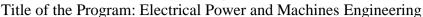
Department: Electrical Engineering





51. Course Specification of High Voltage Engineering

	I. Course Identification and General Information:						
1.	Course Title:	High '	Voltage En	gineering	g		
2.	Course Code & Number:	PME4	46				
			C.	H		Total	
3.	Credit hours:	Th.	Tu.	Pr.	Tr.	Total	
		2	2	-	-	3	
4.	Study level/ semester at which this course is offered:	Fifth Year/First Semester					
5.	Pre –requisite (if any):	Power System Analysis 2 (PME333)				33)	
6.	Co –requisite (if any):	NA					
7.	Program (s) in which the course is offered:	Power Engineering and Electrical Machines					
8.	Language of teaching the course:	English					
9.	Location of teaching the course:	Class					
10.	Prepared By:	Asst. Prof. Dr. Adel Ahmed Al-Shogairy				nogairy	
11.	Date of Approval					-	

Course Description: II.

This Course provides students of Electrical Engineering with knowledge about High Voltage techniques. It covers broadly the entire range of topics in high voltage engineering and presents the material in a lucid manner. It provides all the latest information on insulating materials, breakdown phenomena, over voltages, and testing techniques.

	Referenced PILOs	
a1	Define principles of elements, processes and/or systems related to High Voltage Engineering	A2
a2	Acquire knowledge of new issues in High Voltage Engineering.	A3

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Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti

Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad

Sana'a University
Faculty of Engineering
Department: Electrical Engineering





Title of the Program: Electrical Power and Machines Engineering

b1	Identify engineering problems related to strength of different isolating materials.	B1
b2	Evaluate the operation conditions, and problems of High Voltage Engineering.	В2
c1	Solve High Voltage Engineering problems using mathematics and science.	C1
c2	Conduct tests related to electric field stress for different Gaps and interpret data.	С3
d1	Adopt professional responsible when contact High Voltage Testing	D3

(A) Alignment Course Intended Learning Outcomes of Knowledge and Understanding to Teaching Strategies and Assessment Strategies:					
C	ourse Intended Learning Outcomes	Teaching strategies	Assessment Strategies		
a1.	Define principles of elements, processes and/or systems related to High Voltage Engineering	- Dialogue and	Written examWritten assignmentPresentation assignment		
a2.	Acquire knowledge of issues in High Voltage Engineering.	· ·	Written examWritten assignmentPresentation assignment		

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Title of the Program: Electrical Power and Machines Engineering

(B) Alignment Course Intended Learning Outcomes of Intellectual Skills to Teaching Strategies and Assessment Strategies:				
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies		
b1. Identify engineering problems related to strength of different isolating materials.	LectureDialogue and discussionBrainstormingProblem Solving	Homework AssignmentResearch assignment		
b2- Evaluate the operation conditions, and problems of High Voltage Engineering.	LectureDialogue and discussionBrainstormingProblem Solving	Homework AssignmentResearch assignment		

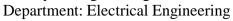
© Alignment Course Intended Learning Outcomes of Professional and Practical Skills to Teaching Strategies and Assessment Strategies:				
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies		
c1. Solve High Voltage Engineering problems using mathematics and science.	Dialogue and discussionBrainstormingProblem Solving	Written reportGroup workfinal exam		
c2. Conduct tests related to electric field stress for different Gaps and interpret data.	Lecture and SiteDialogue and discussionBrainstormingProblem Solving	 Written report Group work final exam		

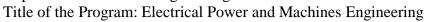
(D) Alignment Course Intended Learning Outcomes of Transferable Skills to Teaching Strategies and Assessment Strategies:				
Course Intended Learning Outcomes	Teaching strategies	Assessment Strategies		
d1- Adopt professional responsible when contact High Voltage Testing	Dialogue and discussionBrainstormingProblem Solving	Written reportGroup workfinal exam		

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- Practical application

IV. Course Content:

A – Theoretical Aspect:

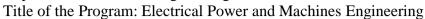
	A – Theoretical Aspect:				
Order	Units/Topics List	Learning Outcomes	Sub Topics List	Number of Weeks	Contact hours
1.	Introduction	a1	Introduction to the courseHistory of High VoltageEngineering	1	2
2.	Fields	a1	Electric FieldMagnetic Field	1	2
3.	Conduction and Breakdown in Gases Dielectrics	a1, b2, d1,c1	 Ionization Processes Townsend's Current Growth Equation Streamer Theory Paschen's Law Breakdown in Non- uniform Fields Corona Discharges 	3	6
4.	Conduction and Breakdown in Liquid Dielectrics	a1, b1, b2,c2	Pure LiquidCommercial Liquids	1	2
5.	Conduction and Breakdown in Solid Dielectrics	a1, b1, b2,c1	Electrical BreakdownThermal Breakdowns	2	4
6.	High voltage and current generation	a1, b1, b2,c1,c2	 Generation of High AC Voltage Generation of High DC Voltage 	2	4

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Department: Electrical Engineering











	Number of Weeks /and Units Per Semester			14	28
8.	High Voltage testing	a1, a2, b1, b2, ,d1,c1,c2	 Testing of Materials Testing of Electrical Apparatus Partial Discharge Measurements Tests of Insulators Tests of Circuit Breakers, Tests of Cables 	2	4
7.	High voltage and current measurements	a1, a2, b1, b2,c1,c2	Measurement of High VoltageMeasurement of High Current	2	4
			 Generation of High Impulse Voltage Generation of High AC Impulse Current Generation of High DC Impulse Current 		

B – Tutorial Aspect:						
Order	Tasks/ Experiments	Number of Weeks	Contact hours	Learning Outcomes		
1.	Student Presentation on History of High Voltage Engineering	1	2	a1, a2, b2, d1		
2.	Student Presentation on Fields	1	2	a1, a2, b2,c2,d1		
3.	 Ionization Processes Townsend's Current Growth	1	2	a1, b1, b2,c1,d1		
4.	- Streamer Theory - Paschen's Law	2	4	a1, b1, b2,c1,d1		
5.	Student Presentation on Conduction and Breakdown in Liquid Dielectrics	2	4	a1, b1, b2,c1,d1		
6.	Student Presentation on Conduction and Breakdown in Solid Dielectrics	2	4	a1, b1, b2,c1,d1		
7.	Student Presentation on High voltage and current generation	2	4	a1, b1, b2,c2,d1		
8.	Student Presentation on High voltage and current measurements	1	2	a1, b1, b2,c1,d1		

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Huda Al-Emad







		_	_		
Title of the	Program:	Electrical	Power an	nd Machines	Engineering

9.	Student Presentation on High Voltage testing	2	4	a1, b1, b2,c1,d1
Number of Weeks /and Units Per Semester		14	28	

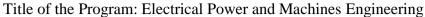
V. Teaching strategies of the course:

- Lecture
- Dialogue and discussion
- Brainstorming
- Problem Solving
- Practical application
- Presentation

,	VI. Assignments:							
No	Assignments	Aligned CILOs(symbols)	Week Due	Mark				
1.	Student Presentation on History of High Voltage Engineering	a1, a2, b2,c1,d1	3	1.25				
2.	Student Presentation on Fields	a1, a2, b2,c1,d1	4	1.25				
3.	Student Presentation on Conduction and Breakdown in Gases Dielectrics	a1, b1, b2,c1,d1	5	1.25				
4.	Student Presentation on Conduction and Breakdown in Liquid Dielectrics	a1, b1, b2,c1,d1	6	1.25				
5.	Student Presentation on Conduction and Breakdown in Solid Dielectrics	a1, b1, b2,c1,d1	8	1.25				
6.	Student Presentation on High voltage and current generation	a1, b1, b2,c1,d1	9	1.25				
7.	Student Presentation on High voltage and current measurements	a1, b1, b2,c1,d1	10	1.25				
8.	Student Presentation on High Voltage testing	a1, b1, b2,c1,d1	11	1.25				
	Total			10				

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VII. Schedule of Assessment Tasks for Students during the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1.	Assignment	3- 11	10	6.7%	a1, a2, b1, b2. d1
3.	Presentation project	Weekly	10	6.7%	b1, b2.c1, c2,d1
4.	Quizzes	9,10,11	10	6.7%	a1, a2, b1, b2,
5.	Mid-Term exam	7	30	20%	a1, a2, b1, b2.
6.	Final Exam	16	90	60%	a1, a2, b1, b2,
	Total		150	100%	

VIII. Learning Resources:

• Written in the following order: (Author – Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

- **1.** E. Kuffel, W.S. Zaengl, J. Kuffel-2000-High Voltage Engineering Fundamentals-2nd edition-Toronto, Canada-published by Butterworth-Heinemann.
- **2.** M S Naidu, V Kamaraju-1996- Voltage Engineering-2nd edition- United States of America- McGraw-Hill.
- 2- Electronic Materials and Web Sites etc.

-

3- Essential References.

- **1.** Dr JP Holtzhausen, Dr WL Vosloo, 2006. High Voltage Engineering. Practice and Theory
- **2.** M. Khalifa-1990- High Voltage Engineering-Theory and Practice- United States of America-Marcel Dekker.
- **3.** G. Rohan Lucas-2001- High Voltage Engineering-Revised Edition-Sri Lanka- J R Lucas.

IX. Course Policies:

1. Class Attendance:

Head of Department Asst. Prof. Dr. Adel Ahmed Al-Shakiri Quality Assurance Unit Assoc. Prof. Dr. Mohammad Algorafi

Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad

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Faculty of Engineering

Department: Electrical Engineering

Title of the Program: Electrical Power and Machines Engineering









	-A student should attend not less than 75 % of total hours of the subject; otherwise he
	will not be able to take the exam and will be considered as exam failure. If the student is
	absent due to illness, he/she should bring an approved statement from university Clinic
	Tardy:
2.	- For late in attending the class, the student will be initially notified. If he repeated
	lateness in attending class he will be considered as absent.
	Exam Attendance/Punctuality:
,	- A student should attend the exam on time. He is Permitted to attend an exam half one
3.	hour from exam beginning, after that he/she will not be permitted to take the exam and
	he/she will be considered as absent in exam.
	Assignments & Projects:
4.	- The assignment is given to the students after each chapter; the student has to submit
	all the assignments for checking on time.
	Cheating:
5.	- For cheating in exam, a student will be considered as failure. In case the cheating is
	repeated three times during his/her study the student will be disengaged from the Faculty.
	Plagiarism:
	Plagiarism is the attending of a student the exam of a course instead of another student.
6.	If the examination committee proved a plagiarism of a student, he will be disengaged
	from the Faculty. The final disengagement of the student from the Faculty should be
	confirmed from the Student Council Affair of the university.
	confirmed from the Student Council Affair of the university. Other policies:
	·
7.	Other policies:
7.	Other policies: - Mobile phones are not allowed to use during a class lecture. It must be closed,

Reviewed	Vice Dean for Academic Affairs and Post Graduate Studies: Asst. Prof. Dr. Tarek				
By	A. Barakat				
	President of Quality Assurance Unit: Assoc. Prof. Dr. Mohammed Algorafi				
	Name of Reviewer from the Department: Assoc. Prof. Dr. Radwan Al bouthigy				
	Deputy Rector for Academic Affairs Asst. Prof. Dr. Ibrahim AlMutaa				
	Assoc. Prof. Dr. Ahmed Mujahed				
	Asst. Prof. Dr. Munasar Alsubri				

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Huda Al-Emad

Department: Electrical Engineering
Title of the Program: Electrical Power and Machines Engineering







51. Template for Course Plan of High Voltage Engineering

I. Information about Faculty Member Responsible for the Course:							
Name of Faculty Member	Asst. Prof. Dr. Adel Ahmed Al-Shogairy Office Hours						
Location& Telephone No.	Electrical Eng. Dept	SAT	SUN	MON	TUE	WED	THU
E-mail	Ashakiri62@gmail.com		8-12		8-12		

II.	II. Course Identification and General Information:							
1.	Course Title:	High Voltage Engineering						
2.	Course Number & Code:	PME446						
			C.	Н		Total		
3.	Credit hours:	Th.	Tu.	Pr.	Tr.	Total		
		2	2	1	-	3		
4.	Study level/year at which this course is offered:	Fifth Year/First Semester						
5.	Pre –requisite (if any):	Power System Analysis 2 (PME333)						
6.	Co –requisite (if any):	NA						
7.	Program (s) in which the course is offered	Power Engineering and Electrical Machines						
8.	Language of teaching the course:	English						
9.	System of Study:	Regular						
10.	Mode of delivery:	Semester						
11.	Location of teaching the course:	Class						

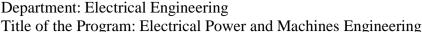
III. Course Description:

This Course provides students of Electrical Engineering with knowledge about High Voltage techniques. It covers broadly the entire range of topics in high voltage engineering and presents the material in a lucid manner. It provides all the latest information on insulating materials, breakdown phenomena, over voltages, and testing techniques.

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IV.Intended learning outcomes (ILOs) of the course:

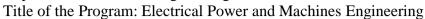
- Brief summary of the knowledge or skill the course is intended to develop:
 - Define principles of elements, processes and/or systems related to High Voltage Engineering
 - 2. Acquire knowledge of new issues in High Voltage Engineering.
 - 3. Identify engineering problems related to strength of different isolating materials.
 - **4.** Evaluate the operation conditions, and problems of High Voltage Engineering.
 - **5.** Solve High Voltage Engineering problems using mathematics and science.
 - **6.** Conduct tests related to electric field stress for different Gaps and interpret data.
 - 7. Adopt professional responsible when contact High Voltage Testing

V.	V. Course Content:								
	A – Theoretical Aspect:								
Order	Units/Topics List	Number of Weeks	Contact hours						
1.	Introduction	Introduction to the courseHistory of High Voltage Engineering	1 st	2					
2.	Fields	Electric FieldMagnetic Field	2 nd	2					
3.	Conduction and Breakdown in Gases Dielectrics	 Ionization Processes Townsend's Current Growth Equation Streamer Theory Paschen's Law Breakdown in Non- uniform Fields Corona Discharges 	3 rd ,4 th ,5 th	6					
4.	Conduction and Breakdown in Liquid Dielectrics	Pure LiquidCommercial Liquids	6 th	2					
5.	Midterm Exam		7^{th}	2					

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6.	Breakdown in	 Electrical Breakdown 	8 th ,9 th	4
0.	Solid Dielectrics	 Thermal Breakdowns 		
7.	High voltage and current generation	 Generation of High AC Voltage Generation of High DC Voltage Generation of High Impulse Voltage Generation of High AC Impulse Current Generation of High DC Impulse Current 	10 th ,11 th	4
8.	High voltage and current measurements	Measurement of High VoltageMeasurement of High Current	12 th ,13 th	4
9.	High Voltage testing	 Testing of Materials Testing of Electrical Apparatus Partial Discharge Measurements Tests of Insulators Tests of Circuit Breakers, Tests of Cables 	14 th ,15 th	4
10.	Final exam		16 th	2
Numbe	Number of Weeks /and Units Per Semester 16 32			

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B – Tu	B – Tutorial Aspect:				
Order	Topics List		Contact Hours		
1.	Student Presentation on History of High Voltage Engineering	1 st	2		
2.	Student Presentation on Fields	2^{nd}	2		
3.	Ionization ProcessesTownsend's Current Growth	3 rd	2		
4.	- Streamer Theory - Paschen's Law	4 th ,5 th	4		
5.	Student Presentation on Conduction and Breakdown in Liquid Dielectrics	6 th ,7 th	4		
6.	Student Presentation on Conduction and Breakdown in Solid Dielectrics	8 th ,9 th	4		
7.	Student Presentation on High voltage and current generation	10 th ,11 th	4		
8.	Student Presentation on High voltage and current measurements	12 th	2		
9.	Student Presentation on High Voltage testing	13 th ,14 th	4		

VI. Teaching strategies of the course:

Number of Weeks /and Units Per Semester

- Lecture
- Dialogue and discussion
- Brainstorming
- **Problem Solving**
- Practical application
- Presentation

VII.Assignments:				
No	Assignments	Aligned CILOs(symbols)	Week Due	Mark
1.	Student Presentation on History of High Voltage Engineering	a1, a2, b2,c1,d1	3	1.25
2.	Student Presentation on Fields	a1, a2, b2,c1,d1	4	1.25

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Quality Assurance Unit Assoc. Prof. Dr. Mohammad Algorafi

Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti

Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad

Rector of Sana'a University Prof. Dr. Al-Qassim Mohammed Abbas

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100%





	Total			10
8.	Student Presentation on High Voltage testing	a1, b1, b2,c1,d1	11	1.25
7.	Student Presentation on High voltage and current measurements	a1, b1, b2,c1,d1	10	1.25
6.	Student Presentation on High voltage and current generation	a1, b1, b2,c1,d1	9	1.25
5.	Student Presentation on Conduction and Breakdown in Solid Dielectrics	a1, b1, b2,c1,d1	8	1.25
4.	Student Presentation on Conduction and Breakdown in Liquid Dielectrics	a1, b1, b2,c1,d1	6	1.25
3.	Student Presentation on Conduction and Breakdown in Gases Dielectrics	a1, b1, b2,c1,d1	5	1.25

VIII. Schedule of Assessment Tasks for Students during the Semester:				
No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
1.	Assignment	3- 11	10	6.7%
3.	Presentation project	Weekly	10	6.7%
4.	Quizzes	9,10,11	10	6.7%
5.	Mid-Term exam	7	30	20%
6.	Final Exam	16	90	60%

150

IX. Learning Resources:

• Written in the following order: (Author – Year of publication – Title – Edition – Place of publication – Publisher).

1- Required Textbook(s) (maximum two).

Total

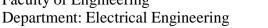
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- 2. M S Naidu, V Kamaraju-1996- Voltage Engineering-2nd edition- United States of America- McGraw-Hill.

2- Electronic Materials and Web Sites etc.

3- Essential References.

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Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad



Title of the Program: Electrical Power and Machines Engineering







- 1. Dr JP Holtzhausen, Dr WL Vosloo, 2006. High Voltage Engineering. Practice and Theory
- **2.** M. Khalifa-1990- High Voltage Engineering-Theory and Practice- United States of America-Marcel Dekker.
- **3.** G. Rohan Lucas-2001- High Voltage Engineering-Revised Edition-Sri Lanka- J R Lucas.

X.	Course Policies:		
1.	Class Attendance: -A student should attend not less than 75 % of total hours of the subject; otherwise he will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring an approved statement from university Clinic		
2.	Tardy:For late in attending the class, the student will be initially notified. If he repeated lateness in attending class he will be considered as absent.		
3.	Exam Attendance/Punctuality: - A student should attend the exam on time. He is Permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam.		
4.	Assignments & Projects: - The assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time.		
5.	Cheating:For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.		
6.	Plagiarism: Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proved a plagiarism of a student, he will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university.		
7.	 Other policies: Mobile phones are not allowed to use during a class lecture. It must be closed, otherwise the student will be asked to leave the lecture room Mobile phones are not allowed in class during the examination. 		

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Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti Academic
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Assoc. Prof. Dr.
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Sana'a University
Faculty of Engineering
Department: Electrical Engineering
Title of the Program: Electrical Power and Machines Engineering







Lecture notes and assignments my given directly to students using soft or hard copy

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Department: Electrical Engineering

Title of the Program: Electrical Power and Machines Engineering







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Quality Assurance Unit Assoc. Prof. Dr. Mohammad Algorafi Dean of the Faculty Prof. Dr. Mohammed AL-Bukhaiti Academic Development Center & Quality Assurance Assoc. Prof. Dr. Huda Al-Emad