

Academic Course Description

BHARATH UNIVERSITY
 Faculty of Engineering and Technology
 Department of Electrical and Electronics Engineering
BEE013 & HIGH VOLTAGE ENGINEERING
Fifth Semester (odd Semester)

Course (catalog) description

To get a fair knowledge about the generation, measurements of high voltages and currents, testing of high voltage apparatus

Compulsory/Elective course: Elective course for EEE students

Credit hours : 3& 45

Course Coordinator : S.UmaMageswaran

Instructors : S. Dinakarraj

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@bharathuniv.ac.in)	Consultation
S.UmaMageswaran	Third Year EEE	KS 302	04422290125	u_magesh125@yahoo.co.in	9.00-9.50 AM

Relationship to other courses:

Pre –requisites : BEE302 Electrical machines – I

Assumed knowledge : knowledge in over voltages in electrical network, various types of circuit breakers

Following courses : BEE701 Power System Analysis

Syllabus Contents

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS

9

Causes of over voltages and their effects on power system – Lightning, switching and temporary over voltages – protection against over voltages - Insulation coordination

UNIT II ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS

9

Gaseous breakdown in uniform and non-uniform fields – corona discharges – Vacuum breakdown – conduction and breakdown in pure and commercial liquids – breakdown mechanisms in solid and composite dielectrics.

UNIT III GENERATION OF HIGH VOLTAGE AND CURRENTS

9

Generation of high DC voltages - multiplier circuits –Van de Graff generator – high alternating voltage generation using cascade transformers-production of high frequency AC high voltages-standard impulse wave shapes-Marx circuit- generation of switching surges - impulse current generation-tripping and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND CURRENTS**9**

HVDC measurement techniques – measurement of power frequency A.C voltages- sphere gap measurement technique-potential divider for impulse voltage measurements – measurement of high D.C, A.C and impulse currents

UNIT V HIGH VOLTAGE TESTING**9**

Tests on insulators-testing of bushings-testing of isolators and circuit breakers- cable testing- testing of transformers-surge diverter testing -radio interference measurement-use of I.S for testing.

Total: 45 HOURS**Text book(s) and/or required materials**

T1. . Naidu.M.S, andKamaraju, “High Voltage Engineering”, Tata McGraw Hill, 2009.

T2.Wadhwa.C.L, “High Voltage Engineering”, Wiley Eastern Limited, 2007.

Reference Books:

R1.Kuffel.E and Abdullah. M, “High Voltage Engineering”, Pergamon Press, 2000.

Dieter Kind, “An Introduction to High Voltage Experimental Techniqu Eastern Limited, 1978

R2Ravindra Arora, Wolfgang Mosh, “High Voltage and Electrical Insulation e”, Wiley Engineering”, Wiley-VCH Publishers, 2011.

<http://nptel.ac.in/courses/108104048/ui/TOC.htm>

Computer usage:**Professional component**

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	0%
Major elective	-	100%

Broad area :Circuit Theory | Electrical Machines| Electronics | **Power System**| Control &Instrumentation

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 1 st week	Session 1 to 14	2 Periods
2	Cycle Test-2	September 2 nd week	Session 15 to 28	2 Periods
3	Model Test	October 2 nd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To get a fair knowledge about the generation, measurements of high voltages and currents, testing of high voltage apparatus	Correlates to program outcome		
	H	M	L
1. To understand the various types of over voltages in power system and protection methods.	b,c,f,l,j,l	a,e,h	g
2. Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.	b,e,l,j	f,g,h,l	a
3. To understand the generation of high voltages and currents	b,c,l,j	e,g,h,l	a
4. To understand the measurement of high voltages and currents	f,l,j,l	b,e,g,h	a
5. To gain knowledge in testing of high voltage equipments..	b,j,l,j	c,e,g,h,l	a

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I			
1.	High Voltage Engineering - Introduction	No	T1, R2
2.	Causes of over voltages and their effects on power system	No	
3.	Lightning - Introduction	No	
4.	Lightning - Theory	No	
5.	switching and temporary over voltages	No	
6.	protection against over voltages	No	
7.	protection against over voltages	No	
8.	Insulation coordination	No	
9.	Insulation coordination	No	
UNIT II			
10.	Electrical Breakdown - Introduction	No	T1,T2
11.	Gaseous breakdown in uniform and non-uniform fields	No	
12.	Gaseous breakdown in uniform and non-uniform fields	No	
13.	corona discharges	No	
14.	Vacuum breakdown	No	
15.	conduction and breakdown in pure liquids	No	
16.	conduction and breakdown in commercial liquids	No	
17.	breakdown mechanisms in composite dielectrics.	No	
18.	breakdown mechanisms in solid dielectrics.	No	
UNIT III			
19.	Generation of high DC voltages -	No	T2
20.	multiplier circuits	No	
21.	Van de Graff generator	No	
22.	high alternating voltage generation using cascade transformers	No	
23.	production of high frequency AC high voltages-	No	
24.	standard impulse wave shapes-Marx circuit	No	
25.	Generation of switching surges	No	
26.	impulse current generation-tripping	No	

27.	impulse current generation - control of impulse generators	No	
UNIT IV			
28.	Voltage and Current measurement - Introduction	No	T1,R1
29.	HVDC measurement techniques	No	
30.	HVDC measurement techniques	No	
31.	measurement of power frequency A.C voltages	No	
32.	sphere gap measurement technique	No	
33.	potential divider for impulse voltage measurements	No	
34.	measurement of high D.C currents	No	
35.	measurement of high A.C currents	No	
36.	measurement of high impulse currents	No	
UNIT V			
37.	Tests on insulators-testing of bushings	No	T1,T2
38.	testing of isolators	No	
39.	circuit breakers - Testing	No	
40.	circuit breakers - Testing	No	
41.	cable testing	No	
42.	cable testing	No	
43.	testing of transformers-surge diverter testing	No	
44.	testing of transformers-surge diverter testing radio interference measurement	No	
45.	testing of transformers-surge diverter testing - use of I.S for testing.	No	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	05%
Cycle Test – II	-	05%

Model Test	-	10%
Attendance	-	5%
SEMINAR& ASSIGNMENT		05%
Final exam	-	70%

Prepared by: S.UmaMageswaran Assistant Professor, Department of EEE

Dated :

BEE013 & HIGH VOLTAGE ENGINEERING

Addendum

ABET Outcomes expected of graduates of B.Tech / EEE / program by the time that they graduate:

- a) An ability to apply knowledge of mathematics, science, and engineering fundamentals.
- b) An ability to identify, formulate, and solve engineering problems.
- c) An ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- d) An ability to design and conduct experiments, as well as to analyze and interpret data.
- e) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- f) An ability to apply reasoning informed by the knowledge of contemporary issues.
- g) An ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- h) An ability to understand professional and ethical responsibility and apply them in engineering practices.
- i) An ability to function on multidisciplinary teams.
- j) An ability to communicate effectively with the engineering community and with society at large.
- k) An ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.
- l) An ability to recognize the need for, and an ability to engage in life-long learning.

Program Educational Objectives

PEO1: PREPARATION

Electrical Engineering Graduates are in position with the knowledge of Basic Sciences in general and Electrical Engineering in particular so as to impart the necessary skill to analyze and synthesize electrical circuits, algorithms and complex apparatus.

PEO2: CORE COMPETENCE

Electrical Engineering Graduates have competence to provide technical knowledge, skill and also to identify, comprehend and solve problems in industry, research and academics related to power, information and electronics hardware.

PEO3: PROFESSIONALISM

Electrical Engineering Graduates are successfully work in various Industrial and Government organizations, both at the National and International level, with professional competence and ethical administrative acumen so as to be able to handle critical situations and meet deadlines.

PEO4: SKILL

Electrical Engineering Graduates have better opportunity to become a future researchers/ scientists with good communication skills so that they may be both good team-members and leaders with innovative ideas for a sustainable development.

PEO5: ETHICS

Electrical Engineering Graduates are framed to improve their technical and intellectual capabilities through life-long learning process with ethical feeling so as to become good teachers, either in a class or to juniors in industry.

Course Teacher	Signature
Mr.S.UmaMageswaran	

Course Coordinator**(Mr.S.UmaMageswaran)****HOD/EEE**