design and ratings • Electrical and water treeing • Joints and Terminations • Partial discharge measurements for cables • Fault location calculations 	KE	6
7	High Voltage testing of transformers <ul style="list-style-type: none"> • Surge voltage performance • Insulation design • Aging and analysis • Impulse testing of surge arrestors and insulators 	FH1	6
8	<ul style="list-style-type: none"> • Recent Trends in High Voltage Engineering 	KE	3
9	<ul style="list-style-type: none"> • Guest lectures by professionals from industry 		3
	Total		45

11. Details of lab work, workshops practice (N/A).
 Lab work assignments and small projects will complement the course work.
12. Recommended Reading (including Textbooks and Reference books).

S. No.	Title	Author(s)	Year Published	Assigned Code	Remarks
I.	Industrial High Voltage; Fields, dielectrics construction	F.H. Krueger	2009	FH1	Text Book
II.	Industrial High Voltage; Coordinating, measuring, testing	Kuffel. E., Zaengl W.S., Kuffel. J.	2000	KE	Reference Book
III.	High Voltage Engineering; Theory and Practice	M.N. Arbab	2013	MN	Reference Book
IV.	High Voltage Engineering Fundamentals	F.H. Krueger	1992	FH2	Reference Book

- j. Details of online resources (N/A)
- k. Recommended Journals/Conference
- a. IEEE Transactions on Dielectric and Electrical Insulation
 - b. Electrical Insulation and Dielectric Phenomena, (CEIDP) - IEEE Xplore
 - c. IEEE Transactions on Power Delivery
 - d. High Voltage Engineering (IET Journal)