

AlKarkh University of Science جامعة الكرخ للعلوم



*First Cycle – Bachelor's degree (B.Sc.) – Renewable
Energy Science*

باكلوريوس علوم – علوم الطاقة المتجددة



نموذج وصف البرنامج الأكاديمي

اسم الجامعة: جامعة الكرخ
الكلية/ المعهد: كلية علوم الطاقة والبيئة
القسم العلمي: قسم الطاقة المتجددة
اسم البرنامج الأكاديمي او المهني: بكالوريوس علوم طاقة
اسم الشهادة النهائية: بكالوريوس في . علوم الطاقة
النظام الدراسي: مسار بولونيا
تاريخ اعداد الوصف: 2/3/ 2026
تاريخ ملء الملف: 2/3/2026

التوقيع
اسم المعاون العلمي م.أ. د. هاشم بهار
التاريخ ٢٠٢٦ / ٢ / ٨

التوقيع
اسم رئيس القسم د. م.أ. د. عبد العزيز
التاريخ ٢٠٢٦ / ٢ / ٨

دقق الملف من قبل
شعبة ضمان الجودة والأداء الجامعي
اسم مدير شعبة ضمان الجودة والأداء الجامعي: د.أ. د. هاشم
التاريخ ٢٠٢٦ / ٢ / ٨
التوقيع

مصادقة السيد العميد
د.أ. د. راند توفي حسان
عميد كلية علوم الطاقة والبيئة
٢٠ / ٢ / ٨

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1. Overview

This catalogue is about the courses (modules) given by the program of Renewable Energy Science to gain the Bachelor of Science degree. The program delivers (48) Modules with (6000) total student workload hours and 240 total ECTS. The module delivery is based on the Bologna Process.

نظرة عامة

يتناول هذا الدليل المواد الدراسية التي يقدمها برنامج علوم الطاقة المتجددة للحصول على درجة بكالوريوس في العلوم. يقدم البرنامج (٤٠) مادة دراسية، على سبيل المثال، مع (٦٠٠٠) إجمالي ساعات حمل الطالب و ٢٤٠ إجمالي وحدات أوروبية. يعتمد تقديم المواد الدراسية على عملية بولونيا.

2. Undergraduate Courses 2025-2026

Module 1

Code	Course/Module Title	ECTS	Semester
KUS1101	Mathematics	5	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	62
Description			
This section includes a description of the module, 100-150 words			

Module 2

Code	Course/Module Title	ECTS	Semester
KUS1102	Fundamentals of computer science	3	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	64	11
Description			

This section includes a description of the module, 100-150 words

Module 3

Code	Course/Module Title	ECTS	Semester
KUS1103	Democracy and Human Rights	2	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2		33	17
Description			
This section includes a description of the module, 100-150 words			

Module 4

Code	Course/Module Title	ECTS	Semester
CRE1104	Analytical Chemistry	6	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	79	71
Description			
This section includes a description of the module, 100-150 words			

Module 5

Code	Course/Module Title	ECTS	Semester
CRE1105	General physics	7	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	4	94	81
Description			
This section includes a description of the module, 100-150 words			

Module 6

Code	Course/Module Title	ECTS	Semester
REE1106	Principles of renewable energies	7	1
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	97

Description
This section includes a description of the module, 100-150 words

Module 7

Module 7			
Code	Course/Module Title	ECTS	Semester
REE1217	Optics	7	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	4	94	81
Description			
This section includes a description of the module, 100-150 words			

Module 8

Module 6			
Code	Course/Module Title	ECTS	Semester
CRE1208	Organic chemistry	6	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	79	71
Description			
This section includes a description of the module, 100-150 words			

Module 9

Module 5			
Code	Course/Module Title	ECTS	Semester
CRE1209	Geology	6	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	79	71
Description			
This section includes a description of the module, 100-150 words			

Module 10

Code	Course/Module Title	ECTS	Semester
KUS12010	Arabic language	2	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2		33	17

Description
This section includes a description of the module, 100-150 words

Module 11

Code	Course/Module Title	ECTS	Semester
KUS12011	English language	2	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2		33	17
Description			
This section includes a description of the module, 100-150 words			

Module 12

Code	Course/Module Title	ECTS	Semester
REE12012	Fundamentals of electricity	7	2
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	79	96
Description			
This section includes a description of the module, 100-150 words			

Module 13

Code	Course/Module Title	ECTS	Semester
REE23013	Electronics	7	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	4	94	81
Description			
This section includes a description of the module, 100-150 words			

Module 14

Code	Course/Module Title	ECTS	Semester
REE23114	Circuit Analysis	6	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)

2	3	79	71
Description			
This section includes a description of the module, 100-150 words			

Module 15

Code	Course/Module Title	ECTS	Semester
REE23015	Inorganic Chemistry	3	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2		33	42
Description			
This section includes a description of the module, 100-150 words			

Module 16

Code	Course/Module Title	ECTS	Semester
KUS23016	Crimes of the baath party regime in Iraq	2	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2		33	17
Description			
This section includes a description of the module, 100-150 words			

Module 17

Code	Course/Module Title	ECTS	Semester
REE23017	Optoelectronics	6	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	79	71
Description			
This section includes a description of the module, 100-150 words			

Module 18

Code	Course/Module Title	ECTS	Semester
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REE23018	Thermodynamics	6	3
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	4	93	57
Description			
This section includes a description of the module, 100-150 words			

Module 19

Code	Course/Module Title	ECTS	Semester
REE24119	Digital Electronics	6	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	79	71
Description			
This section includes a description of the module, 100-150 words			

Module 20

Code	Course/Module Title	ECTS	Semester
KUS24120	Arabic Language (2)	2	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2		33	17
Description			
This section includes a description of the module, 100-150 words			

Module 21

Code	Course/Module Title	ECTS	Semester
KUS24021	English Language (2)	2	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2		33	17
Description			
This section includes a description of the module, 100-150 words			

Module 22

Code	Course/Module Title	ECTS	Semester
REE24022	Fluids	6	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	79	71
Description			
This section includes a description of the module, 100-150 words			

Module 23

Code	Course/Module Title	ECTS	Semester
REE24123	Renewable energy resources	3	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	48	27
Description			
This section includes a description of the module, 100-150 words			

Module 24

Code	Course/Module Title	ECTS	Semester
REE24024	Solar cells pv	4	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	37
Description			
This section includes a description of the module, 100-150 words			

Module 25

Code	Course/Module Title	ECTS	Semester
REE24025	Geothermal energy	4	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	48	52
Description			
This section includes a description of the module, 100-150 words			

Module 26

Code	Course/Module Title	ECTS	Semester
REE24026	Differential equations	3	4
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	48	27
Description			
This section includes a description of the module, 100-150 words			

Module 27

Code	Course/Module Title	ECTS	Semester
REE35025	Measurements & Control	3	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	48	27
Description			
This section includes a description of the module, 100-150 words			

Module 28

Code	Course/Module Title	ECTS	Semester
REE35026	Bioenergy	4	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	48	52
Description			
This section includes a description of the module, 100-150 words			

Module 29

Code	Course/Module Title	ECTS	Semester
REE35027	Solar Energy System	6	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	79	71
Description			
This section includes a description of the module, 100-150 words			

Module 30

Code	Course/Module Title	ECTS	Semester
REE35028	Energy Transmission & Storage	4	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	48	52
Description			
This section includes a description of the module, 100-150 words			

Module 31

Code	Course/Module Title	ECTS	Semester
REE35029	Modeling of Renewable Energy	6	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	79	71
Description			
This section includes a description of the module, 100-150 words			

Module 32

Code	Course/Module Title	ECTS	Semester
REE35030	Hydroelectronic Energy	4	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	37
Description			
This section includes a description of the module, 100-150 words			

Module 33

Code	Course/Module Title	ECTS	Semester
KUS24022	Application of computer science	3	5
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	64	11
Description			
This section includes a description of the module, 100-150 words			

Module 34

Code	Course/Module Title	ECTS	Semester
REE36031	Passive Solar Energy	7	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	97
Description			
This section includes a description of the module, 100-150 words			

Module 35

Code	Course/Module Title	ECTS	Semester
CRE36032	Climate Change	6	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	87
Description			
This section includes a description of the module, 100-150 words			

Module 36

Code	Course/Module Title	ECTS	Semester
REE36033	Methodology of scientific research	1	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
1		18	7
Description			
This section includes a description of the module, 100-150 words			

Module 37

Code	Course/Module Title	ECTS	Semester
REE36034	Heat Transfer	7	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	4	94	81
Description			

This section includes a description of the module, 100-150 words

Module 38

Code	Course/Module Title	ECTS	Semester
REE36035	Statistics	5	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	48	77
Description			
This section includes a description of the module, 100-150 words			

Module 39

Code	Course/Module Title	ECTS	Semester
REE36036	Elective Course	4	6
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	48	52
Description			
This section includes a description of the module, 100-150 words			

Module 40

Code	Course/Module Title	ECTS	Semester
REE47037	Hybrid Energy	6	7
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
This section includes a description of the module, 100-150 words			

Module 41

Code	Course/Module Title	ECTS	Semester
KUS47038	Job Ethics	3	7
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2		33	24
Description			

This section includes a description of the module, 100-150 words

Module 42

Code	Course/Module Title	ECTS	Semester
REE47039	Energy Management	7	7
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	97
Description			
This section includes a description of the module, 100-150 words			

Module 43

Code	Course/Module Title	ECTS	Semester
REE47040	Energy Efficiency	6	7
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	78	72
Description			
This section includes a description of the module, 100-150 words			

Module 44

Code	Course/Module Title	ECTS	Semester
REE47041	Graduation Project	4	7
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	48	52
Description			
This section includes a description of the module, 100-150 words			

Module 45

Code	Course/Module Title	ECTS	Semester
REE47042	Elective Course	4	7
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	48	52
Description			

This section includes a description of the module, 100-150 words

Module 46

Code	Course/Module Title	ECTS	Semester
REE48043	Wind Energy	6	8
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	3	79	71
Description			
This section includes a description of the module, 100-150 words			

Module 47

Code	Course/Module Title	ECTS	Semester
REE48144	Solar Thermal Energy Systems	7	8
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	4	94	81
Description			
This section includes a description of the module, 100-150 words			

Module 48

Code	Course/Module Title	ECTS	Semester
REE40845	Meteorology	4	8
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	48	52
Description			
This section includes a description of the module, 100-150 words			

Module 49

Code	Course/Module Title	ECTS	Semester
REE48046	Materials science and nanotechnology	4	8
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)

2	2	63	37
Description			
This section includes a description of the module, 100-150 words			

Module 50

Code	Course/Module Title	ECTS	Semester
REE48147	Economics of Energy	5	8
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	2	63	62
Description			
This section includes a description of the module, 100-150 words			

Module 51

Code	Course/Module Title	ECTS	Semester
REE48048	Elective Course	4	8
Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1	48	52
Description			
This section includes a description of the module, 100-150 words			

3. Contact

Program Manager:

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Mobile no.: +9647710399335



MODULE DESCRIPTION FOR MATHEMATICS

University Name: ALkarkh University of Science

College: Renewable Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information				
معلومات المادة الدراسية				
Module Title	Mathematics		Module Delivery	
Module Type	B		☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	Kus1101			
ECTS Credits	5			
SWL (hr/sem)	125			
Module Level	1	Semester of Delivery		1
Administering Department	REE	College	CRE	
Module Leader	Haleema swaidan ali		e-mail	haleemaswaidan@kus.edu.iq
Module Leader's Acad. Title	Proof.	Module Leader's Qualification	Ph.D	
Module Tutor	NONE		e-mail	NONE
Peer Reviewer Name	NONE		e-mail	NONE
Scientific Committee Approval Date	NONE	Version Number	1	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	NONE	Semester	
Co-requisites module	NONE	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. Introducing students to mathematical concepts in the subject of linear algebra and matrices. 2. Use and apply these concepts to solve applied problems. 3. Teach students to analyze results using mathematical methods. 4. Teaching students some special functions and their properties. 5. Teaching students to mix and combine mathematical concepts with practical problems. 6. Introducing students to the importance of mathematics
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Solving mathematical problems with scientific material. 2. Writing scientific reports and analyzing data. 3. Self learning method. 4. Solving problems relevant with mathematical subject. 5. Testing the student's ability to solve mathematical problems related to the subjects he studied.
Indicative Contents المحتويات الإرشادية	1. Introduction to Linear Algebra. 2. Linear system -Linear Equations –Solution Of Linear Equations. 3. Matrix Algebra. 4. Logarithmic function. 5. Trigonometric functions. 6. Exponential function. 7. Techniques of integrations.

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	1. Lectures: Providing students with basic mathematical concepts and their practical applications. 2. Forming discussion groups during lectures to discuss mathematics topics and solve practical problems. 3. Ask the students a set of thinking questions during the lectures, such as what, how, when and why for specific topics in mathematics. 4. Giving students homework that requires self-explanations in different ways. 5. Writing scientific reports and analyzing data. 6. solving problems relevant with mathematical subject.
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Student Work load (SWL)

الحمل الدراسي للطالب ل 15 اسبوعاً

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب أسبوعياً	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	62	Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب أسبوعياً	5.3
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	125 (h/sem)		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	Lo #2,#4,#6,#8,#10
	Assignments	2	10% (10)	2 and 12	Lo #1, #3,#5,#7,#9,#11
	Projects / Lab.	1	5%(5)	13	All
	Report	1	5% (5)	14	All
Summative assessment	Midterm Exam	2 hr	20% (20)	8	Lo #1-#8
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Matrices - the concept of matrices - some types of matrices- operations on matrices
Week 2	Determinants, Properties of the determinants ,Calculate the determinant of a 2x2 matrix and a nxn matrix.
Week 3	The Inverse - Matrix - Properties Of The Inverse - Matrix, The Transpose OperationProperties.
Week 4	practical - method for finding the Inverse the cofactor method.
Week 5	solution of linear systems using the inverse matrix- the adjutant inverse.
Week 6	solution of linear systems using The Cramer's rule.
Week 7	solution of linear systems using Gauss_ Jordan Elimination method.
Week 8	Slop of a line, equation of a line, types of line equation.
Week 9	Trigonometric functions - Derivation of trigonometric functions.
Week 10	Integration of Trigonometric Functions - Applications to Trigonometric Functions.
Week 11	Logarithmic function - properties of logarithmic function – derivation of logarithmic function.
Week 12	Integration of the logarithmic function-Applications to the logarithmic function.
Week 13	Exponential function - properties of the exponential function- derivation of the exponential function - integration of the exponential function.
Week 14	Techniques of integrations (by parts, tables)
Week 15	Techniques of integrations (partial fractions)
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Non

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Larson, Ron, and Bruce H. Edwards. Calculus. Cengage Learning , Calculus 2022.	yes
Recommended Texts	Larson, Ron. Precalculus with limits. Cengage Learning.	yes
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION OF FUNDAMENTAL OF COMPUTER SCIENCE

Module Information			
معلومات المادة الدراسية			
Module Title	Fundamental of computer Science		Module Delivery
Module Type	B		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	KUS1104		
ECTS Credits	٣		
SWL (hr/sem)	150		
Module Level	1	Semester of Delivery	
Administering Department	Energy and Environmental Science	College	1
Module Leader	Ahmed Adnan	e-mail	College of Energy and Environmental Science
Module Leader’s Acad. Title	Assistant lecturer	Module Leader’s Qualification	a.algbory@kus.edu.iq
Module Tutor	/	e-mail	M.SC
Peer Reviewer Name	/	e-mail	/
Scientific Committee Approval Date		Version Number	1.0

Relation with other Modules العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives

أهداف المادة الدراسية

1. Hardware: Computers consist of physical components, including the central processing unit (CPU), memory (RAM), storage devices (hard drives or solid-state drives), input/output devices (keyboard, mouse, monitor), and other peripheral devices.
2. Software: Software refers to the programs and instructions that enable computers to perform specific tasks. This includes the operating system, applications, and utilities that facilitate user interaction and manage hardware resources.
3. Central Processing Unit (CPU): The CPU is the "brain" of a computer, responsible for executing instructions and performing calculations. It performs tasks such as fetching, decoding, and executing program instructions.
4. Memory (RAM): Random Access Memory (RAM) is a volatile type of computer memory that provides temporary storage for data and instructions needed by the CPU in real-time. It allows for faster data access compared to permanent storage.
5. Storage: Computers use various types of storage devices to store data and programs permanently. Hard disk drives (HDDs) and solid-state drives (SSDs) are common examples. They retain data even when the computer is powered off.
6. Input and Output Devices: Input devices like keyboards and mouse allow users to provide instructions and interact with the computer. Output devices such as monitors and printers display or produce the results of computations or data processing.
7. Operating System (OS): The operating system is software that manages computer hardware and software resources. It provides a user interface, controls system functions, and facilitates the execution of programs.
8. Algorithms and Programming: Algorithms are step-by-step procedures or instructions for solving problems or accomplishing specific tasks. Programming involves writing code using programming languages to create software that instructs the computer to perform desired functions.

Module Learning Outcomes

مخرجات التعلم للمادة الدراسية

1. Understand the basic components of a computer system, including the CPU, memory, storage devices, and input/output devices.
2. Explain the role and functioning of the operating system in managing computer

	resources and facilitating user interaction. 3. Describe the binary number system and understand how data is represented and manipulated in digital computers. 4. Comprehend the concept of algorithms and their importance in solving computational problems. 5. Demonstrate knowledge of computer hardware and software interaction, including how the CPU executes instructions and interacts with memory and input/output devices. 6. Explain the basics of computer networking, including protocols, IP addressing, and network topologies. 7. Understand the principles of data storage and retrieval, including file systems and database management systems. 8. Evaluate the impact of emerging technologies on the field of computing, such as cloud computing, artificial intelligence, and cybersecurity. 9. Apply programming concepts to solve simple problems, including variables, control structures, and functions. 10. Demonstrate effective and safe use of computer systems, including understanding security measures and ethical considerations in computing.
Indicative Contents المحتويات الإرشادية	1. Introduction to Computers: - Evolution and history of computers - Basic computer components and their functions - Types of computers and their applications 2. Computer Hardware: - Central Processing Unit (CPU) and its architecture - Memory (RAM) and storage devices (hard drives, solid-state drives) - Input devices (keyboard, mouse, etc.) and output devices (monitor, printer, etc.) - Motherboard, power supply, and other peripheral devices 3. Computer Software: - Operating systems and their functions - Application software and utilities - Programming languages and software development tools

	4. Data Representation: - Binary number system and conversions - Character encoding (ASCII, Unicode) - Representation of integers, floating-point numbers, and characters 5. Algorithms and Problem Solving: - Introduction to algorithms and problem-solving approaches - Pseudocode and flowcharts - Fundamental algorithms like sorting, searching, and recursion 6. Computer Networks: - Basics of computer networking - Network topologies and protocols - IP addressing and subnetting 7. Programming Concepts: - Introduction to programming languages and paradigms - Variables, data types, and operators - Control structures (conditionals, loops) and functions 8. Emerging Technologies: - Cloud computing and its applications - Artificial intelligence and machine learning - Cybersecurity and data privacy considerations
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Lecture Discussion Practical Experience Clarification and Ask Questions reflect on what you have learned Research and reports

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	64	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	11	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	5% (10)	5 and 10	LO #1, #2 and #9, #10
	Assignments	2	5% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	14	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	10% (10)	7	LO #1 - #6
	Final Exam	3hr	60% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Enabling students to Know about computers and computing
Week 2	Enabling students to define binary representation and data storage
Week 3	Definition of Computer Hardware and CPU Operations
Week 4	Definition of Software and Operating Systems
Week 5	Understanding the algorithms and problem solving
Week 6	Empowering students to understand computer networks and the Internet
Week 7	Empowering students to become acquainted with data representation and encoding
Week 8	Empowering students to Introduction to database systems
Week 9	Empowering students about programming concepts and Constructs

Week 10	Empowering students to get an overview of the software development
Week 11	Empowering students to acquire knowledge about fundamentals of computer security
Week 12	Review and Final Assessment
Week 13	Empowering students to acquire knowledge about artificial Intelligence and machine Learning
Week 14	Enabling students to get an overview of emerging technologies in computing
Week 15	Empowering students to understand the privacy concerns and data protection regulations
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Lab 1: Familiarization with computer components: CPU, RAM, storage devices
Week 2	Lab 2: Installation and configuration of an operating system (e.g., Windows or Linux)
Week 3	Lab 3: Binary number system conversion exercises
Week 4	Lab 4: Implementing simple algorithms using pseudocode
Week 5	Lab 5: Setting up a small computer network
Week 6	Lab 6: Network troubleshooting exercises
Week 7	Lab 7: Working with file systems and organizing files
Week 8	Lab 8: Introduction to a programming language
Week 9	Lab 9: Implementing user-defined functions
Week 10	Lab 10: Discussing ethical implications of computer use
Week 11	Lab 11: Collaborative project to apply learned concepts or review sessions
Week 12	Lab 12: Practice with conditional statements and loops
Week 13	Lab 13: Sorting algorithms: (e.g., bubble sort or selection sort)
Week 14	Lab 15: Implementing algorithms to solve specific problems
Week 15	Lab 15: Familiarization with Stacks and queues
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Brookshear, J. Glenn, Dennis Brylow, and S. Manasa. "Computer science: An overview." (2009).	Yes

Recommended Texts	Patterson, David A., and John L. Hennessy. Computer organization and design ARM edition: the hardware software interface. Morgan kaufmann, 2016. Petzold, Charles. Code: The hidden language of computer hardware and software. Microsoft Press, 2000.	No
Websites	Computer Science YouTube Channels: Channels like "Computerphile" Computer Science," and "MIT Open Courseware".	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (فقد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Democracy and Human Rights		Module Delivery
Module Type	B		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	KUS1103		
ECTS Credits	2		
SWL (hr/sem)	50		
Module Level	1	Semester of Delivery	1
Administering Department	REE	College	CRE
Module Leader	Dr.Mohanad Basim Ibrahim		e-mail
Module Leader's Acad. Title		Lecturer	Module Leader's Qualification
Module Tutor	Name (if available)		e-mail
Peer Reviewer Name		None	e-mail
Scientific Committee Approval Date		Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	تهدف المادة إلى بيان أهمية الحقوق الأصلية للصيقة بالإنسان، التي تتفق مع فطرته، والتي يقبلها العقل المجرد، والتي لا تختلف باختلاف الزمان والمكان، وهذه هي حقوق الإنسان.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	تسهم المادة العلمي (لحقوق الإنسان) إلى تثقيف الطالب من الناحية القانونية؛ ليكون مطلع على ماهية الحقوق الإنسانية، وأصلها التاريخي، وتعريف ماله من حقوق وما عليه من التزامات، من خلال معرفة حقه وحدود ذلك الحق، وحقوق الآخرين، وما سعت إليه الدول والمنظمات الدولية والاقليمية في تعزيز مفاهيم تلك الحقوق، وإلزام الدول للنص عليها في التشريعات الداخلية، والضمانات التي تكفل تطبيق تلك الحقوق العالمية.
Indicative Contents المحتويات الإرشادية	إن المحتويات الإرشادية لمادة حقوق الإنسان تتلخص بتهذيب سلوك الطالب، [20hr] وتعريفه إن تعامله مع غيره من بني البشر-يقوم على مبدأ: ((إن الناس صنفان؛ إما أخو لك في الدين، أو نظير لك في الخلق)).[20 hr]

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	نعمد في هذا الجانب إلى ما يلي: - يعرف الطالب إبتداءً بمضمون موجز عن المفردات التي سيتم تناولها خلال المحاضرة، ثم نوجه له بعض الأسئلة التي تحرك ذهنه، وتشد إنتباهه؛ لضمان حسن الاستماع. - يتم التعمق بشرح المفردات العلمية في حدود تناسب متوسط المستويات العلمية لضمان عدم تجاوز الفروق الفردية عند عموم الطلبة. - يتم ترك مساحة للنقاش الحر في إطار الموضوع المخصص للمحاضرة. - الحرص على جانب التغذية الراجعة للمعلومات قبل نهاية المحاضرة. - التواصل إلكترونياً مع الطلبة لنشر المحاضرات المسجلة، والمكتوبة من خلال الموقع الرسمي للجامعة.
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Student Workload (SWL)

الحمل الدراسي للطلاب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطلاب خلال الفصل	33	Structured SWL (h/w) الحمل الدراسي المنتظم للطلاب أسبوعياً	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطلاب خلال الفصل	17	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطلاب أسبوعياً	
Total SWL (h/sem) الحمل الدراسي الكلي للطلاب خلال الفصل	50		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10	LO #1, 2, 10 and 11
	Seminar	1	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Home work	1	10% (10)	14	
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	تعريف وطبيعة حقوق الإنسان, التطور التاريخي لحقوق الإنسان
Week 2	مميزات حقوق الإنسان عن غيرها من الحقوق, حقوق الإنسان في الديانات السماوية
Week 3	حقوق الإنسان في المواثيق الدولية, حقوق الإنسان في التشريعات الداخلية
Week 4	حقوق الإنسان الشخصية, الاجتماعية, الثقافية, الاقتصادية
Week 5	ضمانات حقوق الإنسان الدولية, الإقليمية
Week 6	مفهوم الحرية, الحريات الشخصية والعامة
Week 7	حرية التعبير عن الرأي والمساواة امام القانون, حرية التنظيم والاقليات
Week 8	مفهوم الديمقراطية ومميزاتها
Week 9	الديمقراطية في الدستور
Week 10	أنواع الديمقراطية المباشرة وشبه المباشرة
Week 11	الديمقراطية النيابية, العلاقة بين حقوق الانسان والديمقراطية
Week 12	الجزاءات المترتبة على المساس بحقوق الإنسان
Week 13	المجتمع المدني والديمقراطية
Week 14	ضمانات حقوق الإنسان الداخلية (الوطنية)
Week 15	امتحان

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	كتاب/ حقوق الانسان (تطورها، مضامينها، حمايتها) د. رياض عزيز هادي.	Yes

Recommended Texts	كتاب/ حقوق الانسان د. حميد حنون.	No
Websites	https://www.noor-book.com/ https://www.un.org/ar/about-us/universal-declaration-of-human-rights https://ar.wikipedia.org/wiki/	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION of ANALYTICAL CHEMISTRY

Module Information			
معلومات المادة الدراسية			
Module Title	Analytical Chemistry		Module Delivery
Module Type	S		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar
Module Code	CRE1104		
ECTS Credits	1		
SWL (hr/sem)	150		
Module Level	1	Semester of Delivery	
Administering Department	Type Dept. Code	College	Type College Code
Module Leader	Hasan Mohammed Luaibi	e-mail	hasan.luaibi@kus.edu.iq
Module Leader's Acad. Title	Assistant Professor	Module Leader's Qualification	Ph.D
Module Tutor	None	e-mail	E-mail
Peer Reviewer Name	None	e-mail	E-mail
Scientific Committee Approval Date	20/06/2023	Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	The main objectives of a General Chemistry I module that covers the basics of general Chemistry and how to solve their parameters, which include: 1. Understanding the Buffer solutions, Volumetric Analysis. ,Types of Titration. ,Gravimetric Analysis. , Analytical Statistics. ,Analytical Separation Methods. And Green Chemistry . 2. Understanding about Buffer solution Understanding about Buffer solutions and the Buffer capacity , how can solve the problems of Buffer calculate when used strong acid and strong base or weak acid and base. 3. Understanding volumetric analysis , This objective would cover the types of classical methods with the titration steps and explain them details and solve their different question. 4. Understanding the second type of classical method it's gravimetric analysis and define the types of it , also explain the different between organic an in organic reagents , and the steps of gravimetric analysis in details. and examining the advantage and disadvantages between the types of gravimetric analysis. 5. Study the analytical Statistics ,this objective would cover statistical laws with learning how to used them to solve the practical data. 7. Explain another type of analytical chemistry is Analytical Separation Methods, and types of column which used to separate the different positive and negative ion . explain also how can separated the analyte from the interferences in the same sample , and which masking agent should used to avoid the interferences. 8. Green Chemistry, this objective would cover after all the subjects which the student studied them. how can chose the green material and used it instead of chemistry materials, or at least the students will Know how to choose the material which is safety for health and the environment From that this section would also cover the role that green chemistry may play in meeting future energy needs and reducing greenhouse gas emissions.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The students will be able to: 1. How can identify the primary standard materials and solutions . 2. How can identify the secondary standard materials and solutions . 3. Calculate the pH function for strong and weak acid and base , and how to distinguish between them. 4. Calculate concentration of liquid example and the percentage of example . 5. How to derive the calibration curve. 6. How to determine of Calcium or Magnesium ions which cause hardness in water at PH 10. 7. How to determination of halids in presence of the other without problem or side reaction. 8. How to calculate the mean, Recovery , Relative standard division and relative error. 9. How to separated the different ions from the other

	10. How can avoid the interferences. 11. What is green chemistry .
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Theory: - Buffer solutions and their calculations. [3 hrs]. - Volumetric Analysis. ,Types of Titrations., Acid- base titrations [12hrs] - Gravimetric Analysis. [9hrs] - Analytical Statistics. [3hrs] - Analytical Separation Methods. [18hrs] - Green Chemistry [3hrs]

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Lectures: used to introduce and explain key concepts related to Buffer solutions. Volumetric Analysis. Types of Titration, Gravimetric Analysis, Analytical Statistics, Analytical Separation Methods, Green Chemistry. Interactive discussions: used to engage students in critical thinking and problem-solving questions related to calculate the pH ,the percentage , the concentration of metal ion , separation the ion through group discussions, debates, case studies, and simulations. Multimedia resources: used to enhance student engagement and understanding of complex concepts related to the types of chemistry through videos, and animations. Assessment and feedback: used to measure student learning and provide feedback on their progress through quizzes, exams, and projects.
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Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ٥١ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	79	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	71	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.06
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1, #2 and #3, #6
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #5, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #2, #3 and #5
Summative assessment	Midterm Exam	1hr	10% (10)	7	LO #1 - #5
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Buffer solutions ,
Week 2	calculate buffer solution.
Week 3	Volumetric Analysis methods , Titrations
Week 4	Neutralization titrations and solve the problem.
Week 5	Acid -base titrations
Week 6	Precipitation titrations
Week 7	Complex-formation titrations
Week 8	Oxidation -reduction titrations
Week 9	Gravimetric analysis methods
Week 10	Calculation
Week 11	Analytical Statistics.
Week 12	Analytical Separation Methods
Week 13	Types of Analytical Separation Methods
Week 14	Applications of Analytical Separation Methods
Week 15	Green Chemistry
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الأسبوعي للمختبر

	Material Covered
Week 1	Preparation of 0.1 N Hydrochloric Acid (Secondary Standard) and its standardization with Sodium Carbonate (Primary Standard).
Week 2	Preparation of 0.1 N Sodium Hydroxide and its standardization with standard HCl solution.
Week 3	Standardization of HCl using standard solution of sodium carbonate then determination of concentration of sodium hydroxide and carbonate sodium in mixture.
Week 4	Determination of ammonia using standard solution of HCl.
Week 5	Determination the percentage of ethanoic acid (acetic acid) in vinegar.
Week 6	Standardization of potassium permanganate using oxalic acid.
Week 7	Silver nitrate titrations by Mohr method.

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1. Fundamental of Analytical Chemistry. by Skoog & West, Holler , Crouch. 10th-Ed 2022 2. Handbook of Green Analytical Chemistry MIGUEL DE LA GUARDIA SALVADOR GARRIGUES 1st Ed. 2012 3. Principle of Instrumental Analysis 7Th Edition By Douglas A. Skoog, F.Games Holler, Stanley R. Crouch 2016.	No

Recommended Texts	1. Analytical Chemistry. by Christian. 2004 2. Fundamental Chemistry for Medical Science By Dr. Jameel M. Dhabab 2020	No
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Websites	None
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Grading Scheme مخطط الدرجات
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Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
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Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR

GENERAL PHYSICS

University Name: ALkarkh University of Science

College: Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information				
Module Title	General physics		Module Delivery	
Module Type	S		☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☒Seminar	
Module Code	CRE110 ^o			
ECTS Credits	7			
SWL (hr/sem)	175			
Module Level	1	Semester of Delivery		
Administering Department	REE	College	CRE	
Module Leader	Mohammed Ali Hassan GHlem		e-mail	Albeaty33@kus.edu.iq
Module Leader’s Acad. Title	Lecture doctor	Module Leader’s Qualification	Ph.D.	
Module Tutor	Mohammed Obaid		e-mail	NONE
Peer Reviewer Name	NONE		e-mail	NONE
Scientific Committee Approval Date	2023/06/20	Version Number	1.0	

Relation with other Modules

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	1- becomes able to know 1. Measurement units and coordinates. 2. Object movement and the use of vectors. 3. Distinguish between work and energy and the relationship between them 4- Understand electric charge and electric field. 5- Knowing the materials. 6- Identify the electric field of charges and electric field lines. 7- Identifying the forces, moments and electric potential energy. 8- Learn about Gauss' law ,Ohm's Law, Coulomb's law.
Module Learning Outcomes	Make the student able to: 1- Determine the coordinates and units of measurement used. 2. Applying Newton's laws of motion 3-Understand electric charge and electric field. 4- Knowing the composition of the material. 5- Know the types of matter. 6- Know the types of electric charge. 7- Learn about Coulomb's law. 8- Identify the electric field of charges and electric field lines. 9- Identifying the forces, moments and electric potential energy. 10- Learn about Gauss' law.
Indicative Contents	Indicative content includes the following. Physical Quantities Units, and vectors ,Motion Along a straight Line, Motion in two dimensions,Newton's Laws of Motion,Work and kinetic energy electric charge and electric field, electric charge and structure of matter, types of matter, charge is conserved, charging by induction and friction,electric forces on uncharged objects, Coulomb's law, electric field, electric field on a point charge, electric field calculations, electric field lines, electric dipole, forces, moments and electric potential energy, Gauss' law.

Learning and Teaching Strategies

Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students and by oral, written exams and homeworks
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Student Workload (SWL)

Structured SWL (h/sem)	94		
Unstructured SWL (h/sem)	81		
Total SWL (h/sem)	175		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	20% (20)	2, 5, 10, 12	
	Assignments	2	5%(5)	2, 12	
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	5% (5)	13	
Summative assessment	Midterm Exam	2 hr	10% (10)	8	
	Final Exam	2hr	50% (50)	16	
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	1. Fundamentals of physics.
Week 2	2. Coordinates and units of measurement used in the field of physics
Week 3	3. The motion of bodies and the application of Newton's laws.
Week 4	4. The relationship between work and energy
Week 5	5 - Analysis of the influencing forces
Week 6	Analysis of the influencing forces
Week 7	electric charge, electric field, electric charge and structure of matter.

Week 8	Mid exam + types of matter, charge is conserved, charging by induction and friction
Week 9	electric forces on uncharged objects, Coulomb's law
Week 10	electric forces on uncharged objects, Coulomb's law
Week 11	electric field, electric field on a point charge,
Week 12	electric field calculations, electric field lines,
Week 13	electric dipole, forces, moments and electric potential energy
Week 14	Causs' law, electric flux and the enclosed charge
Week 15	
Week 16	Preparative for final exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Lab 1: Ohms law and Ohmic and Non Ohmic materials
Week 2	Lab 2: Diffraction grating
Week 3	Lab 3: Archimedes principle
Week 4	Lab 4: Spiral spring
Week 5	Lab 5: Simple pendulum
Week 6	Lab 6: speed and sound
Week 7	Lab 7: The flywheel

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	Edward M.Purcell, Electriscity and magnetism,3 rd edition	yes
Recommended Texts	University physics with modern physics, 13 th edition	Yes
	University Physics, 13th Edition Hugh D. Young and Roger A. Freedman Addison-Wesley publishing.	yes
	Physics for Scientists and Engineers with Modern Physics, Ninth Edition .Raymond A. Serway and John W. Jewett, Jr	yes

Grading Scheme				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION OF PRINCIPLE OF RENEWABLE ENERGIES

University Name: ALkarkh University of Sciences

College: Renewable Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information					
Module Title	Principle of New and Renewable Energies		Module Delivery		
Module Type	C		☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☒ Practical ☒ Seminar		
Module Code	REE110٦				
ECTS Credits	7				
SWL (hr/sem)	1٧5				
Module Level		1	Semester of Delivery		1
Administering Department		REE	College	CRE	
Module Leader	Firas Abdulrazzaq Hadi		e-mail	Firas.A.Hadi@kus.edu.iq	
Module Leader’s Acad. Title		Asst. Prof.	Module Leader’s Qualification		Ph.D.
Module Tutor	NONE		e-mail	NONE	
Peer Reviewer Name		NONE	e-mail	NONE	
Scientific Committee Approval Date		20/6/2023	Version Number		1

Relation with other Modules			
Prerequisite module	NONE	Semester	No
Co-requisites module	NONE	Semester	No

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	The Renewable and Sustainable Energy Systems course provides a graduate-level understanding of the conversion principles and technology behind various renewable energy sources. It also examines the issues involved in the integration of various renewable energy sources and their economics for heat, power, and transportation needs. Based on the technical and sustainability challenges, the future outlook for each of the sources and systems is discussed. This is a required core course for the Master of Professional Studies in Renewable Energy and Sustainability Systems Program. When you successfully complete this course, you will be to: • understand the principles of operation of the broad spectrum of renewable energy technologies; • conduct preliminary resource assessments for a variety of renewable energy technologies; • analyze energy technologies from a systems perspective; • articulate the technical challenges for each of the renewable sources; and • discuss economic, technical, and sustainability issues involved in the integration of renewable energy systems.
Module Learning Outcomes	1. demonstrate an ability to use critical thinking and problem-solving skills to evaluate business energy use and how and when to apply renewable energy solutions 2. demonstrate an understanding of, and assess the obstacles associated with implementation of renewable energy systems 3. evaluate the advantages, limitations and potential of various clean energy sources for buildings and businesses . 4. demonstrate an understanding and familiarity with engineering and financial aspects of projects . 5. demonstrate an understanding and familiarity with the regulatory aspects of renewable energy projects . 6. demonstrate an understanding and familiarity with the State policies, financing and utility-led programs in CT 7. produce a clean energy project proposal
Indicative Contents	Introduction to conventional and Renewable energy sources environmental impacts, challenges and future trends, fundamentals, potential, estimation and, applications: Solar Energy Wind Energy Hydropower Biomass Geothermal Energy Ocean Energy

Learning and Teaching Strategies

Strategies	1- Speaking 2- Discussion 3- Reports 4- Projects 5- Assignments
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Student Workload (SWL)

Structured SWL (h/sem)	VA	Structured SWL (h/w)	4
Unstructured SWL (h/sem)	9V	Unstructured SWL (h/w)	4
Total SWL (h/sem)	1V5		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5,10	
	Assignments	2	10% (10)	2,12	
	Projects / Lab.	1	10% (10)	-	
	Report	1	10% (10)	13	
Summative assessment	Midterm Exam	2 hr	10% (10)	7	
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Energy Sources
Week 2	Solar Photovoltaics
Week 3	PV system components
Week 4	Solar Power Systems - Electrical
Week 5	Solar Power Systems - Thermal
Week 6	Wind Power Fundamentals
Week 7	Wind Power Systems

Week 8	Wind Turbine Control
Week 9	Biomass Technologies
Week 10	Geothermal Power Generation
Week 11	Hydropower
Week 12	Fuel Cells
Week 13	Environmental Effects
Week 14	Connecting to The Grid
Week 15	Economics of RE
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	/
Week 2	/
Week 3	/
Week 4	/
Week 5	/
Week 6	/
Week 7	/

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	Renewable Energy Systems, David Buchla, Thomas Kissell and Thomas Floyd, Pearson, 2015, ISBN: 978-0-13-262251-6. Hardcopy available in the bookstore, eBook	
Recommended Texts	1. Renewable energy resources: Tiwari and ghosal, Narosa publication. 2. Non conventional Energy Sources, Khanna Publication	
Websites	• Wind LCA Harmonization (NREL/FS-6A20-57131 • June 2013) (link is external)(link is external) • • Solar Energy Industry Association's Solar Market Insight Report for 2013	

Grading Scheme				
Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Module Information					
معلومات المادة الدراسية					
Module Title	Optics		Module Delivery		
Module Type	Core learning activity		☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☒ Seminar		
Module Code	REE1217				
ECTS Credits	7				
SWL (hr/sem)	175				
Module Level		UGI	Semester of Delivery		2
Administering Department		REE	College	CRE	
Module Leader	Dr. Ethar Yahya Salih		e-mail	ethar@kus.edu.iq	
Module Leader's Acad. Title		Dr.	Module Leader's Qualification		Ph.D.
Module Tutor	Dr. Ethar Yahya Salih		e-mail	ethar@kus.edu.iq	
Peer Reviewer Name		Name	e-mail		
Scientific Committee Approval Date		01/07/2023	Version Number	1.0	

Relation with other Modules				
العلاقة مع المواد الدراسية الأخرى				
Prerequisite module	General Physics (CRE110٥)		Semester	1
Co-requisites module	None		Semester	None

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. To develop problem solving skills and understanding of optics through the application of techniques. 2. To understand electromagnetic radiation, nature of light, & optical systems. 3. A central theme is a description of phase and coherence that enables a discussion of applications of modern optics including interference & diffraction by introducing interferometers, interference in multilayer films, & diffracting gratings. 4. This course deals with the basic concept of optical systems. 5. To understand how different types of lenses and mirrors are used for solar energy.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Qualitatively describe the diffraction pattern techniques. 2. Explain how various optical instruments work. 3. Calculate the properties of optical systems. 4. Develop a deep understanding of how mirrors or other optics collect incoming sunlight and focus it efficiently onto a photovoltaic cell array, which then converts sunlight into useable, storable energy. 5. Review and justify the commercial advantage of different forms of mirrors & lenses for solar energy.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part 1</u> Introduction to Electromagnetic Wave, The Nature of Light & Light Propagation, Speed of Light in Matter, The Ray Model of Light & the Ray Model of Light, Reflection & Refraction, & Dispersion & Polarization [30 hrs.]. <u>Part 2</u> Introduction to Mirrors & their uses in Renewable Energy, Spherical Mirrors & Ray Tracing (The Mirror Equation), Introduction to Thin Lenses & their uses in Renewable Energy, & Types of Lenses (convex & Concave Lenses) [30 hrs.]. <u>Part 3</u> Interference & Young's Double-Slit Interference [12 hrs.]. <u>Part 4</u> Applications of optics for Renewable Energies I & II [18 hrs.].

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	1. Visualization 2. Cooperative Learning 3. Differentiated Instruction 4. Using Technology to your Advantage 5. Student Centered Inquiry 6. Professional Development
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعياً	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	81	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعياً	5.4
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 11	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	4, 13	LO # 3, 4, 6 and 7
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week 1	Introduction to Electromagnetic Wave
Week 2	The Nature of Light & Light Propagation
Week 3	Speed of Light in Matter
Week 4	The Ray Model of Light & the Ray Model of Light
Week 5	Reflection & Refraction
Week 6	Dispersion & Polarization
Week 7	Introduction to Mirrors & their uses in Renewable Energy
Week 8	Spherical Mirrors & Ray Tracing (The Mirror Equation)
Week 9	Introduction to Thin Lenses & their uses in Renewable Energy
Week 10	Types of Lenses (convex & Concave Lenses)
Week 11	Interference
Week 12	Young's Double-Slit Interference
Week 13	Applications of optics for Renewable Energies I
Week 14	Applications of optics for Renewable Energies II
Week 15	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الأسبوعي للمختبر

	Material Covered
Week 1	Lab 1: Snell's law (Refractive index)
Week 2	Lab 2: Convex Lens
Week 3	Lab 3: Concave Lens
Week 4	Lab 4: Spherometer
Week 5	Lab 5: Diffraction grating
Week 6	Lab 6: The Spectrometer
Week 7	Lab 7: Young's double slit

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Fundamental of physics, Textbook by David Halliday, Jearl Walker, and Robert Resnick	No
Recommended Texts	University physics, Textbook by Hugh Young and Roger Freedman.	No
Websites	https://phet.colorado.edu/en/simulations/geometric-optics	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FOR ORGANIC CHEMISTRY

University Name: Alkarkh University of Sciences

College: Renewable Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information معلومات المادة الدراسية				
Module Title	Organic chemistry		Module Delivery	
Module Type	S		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	CRE120.٨			
ECTS Credits	٦			
SWL (hr/sem)	1٥0			
Module Level	1	Semester of Delivery		2
Administering Department	REE	College	CRE	
Module Leader	Alaa Joied Hamad		e-mail	alaajoied@kus.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	Ph.D	
Module Tutor	NONE		e-mail	NONE
Peer Reviewer Name	NONE		e-mail	NONE
Scientific Committee Approval Date	20/6/2023	Version Number	1.0	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	Organic chemistry	Semester	2
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. To know the structure and bonding in organic compound 2. Nomenclature of different organic compounds 3. Physical properties 4. Preparation of some organic compounds Reaction of some organic compounds
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 1. Alkyl halide and elimination reaction 2. Alcohol, ethers and epoxides 3. Benzene and aromatic compounds 4. Carboxylic acid and acidity of O-H 5. Aldehydes and ketones 1. Amines
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Theoretical lectures</u> Introduction, , types organic compounds structure and bonding physical properties and naming of compounds

Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدرا يس المنتظم للطالب خلال الفصل	٧٩		
Unstructured SWL (h/sem) الحمل الدرا يس غ ري المنتظم للطالب خلال الفصل	٧١		
Total SWL (h/sem) الحمل الدرا يس الك يل للطالب خلال الفصل	1٥٠		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO #1 - #7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المناهج الأسبوعي النظري

	Material Covered
Week 1	Alkyl halide name , structure, physical properties
Week 2	Preparation , reaction.
Week 3	Structure of alcohol ethers and epoxides physical properties name.
Week 4	Reaction and preparation of alcohol.
Week 5	Reaction and preparation of ether.
Week 6	Reaction and preparation of epoxides
Week 7	Carboxylic acid structure, physical properties acidity.
Week 8	Preparation and reaction of carboxylic acids
Week 9	Structure of aldehydes and ketones physical properties and naming
Week 10	Preparation of aldehydes and ketones
Week 11	Reaction of aldehydes and ketones
Week 12	The difference between aldehydes and ketones
Week 13	Structure and bonding in amines Physical properties and naming
Week 14	Preparation of amine
Week 15	Reaction of amine
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	laboratory safety
Week 2	Melting point measurement
Week 3	Boiling point measurement
Week 4	Recrystallization
Week 5	extraction
Week 6	Preparation of detergents
Week 7	Detection of compounds using reagents

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Morrison and boyde 1972 organic chemistry	
Recommended Texts	Janice G 2006 organic chemistry	
Websites	-----	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A – Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E – Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR

Geology

University Name: ALkarkh University of Science

College Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information				
Module Title	Geology		Module Delivery	
Module Type	S		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒Seminar	
Module Code	CRE1209			
ECTS Credits	7			
SWL (hr/sem)	10.			
Module Level	1	Semester of Delivery		
Administering Department		REE	College	CRE
Module Leader	Ahmed Askar Najaf		e-mail	drahmed@kus.edu.iq
Module Leader’s Acad. Title		Professor	Module Leader’s Qualification	
Module Tutor		NONE	e-mail	NONE
Peer Reviewer Name		NONE	e-mail	NONE
Scientific Committee Approval Date		20/06/2023	Version Number	1.0

Relation with other Modules

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives	1. Clarification of how micropaleontology can make significant contributions to a wide range of scientific problems in geosciences. 2. Identify two microfossil groups (ostracode and calcareous nannofossil) which are useful in Geosciences. 3. This course deals with the basic concept of the most important and discriminatory morphological characters, anatomical, and taxonomic aspects of each fossil group. 4. Learn about the most important scientific terms (Terminology) and their definitions related to this topic. 5. To understand and comprehend the impact of these groups on ecology, distribution, and paleoecology. 6. To perform different micropaleontology applications.
Module Learning Outcomes	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 1. List with description, the different groups of organisms and the kingdoms that belong to them. 2. Define the various terms associated with micropaleontology. 3. What is ostracode? Definition, measurement of valves, orientation and importance in geoscience. 4. Summarize what is meant by external and internal features and structures of ostracode. 5. Discuss the reaction and involvement of ostracode in paleoecology, distribution, paleoclimat and stratigraphy. 6. Define Coccoliths, coccolithophores and Coccolithophores and the Biosphere. 7. Identify the Coccoliths and Coccolithogenesis. 8. Explain the Coccolith morphology and formation. 9. List and Describe the Ecology and distribution of Coccolithophores. 10. Discuss the Functions of coccoliths. 11. Identify the relation of coccolith with climate changes. 12. Terminology.
Indicative Contents	Indicative content includes the following. <u>Part A – Theoretical lectures</u> Introduction, organisms groups , types of microfossils, taxonomic position , general characteristic of ostracoda, importance of ostracoda study (as microfossils), morphology of ostracoda, calcareous parts , outer lamella, inner lamella, description

	of margins, features and structures used for the orientation of the carapace, external feature, internal features, terminology of ostracode, dimorphism. [10 hrs] ,Ecology, distribution of marine ostracoda, factors controlled of the distribution of ostracoda, distribution of environments according to the salinity levels, Paleoecology. [8 hrs] Primary producers in the sea, primary Production, coccolithophores, coccolithophores and the biosphere coccoliths and coccolithogenesis, nannofossils, nannoplankton, coccolith morphology and formation, heterococcoliths, holococcoliths, nannoliths. [10 hrs] Ecology of coccolithophores, coccoliths and sedimentology, functions of coccoliths, geologic distribution, effect of global climate change on distribution, evolutionary responses, terminology of calcareous nannofossils. [8 hrs] Revision problem classes [3 hrs] <u>Part B – Practical labs</u> Shape, Overlap, measurements of carapace and valves, orientation, external features, external structures, internal features, internal structures, inner lamella, outer lamella, Hinge line, ornamentation, description of some index species. [18 hrs] coccolith shape, coccoliths orientation, Coccolith size, ultrastructure, types of ultrastructural component, element arrangement , structures spanning central-area, orientation in plan view, structures closing central-area, crystallography, systematic paleontology, description of some index species. [18 hrs]
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Learning and Teaching Strategies

Strategies	Expanding students' perceptions about this science and its contents it includes that help in stratigraphic, paleoecologic, and paleoclimatic analysis. In addition to the use of different microscopes in distinguishing the types of microfossils through observations of the external and internal structures and their diagnosis. This will be achieved through lectures, labs, and interactive tutorials and by types of practical diagnostic methods for microfossils and involving some sampling activities that are interesting to the students.
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Student Workload (SWL)

Structured SWL (h/sem)	V9	Structured SWL (h/w)	5
Unstructured SWL (h/sem)	V1	Unstructured SWL (h/w)	2
Total SWL (h/sem)	10 .		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Structure of earth
Week 2	Crust and mantle and core composition
Week 3	Types of spheres
Week 4	Crystal
Week 5	Minerals (classifications)
Week 6	Rocks type
Week 7	Igneous and sedimentary and metamorphic
Week 8	Rock cycle in nature
Week 9	Soils types and classifications
Week 10	Structure geology
Week 11	Bedding strata
Week 12	Folding type and component
Week 13	Faulting types and component
Week 14	Joints type and classification
Week 15	Geological map and topographic

Week 16	Preparative of final exam
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Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Kious, Jacquelyne; Tilling, Robert I. (1996). "Understanding Plate Motions". This Dynamic Earth: The Story of Plate Tectonics. Kiger, Martha, Russel, Jane (Online ed.). Reston, VA: United States Geological Survey. ISBN 978-0-16-048220-5. Archived from the original on 10 August 2011. Retrieved 13 March 2009.	Yes Yes
Recommended Texts	Zheng, Y; Fu, Bin; Gong, Bing; Li, Long (2003). "Stable isotope geochemistry of ultrahigh pressure metamorphic rocks from the Dabie–Sulu orogen in China: implications for geodynamics and fluid regime". Earth-Science Reviews. ج. 62: 105–161. Bibcode:2003ESRv...62..105Z. DOI:10.1016/S0012-8252(02)00133-2. Condomines, M; Tanguy, J;	Yes No
Websites		

Grading Scheme				
Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM

نموذج وصف مادة اللغة العربية

Module Information			
معلومات المادة الدراسية			
Module Title	Arabic Language		Module Delivery
Module Type	B		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	KUS12010		
ECTS Credits	2		
SWL (hr/sem)	50		
Module Level	1	Semester of Delivery	١
Administering Department	Environmental health Science	College	Energy and Environmental Science
Module Leader	Dr. Ahmed kahlaf	e-mail	Ahmed.k@kus.edu.iq
Module Leader's Acad. Title	Assistant lecturer	Module Leader's Qualification	Ph.D.
Module Tutor	Name (if available)	e-mail	E-mail
Peer Reviewer Name	Name	e-mail	E-mail
Scientific Committee Approval Date		Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims	١- تعلم العربية السليمة كونها اللغة الرسمية للوطن ٢- اللغة جوهر الهوية ورمزها
أهداف المادة الدراسية	

	٣- اللغة تختلف عن اللهجة، فالأولى عالمية والثانية محلية ٤- توظيف المفردات الفصيحة في الصياغة الأكاديمية للبحوث العلمية مترجمة بنظيرها الفصحى ٥- التمكن من كتابة البحوث والمقالات ذات المحتوى العلمي الصرف باللغة العربية الفصحى ٦- تجنب الأخطاء الشائعة في الكتابة واختيار المفردات الصائبة ٧- إثراء الخزين المعجمي لدى الطالب للمساعدة في بناء كاريزما التواصل الكلامي ٨- الاطلاع على نماذج من الأدب العربي شعرا ونثرا لما لها من أساس في بناء الجانب الثقافي المتنوع لدى الطالب ٩- كتابة الأعداد بتمكّن فضلا الكتابة الصحيحة في صياغة الطلبات الرسمية ١٠- التعرف على الدرس الصوتي في اللغة العربية وعلاقته بعلم الفيزياء
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	عند انتهاء مفردات المادة الدراسية يكون الطالب متمكنا من: ١- الكتابة السليمة خالية من الأخطاء ٢- التعبير العلمي الأكاديمي الصحيح ٣- استعمال المفردات الفصيحة توظيفا ونطقا ٤- إضافة رصيد لغوي ومفاهيم جديدة لمعاني الكلمات ٥- القدرة على مخاطبة الإدارية في الطلبات الرسمية
Indicative Contents المحتويات الإرشادية	١- لكل تخصص لغته التي تومئ إليه، وتدل عليه، ولغة كل علم تنبع من طبيعة كنهه، فالاختصاصات العلمية لها معجم خاص بها يعبر عن جوهرها ومضمونها، فضلا عن المصطلحات الخاصة بها التي تدل عليها، وكذلك المصادر العلمية التي يُرجع إليها، والحال كما في اللغة الأدبية؛ فهي أيضا لها مفرداتها وطريقة كتابتها والتعبير بها وعبرها، ومصطلحاتها الخاصة بها التي تعبر عنها وتدل عليها. [4 hrs] ٢- المعاجم - بشكل عام - على اختلاف موارها تمثل محتوى وكفا لمفردات أي لغة مقترنة بالشرح والتفسير لتلك المفردات، أما المعاجم في اللغة العربية فهي واسعة ومتنوعة؛ فهناك معاجم غير معجمات اللغة، فالعربية فيها أول معجم جغرافي في التاريخ، معجم البلدان لـ (ياقوت الحموي)، فضلا عن المعاجم المتخصصة في جزئية معينة، مثل معاجم البلاغة، فضلا عن تنوع المدارس في تأليف المعاجم وتبويبها وطريقة البحث عن المفردة فيها. [4 hrs] ٣- العلامة تدرج ضمن حقل علم السيميائيات، وعلامات الترقيم من المواضيع المهمة بالأخص في البحوث الأكاديمية، بغض النظر عن التخصص، سواء كان التخصص علميا، أو إنسانيا، من هنا تأتي أهمية علامات الترقيم؛ فلها دور سيميائي، ودلالي مهم في الكتابة النصية وفي بناء النص، فهي تُسهّل الفهم على القارئ، وتوضح المعنى المقصود، عبر القراءة والتلفظ بالعبرة، فعلايات الترقيم خير وسيلة لإظهار الصراحة وبيان الوضوح في الكلام المكتوب؛ لأنه يدلّ الناظر إلى تلك العلامات الاصطلاحية وعلى العلاقات التي تربط أجزاء الكلام بعضها ببعض بوجه عام، وأجزاء كلّ جملة بوجه خاص، وكما يقول المتخصصون عن علامات الترقيم: بأن الوقف ليس مستقلاً، وإنّما هو من توابع التّفكير، أي: إنّ السّكتات المقرّرة بمقادير مضبوطة في مواضع معينة، ليست مجرد محطّات تنفسيّة بالمعنى البيولوجيّ للتّنفس، وإنّما في المقام الأوّل وقفات معنويّة. فالعبرة من النّاحية اللّغويّة ليست بأن يستعيد القارئ نفسه، بل المهم أن يتعاطى القارئ السكت بمقادير معلومة، وفي مواضع محددة من السلسلة المنطوقة رفعا للبس، وصونا لمقصد المتكلّم عن التبدّل، فهذه العلامات تجسّد لمشاعر الكاتب وقصديّاته فيها. [4 hrs] ٤. الأسلوب الكتابي يمثل بصمة للكاتب الذي يصدر عنه، ويتجسد عند القارئ، ولكل كاتب أسلوبه الخاص به، ينعكس ذلك في نتاج الكاتب، وللأسلوب أنواع مختلفة، فهناك الأسلوب العلمي، والأسلوب الأدبي، والأسلوب الخطابي، ولكل نوع خصائصه، وقالبه الذي يتكون فيه. [4 hrs] ٥. الأحداث التي تقترن بالزمن تمثل الأفعال، والأفعال في العربية تناظر الأزمنة في اللغات الأخرى من جانب معين، أو من جزئية معينة، والعربية تحتوي على عدد كبير من الجذور، جذور الأفعال، ففي العربية أفعال ثلاثية ورباعية وخماسية وسداسية، والفعل جزء مهم من أجزاء الكلام الأساسية، فضلا عن الجانب الصوتي في هذه الجذور، فعلم (الأصوات الفيزيائي) من العلوم المهمة في اللغة العربية، إذ يُعد علم (الأصوات الأكوستيكي) علما أقرب إلى الفيزياء منه للعلوم الإنسانية، وهو يمثل المرحلة الوسطى بين علم الأصوات النطقي وعلم الأصوات السمعي، وعلاقته مع اللغة العربية انطلاقا من البذرة الأولى في دراسة مخارج الحروف فيزيائيا ودلاليا. [4 hrs] ٦. الكلام عن الشعر لا ينتهي؛ فالشعر تجسيد لمشاعر الفرد المتمثل بالشاعر، والمشاعر الجمعية للإنسانية

Indicative Contents المحتويات الإرشادية

جمعاء، فهو موجود لدى كل بني البشر، والشعر العربي القديم كان بمثابة نشيدا وطنيا لهم، يمثل هويتهم الثقافية الرصينة ويمثل سجلا لتاريخهم وأمجادهم، على اختلاف اغراضه من غزل ومدح ورثاء وغير ذلك، وبحور الشعر في الشعر العربي مبنية بناء صوتيا فريدا عبر التفعيلات التي وضعها الخليل بن احمد الفراهيدي ووضع فلسفتها وكنهها وقواعدها، والشعر رصيد ثقافي، وحجة في الكلام، وزينة ورونقا يضاف على شخصية الفرد والمجتمع بشكل عام. [4 hrs]

٧. الهمزة من المواضيع الاجرائية لدى الفرد الكاتب، بغض النظر عن التخصص، فيحتاجها كل فرد ناطق كاتب بها، فلها قواعدها التي تصدر عنها، وتكتب بالشكل السليم منها، فموضوع رسم الهمزة من الاهمية بمكان؛ فرسمها يغير من المعنى، فلا بد من وضعها ورسمها بالشكل الصحيح لتوخي التعبير الدقيق عن المعنى المقصود. [8 hrs]

٨. المفاعيل في اللغة العربية، من الموضوعات المهمة في درس اللغة العربية، ولا بد لكل دارس من معرفتها بشكل عام، وهناك آراء مختلفة بين البلاغيين والنحويين عن المفاعيل، هل ان تلك المفعولات فضلة، أم أنها ركن رئيس في الجملة ؛ فالنحويون يرون انها فضلة في الجملة، وأن ركني الجملة الأساسيين هما: الفعل، والفاعل ، وأما البلاغيون فيرون :إنها ليست فضلة، وإنما هي ركن أساسي في الجملة؛ لأن كل كلمة تُدَل على معنى في الجملة، وإذا ما دلت على معنى فلا تُعد فضلة، وإنما هي ركن رئيس في الجملة وبنائها، ورأي البلاغيين أقرب للصواب من رأي النحويين، فدراستها في العربية لغير المختصين مما يضيف لهم خزينا تعبيريا متوفا. [4 hrs]

٩. من المعروف وجود ظاهرة الأخطاء اللغوية نحوية كانت أو املائية أو اسلوبية، عند متحدثي اللغة العربية وبالأخص عند غير المختصين بها ولا سيما من يعملون في مجال الاعلام، وهذه الظاهرة اتسعت وزاد انتشارها في العصر الحديث، فأخذت هذه الأخطاء تغزو مجالات الدراسة جميعها، من ذلك موضوع (العدد) في اللغة العربية، فنجد كثيرا من الطلبة وكذلك من عامة الناس يستعملون الأرقام بدلا من كتابتها بالحروف؛ وذلك لتجنب الوقوع في الخطأ وهذا دليل ضعف لا يليق بالدارس أيا كان تخصصه؛ ولهذا فموضوع العدد وقواعد كتابته في اللغة العربية موضوع لا غنى عنه في زمن لغة الأرقام. [8 hrs]

١٠. هناك مجموعة من الالفاظ متداولة بشكل كبير، تُستعمل في غير مكانها الصحيح، وفي غير ما وُضعت له وهذه الالفاظ تُستعمل في المخاطبات الرسمية الادارية بالمعنى غير الصحيح او الدقيق الذي تحمله تلك الالفاظ من معاني، فضلا عن أهمية توخي الدقة في هذه الالفاظ توظيفا لها في الطلبات الرسمية التي تُقدم على اختلاف موضوعاتها، فالطلب لا بد من ان يكون مختصرا مركزا، يعطي الفكرة الموجزة، والهدف المقصود منه ازاء صاحب الادارة الذي تُقدم اليه الطلبات، وما في ذلك من ايجابيات العمل في التخفيف واختصار للجهد والوقت في تنفيذ المهام الادارية الموكلة الافراد على اختلاف درجاتهم. [8 hrs]

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies

صناعة شخصية متكاملة للطالب الجامعي من حيث التخصص العلمي الدقيق والتخصص المساند

Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعياً	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	17	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعياً	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	2, 12	LO # 3, 4, 6 and 7
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week 1	الفرق بين اللغة العلمية واللغة الأدبية
Week 2	المعاجم العربية وأنواعها
Week 3	علامات الترقيم
Week 4	الأسلوب
Week 5	الأفعال – أنواعها وتقسيماتها
Week 6	نماذج مختارة من الشعر العربي القديم - الشعر الإسلامي - الشعر الأموي
Week 7	Mid-term Exam
Week 8	رسم الهمزة / همزة الوصل وهمزة القطع
Week 9	كتابة الهمزة بداية الكلام وآخره
Week 10	المبتدأ والخبر – مهارات كتابة العدد

Week 11	المفاعيل / المفعول به – المفعول لأجله
Week 12	المفعول معه – المفعول فيه – المفعول المطلق
Week 13	النثر العربي
Week 14	الأخطاء الشائعة – طريقة كتابة الطلبات الرسمية
Week 15	نماذج مختارة من الشعر العباسي والشعر الحديث
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الأسبوعي للمختبر

	Material Covered
Wek 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	1- كتاب: العربية الجامعية لغير المتخصصين / د. عبده الراجحي 2- كتاب: النحو التطبيقي / د. عبده الراجحي 3- الصرف التطبيقي / د. عبده الراجحي 4- النحو الوافي / عباس حسن 5- تاريخ الادب العربي / شوقي ضيف	Available in the Library?
Required Texts		
Recommended Texts		
Websites	شبكة الفصيح لعلوم اللغة العربية	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A – Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C – Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E – Sufficient	مقبول	50 - 59	Work meets minimum criteria

Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR ENGLISH LANGUAGE

Module Information				
معلومات المادة الدراسية				
Module Title	English		Module Delivery	
Module Type	B		☐ Theory ☒ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	KUS12011			
ECTS Credits	2			
SWL (hr/sem)	50			
Module Level	1	Semester of Delivery		2
Administering Department	Energy and Environmental Science	College	College of Energy and Environmental Science	
Module Leader	Ahmed Adnan		e-mail	a.algbory@kus.edu.iq
Module Leader's Acad. Title	Assistant lecturer	Module Leader's Qualification	M.SC	
Module Tutor	/		e-mail	/
Peer Reviewer Name	/		e-mail	/
Scientific Committee Approval Date		Version Number	1.0	

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives

أهداف المادة الدراسية

1. Vocabulary and Grammar: Introduce learners to essential English vocabulary and grammar structures, allowing them to understand and construct basic sentences and expressions.
2. Listening Skills: Develop learners' ability to comprehend simple spoken English in various contexts, such as greetings, introductions, and everyday conversations.
3. Speaking Skills: Enable learners to engage in basic conversations using appropriate vocabulary, grammar, and pronunciation. Learners will gain confidence in expressing their ideas, opinions, and preferences.
4. Reading Skills: Improve learners' reading comprehension skills by exposing them to short texts and passages on familiar topics. Learners will practice extracting meaning from the text and understanding main ideas and details.
5. Writing Skills: Enhance learners' ability to write simple sentences and short paragraphs with correct grammar, spelling, and punctuation. Learners will focus on expressing themselves coherently and accurately in written form.
6. Pronunciation and Intonation: Help learners develop clear pronunciation and intonation patterns, enabling effective oral communication and comprehension.
7. Cultural Awareness: Introduce learners to cultural aspects of English-speaking countries, promoting understanding and sensitivity toward cultural differences in language use.
8. Everyday Communication: Provide learners with practical language skills for everyday situations, such as greetings, introducing themselves and others, ordering food, asking for directions, and making basic inquiries.
9. Language Strategies: Equip learners with strategies to improve their language learning, including techniques for vocabulary acquisition, self-study, and independent practice.
10. Confidence and Fluency: Foster learners' confidence in using English and develop their fluency through various speaking and interactive activities.
11. Lifelong Learning: Encourage learners to cultivate a lifelong learning attitude towards English language acquisition, motivating them to continue expanding their language skills beyond the module.

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understand and use basic English vocabulary and expressions related to daily life, including greetings, introductions, and common objects. 2. Comprehend and respond appropriately to simple spoken English in familiar contexts, such as basic conversations, instructions, and short presentations. 3. Construct grammatically correct and meaningful sentences using basic grammar structures, including verb tenses, pronouns, and basic sentence patterns. 4. Read and understand simple texts and passages on familiar topics, extracting main ideas and specific details. 5. Write simple sentences and short paragraphs with appropriate grammar, spelling, and punctuation, expressing ideas clearly and coherently. 6. Engage in basic conversations and interactions, demonstrating effective communication skills in everyday situations. 7. Demonstrate improved pronunciation and intonation patterns, enabling clearer oral communication. 8. Develop cultural awareness and sensitivity towards English-speaking cultures, recognizing and respecting cultural differences in language use. 9. Demonstrate increased confidence and fluency in using English to communicate ideas, opinions, and preferences. 10. Apply critical thinking skills to analyze and evaluate simple texts and language use.
Indicative Contents المحتويات الإرشادية	1. Unit 1: Introduction - Greetings and introductions - Personal information (name, age, nationality) - Basic expressions for everyday communication 2. Unit 2: Everyday Life - Describing daily routines and activities - Expressing likes and dislikes - Talking about hobbies and interests 3. Unit 3: People and Places - Describing people's appearances and personalities - Talking about family members and relationships - Asking for and giving directions

	4. Unit 4: Food and Drinks - Vocabulary related to food and beverages - Ordering food and drinks at a restaurant or café - Talking about preferences and dietary restrictions 5. Unit 5: Shopping - Vocabulary related to shopping and clothes - Describing clothing items and sizes - Making inquiries and purchasing items 6. Unit 6: Travel and Transport - Vocabulary related to travel and transportation - Asking for and giving travel information - Describing modes of transportation and travel experiences 7. Unit 7: Leisure Activities - Talking about leisure activities and hobbies - Discussing weekend plans and free time activities - Making suggestions and invitations 8. Unit 8: Daily Life Skills - Talking about personal routines and habits - Describing abilities and skills - Making requests and giving instructions 9. Unit 9: Health and Well-being - Discussing health and common ailments - Describing symptoms and seeking medical assistance - Giving advice and talking about healthy habits 10. Unit 10: Social Interactions - Engaging in small talk and social conversations - Discussing current events and popular topics - Sharing opinions and perspectives
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Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Lecture Discussion Experimental Quizzes
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	Speaking tasks Written assignments Evaluation methods to track their language development
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Student Workload (SWL)			
الحمل الدراسي للطالب محسوب لـ 13 اسبوعا			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	33	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	17	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	50		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	5% (10)	5 and 10	LO #1, #2 and #9, #10
	Assignments	2	5% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	14	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	10% (10)	7	LO #1 - #7
	Final Exam	3hr	60% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to English Language Basics
Week 2	Language Basics
Week 3	Greetings and Introductions
Week 4	Everyday Conversations
Week 5	Everyday Conversations

Week 6	Vocabulary Expansion
Week 7	Expressing Likes and Dislikes
Week 8	Describing People and Places
Week 9	Describing Objects
Week 10	Daily Activities
Week 11	Daily Routines
Week 12	Reading Skills Development
Week 13	Reading Skills Development
Week 14	Writing Skills Development
Week 15	Writing Skills Development
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
	None

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Soars, John, and Liz Soars. New headway: Beginner student's book. Oxford: Oxford University Press, 2010.	Yes
Recommended Texts	Soars, Liz, John Soars, and Amanda Maris. "American Headway Starter: Teacher's Book."	No
Websites	English language learning websites and mobile applications for additional practice and reinforcement	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (فقد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

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Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR

Fundamentals of electricity

University Name: ALkarkh University of Science

College: Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information			
معلومات المادة الدراسية			
Module Title	Fundamentals of electricity		Module Delivery
Module Type	C	☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	REE12012		
ECTS Credits	7		
SWL (hr/sem)	175		
Module Level	1		Semester of Delivery
Administering Department	REE	College	CRE
Module Leader	omar Kanaan noori	e-mail	Omareng27@gmail.com
Module Leader's Acad. Title	Lecturer Dr	Module Leader's Qualification	PhD
Module Tutor	NONE	e-mail	NONE
Peer Reviewer Name	NONE	e-mail	NONE
Scientific Committee Approval Date	20/6/2023	Version Number	1

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None		Semester
Co-requisites module	None		Semester

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	The overview of development and current trends in electrical engineering and computer science. Fundamentals of electricity, capacitance. Electric current and electrical phenomena. Fundamentals of magnetism, inductance and mutual inductance. Concepts, elements and topology of electric circuits. Kirchhoff's laws. Elementary DC circuits. Circuits with capacitors. Complex DC circuits (bridge circuit, star-delta transformation, circuits with multiple sources). Superposition, Thevenin's, Norton's and Millman's theorem. Current and voltage waveforms. Complex calculus in analysis of AC circuits. RLC circuits. Topographic and locus diagrams. Frequency characteristics. Instantaneous, real, reactive and apparent power. AC circuits with multiple sources. Polyphase system. Harmonic analysis, applications in circuit analysis. Transients.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. define and understand the fundamental concepts related to electricity, magnetism and electric circuit theory. 2. understand and apply Kirchhoff's Laws to DC and AC circuit analysis. 3. understand and apply phasors for sinusoidal steady-state AC circuit analysis. 4. analyze DC and AC circuits by following circuit analysis methods and theorems: nodal analysis, star-delta transformation, transformation between real source models, Millman's, Thévenin's and Norton's theorems. 5. understand and apply the principle of linearity and superposition to AC and DC circuits. 6. analyze circuits with non-sinusoidal sources by harmonic analysis. 7. analyze transient response of first order circuits (series RC and RL). 8. use basic laboratory measurement equipment including the power supplies, ammeters, voltmeters, ohmmeters, digital multimeters, function generators, and oscilloscopes as well as to conduct experiments, to measure basic quantities in electric circuits, and to interpret data.
Indicative Contents المحتويات الإرشادية	The course gives understanding of concepts, laws and principles regarding electrical circuits. After finishing this course students will be able to analyze DC and AC electrical circuits and understand underlying physical phenomena.

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Lectures: Traditional lectures can be used to deliver foundational knowledge on conductive polymers, their properties, and applications. Lectures can also include discussions on historical developments and key concepts. Case Studies: Case studies can be used to explore real-world applications of conductive polymers. Students can analyze and discuss the challenges, opportunities, and outcomes of specific projects or industry collaborations, allowing them to gain insights into practical applications. Group Discussions and Debates: Group discussions encourage active participation and critical thinking. Students can engage in debates on topics such as the future of
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	conductive polymers, ethical considerations, or emerging applications. This promotes collaborative learning and develops communication skills. Problem-Based Learning: Students can be presented with open-ended problems or scenarios related to conductive polymers. They can work in groups to analyze the problem, propose solutions, and present their findings. This fosters analytical thinking and problem-solving skills. Research Projects: Assigning research projects to students allows them to explore specific aspects of conductive polymers in depth. They can conduct literature reviews, design experiments, and analyze data, contributing to the advancement of knowledge in the field. Online Resources and Virtual Tools: Utilizing online resources, digital simulations, and virtual tools can enhance learning. These resources can provide interactive demonstrations, virtual experiments, and supplementary materials for self-paced learning. Presentations and Poster Sessions: Assigning presentations or poster sessions allows students to communicate their research findings or assigned topics effectively. This develops their presentation skills, promotes peer learning, and encourages critical evaluation of information. Formative and Summative Assessments: Regular formative assessments, such as quizzes or group projects, can help monitor students' progress. Summative assessments, such as examinations or research reports, evaluate students' understanding and mastery of the curriculum.
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Student Workload (SWL)			
الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدرا ييس المنتظم للطالب خلال الفصل	79	Structured SWL (h/w)	5
Unstructured SWL (h/sem) الحمل الدرا ييس غري المنتظم للطالب خلال الفصل	96	Unstructured SWL (h/w)	6
Total SWL (h/sem) الحمل الدرا ييس الك يل للطالب خلال الفصل	175		

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Course description with the overview of development and current trends in electrical engineering and computer science. Fundamentals of electricity, (atoms and their structure, electric charge, electric force, electric field, electric potential, capacitance and capacitor, capacitor energy).
Week 2	Electric current and electrical phenomena (resistance, Ohm's and Joule's Law, electrical energy and power). Concepts, elements and topology of electric circuits. Kirchhoff's laws.
Week 3	Elementary DC circuits. Circuits with capacitors.
Week 4	More complex DC circuits (bridge circuit, star-delta transformation, circuits with multiple sources). Superposition principle.
Week 5	Current and voltage waveforms. Complex calculus in analysis of AC circuits. Phasors
Week 6	Fundamentals of magnetism (magnetic force, magnetic field, Faraday's Law, inductance and mutual inductance, inductor energy).
Week 7	1. RLC circuits. Frequency characteristics.
Week 8	1. Midterm exam.
Week 9	1. Power and energy in AC circuits
Week 10	1. Topographic and locus diagrams. Complex AC circuits.
Week 11	1. Circuit analysis methods.
Week 12	1. Poliphase systems.
Week 13	1. Transients. Characteristics of nonsinusoidal periodical waveforms.
Week 14	1. Waveform harmonic analysis
Week 15	Seminars for students on recent developments in conductive polymers
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	V. Pinter (1989.), <i>Osnove elektrotehnike, I i II dio</i> , Tehnička knjiga, Zagreb	No
Recommended Texts	E. Šehović, M. Tkalić, I Felja (1992.), <i>Osnove elektrotehnike - zbirka primjera, I dio</i> , Školska knjiga,	No

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR ELECTRONICS



University Name: ALkarkh University of Sciences

College: Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information				
Module Title	Electronics		Module Delivery	
Module Type	C		☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☒ Seminar	
Module Code	REE23013			
ECTS Credits	7			
SWL (hr/sem)	175			
Module Level		2		
Administering Department		REE	College	CRE
Module Leader	Mohammed Ali Hassan GHlem		e-mail	Albeaty33@kus.edu.iq
Module Leader’s Acad. Title		Lecture doctor	Module Leader’s Qualification	
Module Tutor		NONE	e-mail	NONE
Peer Reviewer Name		NONE	e-mail	NONE
Scientific Committee Approval Date		2023/06/20	Version Number	1.0

Relation with other Modules

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	1- Describe the basics, principles and concepts of electronic circuits 2- Presentation of the physical and electrical properties of semiconductors and insulating materials 3- Designing electronic circuits 4- Identify the most important circuits for converting electrical energy 5- Using the tools to expand the student's understanding of the electronic bite and energy transfers 6- Learn how diodes work and focus on solar energy to generate solar energy.
Module Learning Outcomes	Cognitive objectives (after teaching the course, the student will be able to) 1- Understand the classification of naturally occurring substances by their electrical properties. 2- Able to apply the basic principles of electronic circuits in dealing with electronic devices 3- Understanding the mechanism of solar cell work, in addition to the basic design of solar cells 4- Understanding the conversion mechanism between the types of electrical energy (alternating - continuous) 5- The soft skills objectives of the course. (After teaching the vocabulary of the course, the student will be able to) 6- Analyzing electronic circuits and solving their problems that hinder the operation of systems used in renewable energy 7- Designing and implementing electronic circuits from raw materials for the production of clean energy 8- Designing and implementing electronic circuits to convert between types of electrical energy (alternating-continuous) to reach the final goal of operation. 9- Able to fix solar cell problems
Indicative Contents	Indicative content includes the following. Conduction in semiconductors ,PN junction ,Solar cells structure and design Diode applications (Rectifiers) ,Diode applications (Clipper circuits) Diode applications (Voltage multiplier) ,Zener diodes,Transistors

Learning and Teaching Strategies

Strategies	Search for the latest developments and designs in the field of solar energy production and distribution, in addition to the latest scientific research in the development of electronic circuits to achieve the widest benefit from clean energy
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem)	94		
Unstructured SWL (h/sem)	81		
Total SWL (h/sem)	175		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	20% (20)	2, 6, 10, 12	
	Assignments	2	5%(5)	2, 12	
	Projects / Lab.	1	10% (10)	Continuous	
	Report	1	5% (5)	13	
Summative assessment	Midterm Exam	2 hr	10% (10)	8	
	Final Exam	2hr	50% (50)	16	
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Conduction in semiconductors
Week 2	Conduction in semiconductors
Week 3	PN junction
Week 4	PN junction
Week 5	Solar cells structure and design
Week 6	Solar cells structure and design
Week 7	Diode applications (Rectifiers)
Week 8	Mid-term exam +Diode applications (Rectifiers)
Week 9	Diode applications (Clipper circuits)
Week 10	Diode applications (Clipper circuits)
Week 11	Diode applications (Voltage multiplier)
Week 12	Diode applications (Voltage multiplier)
Week 13	Zener diodes

Week 14	Zener diodes
Week 15	
Week 16	
	Preparatory week for Final Exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Lab 1:
Week 2	Lab 2:
Week 3	Lab 3:
Week 4	Lab 4:
Week 5	Lab 5:
Week 6	Lab 6:
Week 7	Lab 7:

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Boylestad, Robert L., and Louis Nashelsky. "Electronic Devices and Circuit Theory 11th ed." (2018).	yes
Recommended Texts	1. Millman, Jacob, Christos C. Halkias, and Satyabrata Jit. <i>Millman's Electronic Devices and Circuits</i> . Tata McGraw-Hill, 2010. FLOYD, Thomas L., and David BUCHLA. "Electronics Fundamentals Circuits Devices and Applications." (2014).	Yes
Recommended Texts	https://ieeexplore.ieee.org/xpl/RecentIssue.jspx?punumber=55	yes
Websites	https://www.youtube.com/watch?v=Fwj_d3uO5g8&ab_channel=TheEngineeringMindset	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR

Circuit analysis

University Name: ALkarkh University of Sciences

College: Renewable Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information					
معلومات المادة الدراسية					
Module Title	Circuit analysis		Module Delivery		
Module Type	C		☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar		
Module Code	REE23114				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		2			Semester of Delivery
Administering Department		REE	College	CRE	
Module Leader	omar Kanaan noori		e-mail	Omareng27@gmail.com	
Module Leader's Acad. Title		Lecturer	Module Leader's Qualification		PhD
Module Tutor	NONE		e-mail	NONE	
Peer Reviewer Name		NONE	e-mail	NONE	
Scientific Committee Approval Date		NONE	Version Number	NONE	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	FUNDEMENTALS OF ELECTRICITY (RE1208)	Semester	2
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	● To learn the basic concepts and behaviour of DC and AC circuits. ● To understand various methods of circuit/ network analysis using network theorems. ● To understand the transient and steady state response of the circuits subjected to DC excitations and AC with sinusoidal excitations. ● To learn the concept of coupling in circuits and topologies.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Explain the concept and applications of operational amplifiers [a]. Understand the concept, modes of operation and applications of operational amplifiers Study the design of analog systems using operational amplifiers [b, c]. Understand the methodology for using op-amps to design op-amp base amplifiers, oscillators and comparators. Students will understand how to apply this circuit in the medical instrumentation. Understand the operating principle and parameters of TTL and MOSFET logic gates circuits [b, c]. Understand the operating principle, design and applications of TTL and MOSFET logic gates Understand the types, parameters and operation of multivibrators [a]. Be familiar with the principle of astable, monostable and bi-stable multivibrators with their applications in biomedical engineering Understand the use and operation of A/D and D/A converters [a, b]. Be familiar with the principles of DTL, RTL and TTL logic gates
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Active learning, where students should be active and involved in the learning process inside the classroom, will be emphasized in the delivery of this course. - Different active learning methods/approaches such as: Engaged Learning, Project-Based Learning, Cooperative Learning, Problem-based Learning, Structured Problem-solving, will be used. - The teaching method that will be used in this course will be composed of a series of mini lectures interrupted with frequent discussions and brainstorming exercises. PowerPoint presentations will be prepared for the course materials. - A typical lecture would start with a short review (~ 5 minutes) using both PowerPoint presentations and the blackboard. This review will also depend on
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	discussions which will gauge the students' digestion of the previous material. Then, the students would have a lecture on new materials using PowerPoint presentations and blackboard. The lecture presentation will be paused every 15 – 20 minutes with brainstorming questions and discussions that will allow the students to reflect and think in more depth about what they learned in that presentation. Then, some example problems will be presented and discussed with the students to illustrate the appropriate problem solving skills that the students should learn. The lecture will be continued for another 15 – 20 minutes, followed by examples and/or a quiz covering the materials taught in the previous two weeks.
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	79	Structured SWL (h/w)	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	71	Unstructured SWL (h/w)	6
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week 1	Operational Amplifiers Theory of operation, inverting amplifier,
Week 2	summing amplifier, non-inverting amplifier, current to voltage converter, difference amplifier, instrumentation amplifier, integrator, differentiator, and oscillators

Week 3	Op-amp Based Oscillators Conditions of oscillation,
Week 4	Wien bridge oscillator
Week 5	Transistor-Transistor Logic (TTL) Family BJT Inverter Voltage transfer characteristic,
Week 6	logic levels, noise margin, fan-out, transient response,
Week 7	1. MOSFET Logic Circuits NMOSSET inverter,
Week 8	1. complementary NMOSFET (CMOS) Inverter,
Week 9	1. Regenerative Logic Circuits Bistable multivibrator Monostable multivibrator A stable multivibrator
Week 10	1. Analog-Digital Data Converters Digital-to-Analog (D/A)
Week 11	1. converters Analog-to-Digital (A/D) converters
Week 12	1. MOSFET logic gates, interfacing CMOS and TTL logic gates.
Week 13	switching speed, and basic TTL inverter, basic TTL NAND gate
Week 14	
Week 15	Seminars for students on recent developments in conductive polymers
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Adler, Jerry, "Another Bright Idea," <i>Newsweek</i> , June 15, 1992, p. 67. Albean, D. L., "Single Pot Swings Amplifier Gain Positive or Negative," <i>Electronic Design</i> , January 1997, p. 153. Barnes, R., and Wong, K. T., "Unbalanced and Harmonic Studies for the Channel Tunnel Railway System," <i>IEE Proceedings</i> , March 1991, pp. 41–50. Bernstein, Theodore, "Electrical Shock Hazards," <i>IEEE Transactions on Education</i> , August 1991, pp. 216–222. Brown, S. F., "Predicting Earthquakes," <i>Popular Science</i> , June 1989, pp. 124–125.	No
Recommended Texts		No
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR

Inorganic Chemistry

University Name: ALkarkh University of Sciences

College: Energy and Environmental Sciences

Dept: Renewable Energies Sciences

Module Information

معلومات المادة الدراسية

Module Title	Inorganic Chemistry			Module Delivery	
Module Type	C			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	REE23015				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level		2	Semester of Delivery		
			3		
Administering Department		REE	College	CRE	
Module Leader	Al-Hamza Dheyaa Hameed		e-mail		
Module Leader’s Acad. Title		Lecturer	Module Leader’s Qualification		PhD
Module Tutor	None		e-mail	none	
Peer Reviewer Name		None	e-mail	none	
Scientific Committee Approval Date		20/06/2023	Version Number		1.0

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives	1. Acquisition of skills in General Chemistry and Inorganic Chemistry. 2. To develop the ability to correlate the chemical and physical properties of elements and their compounds with their positions in the periodic table. 3. To establish the link between theory and laboratory practice by conducting laboratory experiments. 4. To acquire expertise in chemistry laboratory in handling of reagents and solvents as well as in analytical techniques.
Module Learning Outcomes	The intended subject specific learning outcomes. On successfully completing the module students will be able to: 1. Use chemical terminology. 2. Explain the trend in the periodic table using theoretical models. 3. Write and balance equations. 4. Understand the principles of electronegativity. 5. Explain the reactivity series and give example reactions. 6. Begin to comprehend the inter-relationship of scientific disciplines.
Indicative Contents المحتويات الإرشادية	Introduction, Matter, Atom, Electronic structure of the atom Classical theory, Bohr Theory, Quantum theory: Examples Practical examples using quantum numbers Periodic Table of the Elements: s-block, p-block, d-block, f-block Important Notes, Some periodic properties of atoms, Shielding constant To calculate the shielding constant of the electron in orbital s, p: Periodic Properties: Atom radius, Ionization Energy, Electron Affinity, Electronegativity The basic conditions for the composition of ionic compound.[15 hr] Group I (1A): Introduction, The Alkali Metals, General properties The diagonal relationships: Sodium (Na): Chemical properties, Sodium: reactions of elements Alkaline Earth Metals Group II (IIA): Calcium, Chemical properties, Calcium: reactions of elements Elements of Group IIIA, Boron: reactions of element, Aluminum, Aluminum: reactions of elements Fourth group IVA: Carbon: reactions of elements, Silicon: reactions of elements. Ionic Compound Polarization Factors affecting the increase or decrease of polarization Hydrogen: Preparation Methods of Hydrogen, Reactions of Hydrogen

	Hydrogen Compounds: Nitrogen Hydrogen Compounds, Phosphorus Hydrogen Compounds, Sulfur Hydrogen Compounds, Halogen Hydrogen Compounds Hydrogen isotopes [15 hr] Hybridization: Types of Hybridization: sp Hybridization, sp² Hybridization, sp³ Hybridization Applications of hybridization: Linear molecule: Trigonal planar molecules, Tetrahedral molecules, Tetrahedral molecule (Pyramidal), Tetrahedral molecule (V-Shape), Trigonal bipyramid molecule, Octahedral molecule, Conclusion. Valence bond theory: Examples [15 hrs]
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Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Expanding students' perceptions about this science and its contents it includes that help in acquisition of skills in General Chemistry and Inorganic Chemistry. To develop the ability to correlate the chemical and physical properties of elements and their compounds with their positions in the periodic table and involving some examples activities that are interesting to the students.
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Student Workload (SWL)

الحمل الدراسي يس للطلاب محسوب ل ١٥ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطلاب خلال الفصل	٣٣	Structured SWL (h/w) الحمل الدراسي المنتظم للطلاب أسبوعيا	
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطلاب خلال الفصل	٤٢	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطلاب أسبوعيا	
Total SWL (h/sem) الحمل الدراسي الكلي للطلاب خلال الفصل	٧٥		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	
	Assignments	2	10% (10)	2 and 12	
	Projects	1	10% (10)	Continuous	
	Report	1	10% (10)	13	
Summative assessment	Midterm Exam	2hr	10% (10)	7	
	Final Exam	3hr	50% (50)	16	
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week 1	Introduction, Matter, Atom, Electronic structure of the atom
Week 2	Classical theory, Bohr Theory, Quantum theory: Examples, Practical examples using quantum numbers
Week 3	Periodic Table of the Elements: s-block, p-block, d-block, f-block, Important Notes.
Week 4	Some periodic properties of atoms, Shielding constant, To calculate the shielding constant of the electron in orbital s, p:
Week 5	Periodic Properties: Atom radius, Ionization Energy, Electron Affinity, Electronegativity
Week 6	The basic conditions for the composition of ionic compound.
Week 7	Group I (1A): Introduction, The Alkali Metals, General properties, The diagonal relation ships:
Week 8	Sodium (Na): Chemical properties, Sodium: reactions of elements
Week 9	Alkaline Earth Metals Group II (IIA): Calcium, Chemical properties, Calcium: reactions of elements
Week 10	Elements of Group IIIA, Boron: reactions of element, Aluminum, Aluminum: reactions of elements
Week 11	Fourth group IVA: Carbon: reactions of elements, Silicon: reactions of elements.
Week 12	Ionic Compound Polarization, Factors affecting the increase or decrease of polarization
Week 13	Hydrogen: Preparation Methods of Hydrogen, Reactions of Hydrogen Hydrogen Compounds: Nitrogen Hydrogen Compounds, Phosphorus Hydrogen Compounds, Sulfur Hydrogen Compounds, Halogen Hydrogen Compounds, Hydrogen isotopes
Week 14	Hybridization: Types of Hybridization: sp Hybridization, sp ² Hybridization, sp ³ Hybridization

Week 15	Applications of hybridization: Linear molecule: Trigonal planar molecules, Tetrahedral molecules, Tetrahedral molecule (Pyramidal), Tetrahedral molecule (V-Shape), Trigonal bipyramid molecule, Octahedral molecule, Conclusion. Valence bond theory: Examples.
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Delivery Plan (Weekly Lab. Syllabus)

المنهاج الأسبوعي للمختبر (لا يوجد مختبر)

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	
Week 11	
Week 12	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1- Cotton, F.A. and Wilkinsan, D. 2000 . Advanced Inorganic Chemistry. 5th ed. Wiley-Interscience, New York,.	Yes
	2- Martel, A. E. ,2009. Coordination Chemistry. Van Nostrans Reinhold, New York.	Yes
Recommended Texts		
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	جرائم نظام البعث في العراق		Module Delivery
Module Type	B		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	KUS23016		
ECTS Credits	2		
SWL (hr/sem)	50		
Module Level	3	Semester of Delivery	
Administering Department		College	
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims	
أهداف المادة الدراسية	

Module Learning Outcomes	
مخرجات التعلم للمادة الدراسية	
Indicative Contents	
المحتويات الإرشادية	

	Learning and Teaching Strategies
	استراتيجيات التعلم والتعليم
Strategies	

Student Workload (SWL)			
الحمل الدراسي للطلاب			
Structured SWL (h/sem)		Structured SWL (h/w)	
الحمل الدراسي المنتظم للطلاب خلال الفصل	33		2
Unstructured SWL (h/sem)		Unstructured SWL (h/w)	
الحمل الدراسي غير المنتظم للطلاب خلال الفصل	17		
Total SWL (h/sem)	50		
الحمل الدراسي الكلي للطلاب خلال الفصل			

Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10(10)		
	Assignments	2	10(10)		
	Projects	1	10(10)		
	Report	1	10(10)		
Summative assessment	Midterm Exam	2hr	10% (10)		
	Final Exam	3hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	
Week 11	
Week 12	
Week 13	
Week 14	
Week 15	
Week 16	

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	

Week 11	
Week 12	
Week 10	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts		
Recommended Texts		
Websites		

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 – 89	Above average with some errors
	C - Good	جيد	70 – 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 – 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 – 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Module Information					
معلومات المادة الدراسية					
Module Title	Optoelectronics		Module Delivery		
Module Type	Core learning activity		☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar		
Module Code	REE23017				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		UGII	Semester of Delivery		3
Administering Department		REE	College	CRE	
Module Leader	Dr. Ethar Yahya Salih		e-mail	ethar@kus.edu.iq	
Module Leader's Acad. Title		Dr.	Module Leader's Qualification		Ph.D.
Module Tutor	Dr. Ethar Yahya Salih		e-mail	ethar@kus.edu.iq	
Peer Reviewer Name		Name	e-mail		
Scientific Committee Approval Date		01/07/2023	Version Number	1.0	

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	None
Co-requisites module	None	Semester	None

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	This class focuses on the physics of the interaction of photons with semiconductor materials. The band theory of solids is used to calculate the absorption and gain of semiconductor media. The rate equation formalism is used to develop the concepts of laser threshold, population inversion and modulation response. Matrix methods and coupled mode theory are applied to resonator structures such as distributed feedback lasers, tunable lasers and mirroring devices. The course is also intended to introduce students to noise models for semiconductor devices and to applications of optoelectronic devices to fiber optic communications. Homework problems will be drawn from the current research literature.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Explain fundamental physical and technical base of Optoelectronic systems 2. Describe basic laws and phenomena that define behavior of optoelectronic systems, 3. Analyze various solid states devices and geometries related to optoelectronic systems. 4. Components, devices and equipment of optoelectronic systems. 5. Interpret the acquired data and measured results (IV curve). 6. Describe development and application of optoelectronic systems 7. Take part in team work and be able to independently present various professional materials.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part 1</u> Wave Nature of Light – Conceptual Overview & Polarization and Modulation of light [10 hrs.]. <u>Part 2</u> Introduction to Semiconductor Physics and Devices, PN Junction Introduction The IV Characteristics, Diodes, Photovoltaic Devices, & Light Emitting Diodes (LED) [35 hrs.]. <u>Part 3</u> Optical computing, Practical organic optoelectronic devices, & Optical computing (if time permits) [15 hrs.].

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	1. Visualization 2. Cooperative Learning 3. Differentiated Instruction 4. Using Technology to your Advantage 5. Student Centered Inquiry 6. Professional Development
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	79	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعياً	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	71	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعياً	3.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 11	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	4, 13	LO # 3, 4, 6 and 7
	Seminar	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week 1	Wave Nature of Light – Conceptual Overview
Week 2	Polarization and Modulation of light
Week 3	Introduction to Semiconductor Physics and Devices
Week 4	PN Junction Introduction
Week 5	The IV Characteristics I
Week 6	The IV Characteristics II
Week 7	Diodes I
Week 8	Diodes II
Week 9	Diodes III
Week 10	Photovoltaic Devices
Week 11	Light Emitting Diodes (LED)
Week 12	Optical computing
Week 13	Practical organic optoelectronic devices (if time permits)
Week 14	Optical computing (if time permits)
Week 15	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الأسبوعي للمختبر

	Material Covered
Week 1	NOT APPLICABLE
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	John Wilson and John Hawkes, Optoelectronics, an introduction - 3rd Edition, Prentice Hall 1998.	No
Recommended Texts	Semiconductor Optoelectronic Devices, J. Piprek, Academic Press, New York, 2003.	No
Websites	https://www.rp-photonics.com/optoelectronics.html	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION OF Thermodynamics

University Name: ALkarkh University of Sciences

College: Renewable Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information					
Module Title	Thermodynamics		Module Delivery		
Module Type	C		☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☒ Seminar		
Module Code	REE23018				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		2		Semester of Delivery	3
Administering Department		REE	College	CRE	
Module Leader	Marwah Mohammed Jasim		e-mail	m.m.shuwaili@gmail.com	
Module Leader's Acad. Title		Lecturer	Module Leader's Qualification		PhD
Module Tutor	NONE		e-mail	NONE	
Peer Reviewer Name		NONE	e-mail	NONE	
Scientific Committee Approval Date		20/06/2023	Version Number	1.0	

Relation with other Modules

Prerequisite module	None	Semester	_____
Co-requisites module	None	Semester	_____

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims	Provide a Solid Foundation in Thermodynamics: Develop a comprehensive understanding of the fundamental principles and laws of thermodynamics; and enable students to analyze and solve thermodynamics problems using appropriate mathematical and analytical techniques. Apply Thermodynamics Principles to Energy Systems: Demonstrate the application of thermodynamics principles to various energy systems, such as power plants, renewable energy systems, and energy storage; Develop the ability to analyze and evaluate the performance of energy conversion processes and systems based on thermodynamics principles; And understand the thermodynamic aspects of energy efficiency, optimization, and sustainability in energy systems. Enhance Problem-Solving and Critical Thinking Skills: Cultivate problem-solving skills by applying thermodynamics principles to analyze and solve complex energy-related problems; Foster critical thinking and analytical skills in evaluating and interpreting thermodynamics data and experimental results; And develop the ability to think critically and make informed decisions based on thermodynamic principles and their implications in energy systems. Foster Laboratory Skills and Experimental Techniques: Provide practical laboratory experiences to reinforce theoretical concepts and develop skills in conducting thermodynamics experiments; Familiarize students with experimental techniques, data acquisition, and analysis methods specific to thermodynamics and energy systems; And enhance the ability to interpret and communicate experimental results effectively through laboratory reports and presentations. Cultivate Awareness of Emerging Trends and Technologies: Explore emerging trends, technologies, and advancements in the field of thermodynamics and energy systems; Foster an understanding of the role of thermodynamics in addressing energy challenges, renewable energy integration, and sustainable energy solutions; And develop an awareness of the importance of continuous learning and staying updated with the latest developments in thermodynamics and energy-related fields.
Module Learning Outcomes	1. Demonstrate a comprehensive understanding of the fundamental principles and laws of thermodynamics. 2. Explain the concepts of energy, heat transfer, and work, and their application in energy systems. 3. Identify and describe thermodynamic processes, cycles, and equations relevant to energy conversion and storage. 4. Apply thermodynamics principles to analyze and solve complex problems in energy systems, such as power plants, renewable energy technologies, and

	energy storage. 5. Analyze the performance and efficiency of energy conversion processes based on thermodynamics principles. 6. Evaluate and interpret thermodynamics data and experimental results to draw conclusions and make informed decisions. 7. Demonstrate proficiency in conducting thermodynamics experiments, including data acquisition, analysis, and interpretation. 8. Apply experimental techniques and instrumentation specific to thermodynamics and energy systems. 9. Utilize software tools and simulation software to model and analyze thermodynamic processes and systems.
Indicative Contents المحتويات الإرشادية	Introduction to Thermodynamics includes Basic concepts and definitions in thermodynamics; Energy, heat transfer, and work; and Properties of substances and ideal gases. (15 hrs) Laws of Thermodynamics encompasses First law of thermodynamics (energy conservation), Second law of thermodynamics (entropy and heat transfer) and Carnot cycle and thermodynamic efficiency. (15 hrs) Thermodynamic Processes and Cycles contain Thermodynamic processes (isobaric, isochoric, isothermal, adiabatic), Power cycles (Rankine cycle, Brayton cycle) and Refrigeration cycles (vapor compression cycle). (10 hrs) Energy Conversion Systems: Renewable energy systems (solar, wind, hydroelectric) Heat Transfer: Conduction, convection, and radiation heat transfer and Heat exchangers and their applications in energy systems. (16 hrs) Energy Storage: Thermodynamics of energy storage systems (batteries, flywheels, pumped hydro, compressed air); Energy storage technologies for grid integration and load management; and Thermodynamic analysis of energy losses and efficiency in storage systems. (15 hrs)

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Establish Learning Objectives: Clearly define the learning objectives for the thermodynamics curriculum, aligned with the program goals and industry requirements; Identify the specific knowledge, skills, and competencies students should acquire by the end of the course. Plan the Curriculum: Develop a well-structured curriculum with a logical flow of topics, starting from fundamental concepts to more advanced applications; Consider incorporating case studies, real-world examples, and hands-on experiments to enhance understanding and relevance to energy systems. Engage Students Actively: Encourage active learning by incorporating interactive activities, discussions, and problem-solving exercises; Use multimedia resources, simulations, and virtual labs to enhance engagement and facilitate visualization of thermodynamic processes.
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	Make Connections to Energy Systems: Emphasize the applications of thermodynamics in energy systems throughout the course; Relate thermodynamics concepts to specific energy technologies, such as power plants, renewable energy systems, and energy storage. Provide Practical Laboratory Experiences: Design laboratory experiments that align with the theoretical concepts covered in lectures; Allow students to apply thermodynamics principles through hands-on experiments, data analysis, and interpretation of results. Utilize Technology: Utilize educational technology tools, such as interactive simulations and modeling software, to enhance understanding of complex thermodynamic processes. Incorporate online learning platforms or learning management systems to facilitate content delivery, assessments, and student engagement.
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Student Workload (SWL)			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	93	Structured SWL (h/w)	6
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	57	Unstructured SWL (h/w)	4.7
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	4,7,11	
	Assignments	2	10% (10)	2, 5,7,12	
	Projects / Lab.	1	10% (10)	continuous	
	Report	1	10% (10)	12	
Summative assessment	Midterm Exam	2 hr	10% (10)	8	
	Final Exam	2hr	50% (50)	16	
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to Thermodynamics: Overview of thermodynamics and Definition of key
Week 2	System and Surroundings: Definition of a system and its boundaries; Distinguishing between an open, closed, and isolated system; and Identifying the surroundings as everything external to the system.
Week 3	Energy and the First Law of Thermodynamics: Energy forms and conversions in energy systems; Conservation of energy and the first law of thermodynamics; and Application of the first law to analyze energy transfers, work, and heat interactions.
Week 4	State Variables and Equilibrium: Definition of state variables, such as temperature, pressure, and volume; Describing the concept of equilibrium and its importance in thermodynamics; and Understanding the difference between equilibrium and steady-state conditions.
Week 5	Energy Analysis of Systems: Analysis of closed and open systems; Control volume analysis and the application of the conservation equations; and Calculation of work and heat transfer for various energy devices and processes.
Week 6	Processes and Cycles: Differentiating between various types of processes (e.g., isothermal, adiabatic, isobaric).
Week 7	Second Law of Thermodynamics and Entropy: Introduction to the second law of thermodynamics and its different formulations; Entropy as a measure of system disorder and irreversibility; and Carnot cycle and the concept of maximum efficiency.
Week 8	Midterm exam + Thermodynamic Cycles and Power Systems: Analysis and optimization of power cycles, including Rankine and Brayton cycles; Combined cycles and their efficiency enhancements; and Introduction to renewable energy systems, such as solar thermal power plants and geothermal power plants.
Week 9	Thermodynamic Properties and Equations of State: Explaining intensive and extensive properties; Describing equation of state and its application to ideal gases (e.g., ideal gas law); and Introduction to specific heat capacity and its significance.
Week 10	Refrigeration and Heat Pump Systems: Principles of refrigeration and heat pump systems; Vapor compression and absorption refrigeration cycles; and Performance analysis and optimization of refrigeration systems.

Week 11	Heat Engines and Efficiency: Defining a heat engine and its components (e.g., source, sink, working fluid); and Describing the efficiency of a heat engine and its relationship with temperature.
Week 12	Phase Transitions and Equilibrium: Discussing the behavior of substances during phase transitions (e.g., solid to liquid, liquid to gas); Explaining phase diagrams and critical points; and Understanding the equilibrium conditions for coexisting phases.
Week 13	Heat Transfer: Conduction, convection, and radiation heat transfer and Application of heat transfer principles in energy systems, including heat exchangers
Week 14	Applications in Energy Systems: Applying thermodynamics to power plants, including steam turbines and gas turbines; Exploring the principles of refrigeration and heat pumps; and Discussing energy conversion and efficiency in renewable energy systems.
Week 15	Advanced Topics in Thermodynamics: Irreversibility and availability analysis; Chemical thermodynamics and combustion analysis; and Introduction to statistical thermodynamics and its applications.
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Introduction to Laboratory Safety and Equipment: Safety procedures; and Introduction to common laboratory equipment and instruments used in thermodynamics experiments
Week 2	Measurement Techniques and Data Analysis: Introduction to measurement techniques for temperature, pressure, and volume; Calibration of instruments and uncertainty analysis; and Data acquisition and analysis using software tools.
Week 3	Properties of Pure Substances: Experimental determination of thermodynamic properties, such as specific heat capacity and enthalpy; Measurement of vapor pressure and boiling point for pure substances; and Construction of pressure-temperature phase diagrams.
Week 4	Heat Transfer Experiments: Conduction experiment: Determination of thermal conductivity of materials.

	Convection experiment: Investigation of convective heat transfer coefficients. Radiation experiment: Measurement of radiation heat transfer using different surfaces and configurations.
Week 5	Analysis of Thermodynamic Cycles: Rankine cycle experiment: Performance analysis of a steam power plant setup; Brayton cycle experiment: Study of a gas turbine power plant; Combined cycle experiment: Analysis of a combined gas-steam power plant.
Week 6	Renewable Energy Systems: Solar thermal experiment: Analysis of a solar collector and heat storage system. Wind energy experiment: Measurement and evaluation of wind turbine performance. Geothermal experiment: Investigation of geothermal energy extraction and utilization.
Week 7	Energy Conversion and Efficiency Analysis: Performance analysis of different energy conversion devices, such as turbines and engines; Efficiency measurements and comparisons for various energy systems; and Energy efficiency optimization experiments.

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	Introduction to Thermodynamics and Heat Transfer, Yunus A. Cengel and Afshin J. Ghajar. Thermodynamics: Concepts and Applications, Stephen R. Turns	No
Recommended Texts	Experimental Thermodynamics: Experimental Thermodynamics Volume X, Richard J. Goldstein, Michael I. Mackley, and H.S. Uhlherr	No
Websites		

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FORM OF DIGITAL ELECTRONICS

Module Information			
Module Title	Digital electronics		Module Delivery
Module Type	Core		☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar
Module Code	REE24119		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	UGII	Semester of Delivery	
Administering Department	Renewable Energy	College	College of Environment & Renewable Energy Sciences
Module Leader	Layth Kadhim Turki	e-mail	Layth.kadhim@kus.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	Ph.D.
Module Tutor	Layth Kadhim Turki	e-mail	Layth.kadhim@kus.edu.iq
Peer Reviewer Name	N.A.	e-mail	N.A.
Scientific Committee Approval Date	20/06/2023	Version Number	1.0

Relation with other Modules			
Prerequisite module	Electronics, REE23013	Semester	Three
Co-requisites module	None	Semester	-----

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	- To develop problem solving skills and understanding of Digital electronics theory by means of the practical applications. - To understand the basic construction of logic gates. - To understand the Boolean Algebra operation of logic functions and simplification. - Logic express simplification based on Karnaugh map. - To understand how to design a small system using different types of logic gates. - To understand the all types of adders and subtractors. - To has the ability to design the the decoders and encoders. - To has the ability to design the Multiplexor and Demultiplexer. - The student has the acquire skills for digital system design.
Module Learning	- Recognize digital signals means. - List the various terms associated with logic gates.

Outcomes	3. Summarize what is meant by a basic gates. 4. Discuss the reaction and involvement of gates minimization. 5. How to manage the logic expression according to the logic algebra? 6. Understand the logic expression representation in POS and SOP. 7. Analysis the operation of multiple types of adders. 8. Analysis the circuit and operation of multiple types of adders. 9. Analysis the circuit and operation of multiple types of decoders. 10. Analysis the circuit and operation of multiple types of encoders. 11. Analysis the circuit and operation of multiple types of multiplexer. 12. Analysis the circuit and operation of multiple types of demultiplexer. 13. Design of some practical complete systems.
Indicative Contents	Indicative content includes the following. Introduction to the digital electronics [4 hrs] Numbering systems: Decimal system, binary number, octal numbers and hex. Numbers, number base conversions, Complements, signed numbers binary codes [7 hrs] Boolean algebra and logic gates: SOP, POS, NAND and NOR implementation [9 hrs] Kmap building, representation and design [7 hrs] Don't care combinational logic circuits [4 hrs] Analysis and design procedure of a logic circuit [5 hrs] Binary adders and subtractors [5 hrs] Decimal adders [5 hrs] Comparators [5 hrs] Decoders [5 hrs] Encoders [5 hrs] Multiplexer [5 hrs] Demultiplexer [5 hrs]

Learning and Teaching Strategies

Strategies	This course description provides a necessary summary of the most important course characteristics and expected learning outcomes for the student Evidence of whether he made the most of the available learning opportunities. It must be linked to the description the program. Thus, the main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.
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Student Workload (SWL)

Structured SWL (h/sem)	79	Structured SWL (h/w)	5.2
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Unstructured SWL (h/sem)	71	Unstructured SWL (h/w)	4.7
Total SWL (h/sem)	150		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	10% (10)	5, 8 and 12	LO #1, #2 and #10, #11
	Assignments	4	10% (10)	3, 6, 9, 12	LO #3, #4 and #6, #7
	Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	10% (10)	7	LO #1 -6
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction
Week 2	Dif. Between analog and digital signals, and types of data transfer.
Week 3	Numbering systems- 1.
Week 4	Numbering systems- 2.
Week 5	Complements, signed numbers, binary codes and algebra.
Week 6	Theory and operation of Logic gates- 1.
Week 7	Mid. Term Exam + theory and operation of Logic gates- 2.
Week 8	SOP, POS, NAND and NOR implementation.
Week 9	Kmap, don't care; combinational logic circuits.
Week 10	Introduction to binary adder and subtractor and design procedure.
Week 11	Decimal adders and comparators circuits design.
Week 12	Decoders and encoders circuits design,
Week 13	Multiplexers circuit design.
Week 14	De-multiplexers circuit design.
Week 15	Complete System design.
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	Lab 1: familiarization with instruments and apparatus used in the lab.
Week 2	Lab 2: Basic logic gates 1 & 2. (Verification of operation of different Logic Gate IC (AND, OR, NOT, NAND, NOR and XOR).
Week 3	Lab 3: Verifying Boolean algebra 1 & 2 by implementation of Boolean function by basic logic gates.
Week 4	Lab 4: Design and Verification by Implementation of half and full adder.
Week 5	Lab 5: Familiarization with Seven segment display and BCD to seven segment decoder IC.
Week 6	Lab 6: Implementation of multiplexer and de-multiplexer.
Week 7	Lab 7: Familiarization with Seven display and BCD to seven segment decoder IC.

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	Thomas L. Floyd "Digital Fundamentals", Eleventh Edition Global, Edition 2015.	No
Recommended Texts	1. M. Morris Mano, "Digital Design", 2015.	No
Websites	https://tooabstractive.com/ebooks/ee-files/digital-fundamentals-11th-edition/	

Grading Scheme

Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (فقد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية



Module Information

معلومات المادة الدراسية

Module Title	اللغة العربية ٢	Module Delivery	
Module Type	B	☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	KUS24020		
ECTS Credits	2		
SWL (hr/sem)	50		
Module Level	2	Semester of Delivery	4
Administering Department		College	
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims	أهداف المادة الدراسية
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Module Learning Outcomes مخرجات التعلم للمادة الدراسية	
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	

Student Workload (SWL) الحمل الدراسي للطلاب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطلاب خلال الفصل	33	Structured SWL (h/w)	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطلاب خلال الفصل	17	Unstructured SWL (h/w)	
Total SWL (h/sem) الحمل الدراسي الكلي للطلاب خلال الفصل	50		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes				
	Assignments				
	Projects				
	Report				
Summative assessment	Midterm Exam				
	Final Exam				
Total assessment					

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	
Week 11	
Week 12	
Week 13	
Week 14	
Week 15	
Week 16	

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	

Week 11	
Week 12	
Week 10	

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts		
Recommended Texts		
Websites		

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

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MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	English Language 2		Module Delivery
Module Type	B		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar
Module Code	KUS24021		
ECTS Credits	2		
SWL (hr/sem)	50		
Module Level	2	Semester of Delivery	
Administering Department		College	
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims	
أهداف المادة الدراسية	

Module Learning Outcomes	
مخرجات التعلم للمادة الدراسية	
Indicative Contents	
المحتويات الإرشادية	

	Learning and Teaching Strategies استراتيجيات التعلم والتعليم
Strategies	

Student Workload (SWL) الحمل الدراسي للطلاب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطلاب خلال الفصل	33	Structured SWL (h/w)	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطلاب خلال الفصل	17	Unstructured SWL (h/w)	
Total SWL (h/sem) الحمل الدراسي الكلي للطلاب خلال الفصل	50		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20%	Within the course	All of the previous Lectures
	Assignments	1	10%	Within the course	All of the previous Lectures
	seminar	1	10%	Within the course	All of the previous Lectures
	Report			Within the course	All of the previous Lectures
Summative assessment	Midterm Exam	1hr	10%	Within the course	All
	Final Exam	3hr	50%	after the course	
Total assessment					

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Hello
Week 2	Your world
Week 3	All about you
Week 4	Family and friends
Week 5	The way I live
Week 6	Every day
Week 7	My favorites
Week 8	Where I live
Week 9	Times past
Week 10	We had a great time
Week 11	
Week 12	
Week 13	
Week 14	
Week 15	
Week 16	

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	
Week 8	
Week 9	
Week 10	

Week 11	
Week 12	
Week 10	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts		
Recommended Texts		
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION OF FLUID FLOW



University Name: ALkarkh University of Sciences

College: Energy and Environmental Sciences

Dept: Renewable Energies Sciences

Module Information					
معلومات المادة الدراسية					
Module Title	FLUIDS		Module Delivery		
Module Type	C		☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar		
Module Code	REE24022				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		2	Semester of Delivery		4
Administering Department		REE	College	CRE	
Module Leader	Ammar w. Saeed		e-mail	ammar.waleed@kus.edu.iq	
Module Leader's Acad. Title		Lecturer	Module Leader's Qualification		PhD.
Module Tutor	none		e-mail	none	
Peer Reviewer Name		None	e-mail	none	
Scientific Committee Approval Date		20/6/2023	Version Number	1	

Relation with other Modules			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	1. understanding basic laws, principles and phenomena in the area of fluid mechanics 2. to solve simplified examples of fluid mechanics 3. theoretical and practical preparation enabling students to apply the acquired knowledge and skills in professional and specialist courses.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Students who successfully complete the course should: 1. understand the basic concepts of fluid mechanics. 2. understand the mathematical description of fluid flow. 3. understand the conservation principles governing fluid flows. 4. be able to solve inviscid flow problems using stream functions and velocity potentials. 5. be able to compute forces on bodies in fluid flows. 6. be able to solve (analytical and numerical) viscous flow problems. 7. be able to use mathematical software packages in solution methods.
Indicative Contents المحتويات الإرشادية	Part 1: Topics, Introduction, fluid properties, fluid properties Hydrostatics, Bernoulli equation Part 2: Fluid kinematics, conservation of mass, Conservation of momentum, energy, Inviscid flow Part 3: Dimensional analysis, Viscous flows, Pipe flow, Boundary layers, Drag and lift forces, Computational fluid dynamics, Open channel flow

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem)	79		
Unstructured SWL (h/sem)	71		
Total SWL (h/sem)	150		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Topic
Week 2	Introduction, fluid properties
Week 3	fluid properties
Week 4	Hydrostatics, Bernoulli equation
Week 5	Bernoulli equation
Week 6	Fluid kinematics, conservation of mass
Week 7	Conservation of momentum, energy
Week 8	Inviscid flow

Week 9	MID EXAM,
Week 10	Dimensional analysis
Week 11	Viscous flows, Pipe flow
Week 12	Boundary layers
Week 13	Drag and lift forces
Week 14	Computational fluid dynamics
Week 15	Open channel flow
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Hydrostatic pressure
Week 2	Viscosity of a liquid by Stoke's method
Week 3	Calibration of a Bourdon Gauge
Week 4	U-tube manometer
Week 5	Venturimeter experiment
Week 6	Orifice meter experiment
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	White, Frank M. <i>Fluid Mechanics</i> . 7th ed. McGraw-Hill, 2010. ISBN: 9780077422417.	Not found
Recommended Texts	Robert W. Fox, Alan T. McDonald, and P. J. Pritchard, "Introduction to Fluid Mechanics", Seventh Edition, John Wiley & Sons Inc., New York, 2010.	Not found
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR Energy Sources

University Name: Alkarkh University of Sciences

College: Renewable Energy and Environmental Sciences

Dept: renewable energy Sciences

Module Information					
معلومات المادة الدراسية					
Module Title	Renewable Energy Sources			Module Delivery	
Module Type	C			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	REE24023				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level		2	Semester of Delivery		4
Administering Department		REE	College	CRE	
Module Leader	Luma jamal abbas		e-mail	Luma.jamal@kus.edu.iq	
Module Leader's Acad. Title		Lecturer	Module Leader's Qualification		Ph.D
Module Tutor	NONE		e-mail	NONE	
Peer Reviewer Name		NONE	e-mail	NONE	
Scientific Committee Approval Date		NONE	Version Number	NONE	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	At the end of the course, the student will be able to understand: • Different types of conventional energy resources, • Different types of renewable energy resources, • Energy conversion technologies.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Practicals: • Measurement of Solar Radiation with Pyranometer • Determine the performance of liquid heating solar collector from open -loop through flow test setup • Determination of the performance of Study of Solar Water Heater • Study the construction and operation of wind turbine • Study of Bio gas plant and its principle of operation • Study of Micro/Small hydro power systems
Indicative Contents المحتويات الإرشادية	1. Introduction of Renewable Energy Sources. 2. Photovoltaic Energy System 3. Wind Energy System 4. Energy Storage Devices 5. Integration of Renewable Energy Sources 6 . Distributed Generation

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The lectures will consist of interactive power point presentations, videos, handouts, and other educational materials. Students are responsible for the material covered in the course materials. The knowledge will be evaluated via homework assignments, short quizzes and take-home exams. Different assignments will be given over the semester to allow the student to demonstrate understanding of course material. Some assignments are completed in class.
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدرايس المنتظم للطالب خلال الفصل	48	الحمل الدرايس المنتظم للطالب اسبوعيا	
Unstructured SWL (h/sem) الحمل الدرايس غير المنتظم للطالب خلال الفصل	27	الحمل الدرايس غير المنتظم للطالب اسبوعيا	
Total SWL (h/sem) الحمل الدرايس الكلي للطالب خلال الفصل	75		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5,10	1-5
	Assignments	2	10% (10)	2,12	5-10
	Projects / Lab.	1	10% (10)	continuous	
	Report	1	10% (10)	13	10-12
Summative assessment	Midterm Exam	2 hr	10% (10)	17	13-15
	Final Exam	2hr	50% (50)	16	16
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	☐ Fossil fuels and their characteristics 1. Classification of traditional fuels 2. Refining of crude oil 3. Properties of gasoline and diesel
Week 2	☐ Solar energy 1. Movement of earth and Solar radiation, solar radiation measuring devices. 2. Solar radiation fundamentals and solar angles

Week 3	☐ Bio energy 1. Biogas generation and factors affecting bio digestion or generation of gas 2. Biomass and biochemical conversion to fuels 3. Biogas plants
Week 4	☐ Wind energy 1. Principles of wind energy conversion 2. Types and characteristics of Horizontal & vertical axis wind turbines 3. Wind farming
Week 5	☐ Micro and small hydro power systems 1. Micro/Mini hydropower systems, principles and related technologies 2. Site investigation 3. Determination of flow
Week 6	1. Construction and operation of the different types of water turbines within the range of micro and small hydro power systems 2. Characteristics of turbines used for micro and small hydro power plants
Week 7	☐ Non conventional forms of energy and batteries 1. Introduction to fuel cells and Hydrogen fuel system 2. Hydrogen production processes 3. General introduction to infrastructure requirement for hydrogen production, storage, and utilization
Week 8	1. Battery fundamentals 2. Different types of batteries
Week 9	☐ Nuclear energy 1. Introduction 2. Nuclear fusion and reactions 3. Requirements for nuclear fusion
Week 10	1. Health hazards 2. Radiation protection & shielding
Week 11	Nuclear fission
Week 12	Interaction radiation with matter
Week 13	Biogas plants
Week 14	1. Role of microstructure (single crystal, multicrystalline, polycrystalline, amorphous and nanocrystalline) in electrical and optical properties of the materials 2. Applications of Photovoltaic for power generation

Week 15	1. Flat plate collectors, solar water heaters, Solar Concentrators 2. Photovoltaic materials; Materials in bulk and thin film forms
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Basic properties of nucleus, Springer, 2003. NUCLEAR FISSION AND FUSION, Welter Class publishing.	
Recommended Texts	NUCLEAR PHYSICS, of the European Physical Society October 2016	
Websites	https://www-nds.iaea.org/	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR

Solar cells PV



University Name: Alkarkh University of Sciences

College: Energy and Environmental Sciences

Dept: Renewable Energies Sciences

Module Information

معلومات المادة الدراسية

Module Title	Solar cells Pv			Module Delivery	
Module Type	Core			☒ Theory Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	REF24024				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level		2	Semester of Delivery		4
Administering Department		REE	College	CRE	
Module Leader	Dr. Mohammad AL dharob		e-mail	Dr.m.aldharob@kus.edu.iq	
Module Leader’s Acad. Title		LECTURER	Module Leader’s Qualification		Ph.D
Module Tutor	NON		e-mail	NON	
Peer Reviewer Name		NON	e-mail	NON	
Scientific Committee Approval Date		20/6/2023	Version Number	1	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	NONE	Semester	
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. Understand PV characteristics 2. Explain PV electrical properties 3. Study Ideal PV 4. Describe optical properties 5. Understand typical solar cell structure
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. able to understand the types of solar cells. 2. Understand the pv solar cell principal work. 3. Understand the preparation of solar cell
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدرايس المنتظم للطالب خلال الفصل	63		
Unstructured SWL (h/sem) الحمل الدرايس غير المنتظم للطالب خلال الفصل	37		
Total SWL (h/sem) الحمل الدرايس الكلي للطالب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.		10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	introduction to the concept of solar cells
Week 2	Electrical Characteristics of solar cell
Week 3	Ideal Solar Cell & Solar Cell Characteristics in Practice
Week 4	Optical Properties of solar cell
Week 5	Typical Solar Cell Structures
Week 6	The p-n Junction Solar Cell
Week 7	Mid exam
Week 8	The p-n Junction of solar cell
Week 9	Uniform Emitter and Base of solar cell and Diffused Emitter
Week 10	

Week 11	Solar cell preparation
Week 12	Heterojunction Cells and the p-i-n Structure Series Resistance,
Week 13	
Week 14	Solving mathematical problems related to dams
Week 15	
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	لا يوجد
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Physics of solar cells Peter Wurfel	Not found
Recommended Texts	High Efficiency Solar Cells Xiaodong Wang Zhiming M. Wang	Not found
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR



Geothermal energy

University Name: ALkarkh University of Sciences

College: Energy and Environmental Sciences

Dept: Renewable energy Sciences

Module Information				
معلومات المادة الدراسية				
Module Title	Geothermal energy		Module Delivery	
Module Type	Core		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	Ree24125			
ECTS Credits	4			
SWL (hr/sem)				
Module Level	2	Semester of Delivery		4
Administering Department	REE	College	CRE	
Module Leader			e-mail	
Module Leader's Acad. Title			Module Leader's Qualification	
Module Tutor	NONE		e-mail	NONE
Peer Reviewer Name			e-mail	NONE
Scientific Committee Approval Date	20/6/2023	Version Number	1	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module		Semester	
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1- Describe the basics, principles and concepts of underground energy 2- Knowledge and application of measurements and efficiency factors for underground energy 3- Understanding students and increasing their awareness about the possibility of applying the principles and properties of underground energy 4- Knowing the most important practical and theoretical bases for the energy of the earth's interior and the work steps to build an integrated unit 5- Recognizing that the energy of the earth's interior is one of the ways to achieve sustainable development and expel pollution
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Knows the concept of underground energy 2. Know the most important methods used to benefit from the energy of the earth's interior 3. Calculate the energy capacity generated from the ground 4. Calculate efficiency
Indicative Contents المحتويات الإرشادية	1. Evaluation of underground energy sources 2. Conduct physical and chemical tests to determine the forms of energy in the Earth's interior 3. Finding the total energy calculated from the Earth's interior 4. A census of the most important areas of underground energy sources

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48		
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52		
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week 1	Power plant design
Week 2	Drilling methods

Week 3	Heat exchanger design
Week 4	Engineered Geothermal Systems, Ground source heat pumps
Week 5	Estimate of resource potential
Week 6	Power generation
Week 7	Review & exam
Week 8	Classification of Geothermal resources
Week 9	Deep geothermal vs. Shallow geothermal
Week 10	Geological mapping
Week 11	Geothermal electricity performance
Week 12	Geothermal Energy efficiency
Week 13	Geothermal energy Economics
Week 14	Uses of geothermal energy around the world
Week 15	missions to air and ground waters during power production
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الأسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Geothermal handbook :Planning and financing power generation	
Recommended Texts		
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

MODULE DESCRIPTION FOR

Differential equations

University Name: AL-karkh University of Science
College: Renewable Energy and Environmental Sciences
Dept: Renewable Energy Sciences

Module Information			
معلومات المادة الدراسية			
Module Title	Differential equation		Module Delivery
Module Type	S		☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar
Module Code	REE24024		
CTS Credits	3		
WL (hr/sem)	75		
Module Level	1	Semester of Delivery	1
Administering Department	REE	College	CRE
Module Leader	Thamer Khalil M.S.		e-mail: Thamer.197675@kus.edu.iq
Module Leader's Acad. Title	Asst.Proof.	Module Leader's Qualification	Ph.D
Module Tutor	NONE		e-mail: NONE
Peer Reviewer Name	NONE		e-mail: NONE
Scientific Committee Approval Date	NONE	Version Number	1

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	Kus1102		Semester
Co-requisites module	NONE		Semester

Module Aims, Learning Outcomes and Indicative Contents			
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية			
Module Aims	أهداف المادة الدراسية	1. Introducing students to mathematical concepts in the subject of differential equation 2. Use and apply these concepts to solve applied problems. 3. Teach students to analyze results using mathematical methods. 4. Teaching students some special differential equation 5. Teaching students to mix and combine mathematical concepts with practical problems. 6. Introducing students to the importance of solve equation	
Module Learning Outcomes	مخرجات التعلم للمادة الدراسية	1. Solving mathematical problems with scientific material. 2. Writing scientific reports and analyzing data. 3. Self learning method. 4. Solving problems relevant with mathematical subject. 5. Testing the student's ability to solve mathematical problems related to the subjects he studied.	
Indicative Contents	المحتويات الإرشادية	1. Explain the classification of Differential Equations. 2. Highlights all kinds of Differential Equations and applications. 3. Describe how solve the kinds of Differential Equations. 4. Calculate the results of Differential Equations. 5. make the students solve the Differential Equations by integrating factor.	
Learning and Teaching Strategies			
استراتيجيات التعلم والتعليم			
Strategies		1. Lectures: Providing students with basic mathematical concepts and their practical applications. 2. Forming discussion groups during lectures to discuss mathematics topics and solve practical problems. 3. Ask the students a set of thinking questions during the lectures, such as what, how, when and why for specific topics in mathematics. 4. Giving students homework that requires self-explanations in different ways. 5. Writing scientific reports and analyzing data. 6. solving problems relevant with mathematical subject.	
Student Work load (SWL)			
الحمل الدراسي للطالب ل ١٥ اسبوعاً			
Structured SWL (h/sem)	48	Structured SWL (h/sem)	5
الحمل الدراسي المنتظم للطالب خلال الفصل		الحمل الدراسي المنتظم للطالب خلال الفصل	
Unstructured SWL (h/sem)	27	Unstructured SWL (h/sem)	5.3

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الحمل الدراسي غير المنتظم للطالب خلال الفصل			الحمل الدراسي غير المنتظم للطالب خلال الفصل			
Total SWL (h/sem)			75 (h/sem)			
الحمل الدراسي الكلي للطالب خلال الفصل						
Module Evaluation						
تقييم المادة الدراسية						
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome	
Formative Assessment	Quizzes	2	10% (10)	5 and 10	Lo #2,#4,#6,#8,#10	
	Assignments	2	10% (10)	2 and 12	Lo #1, #3,#5,#7,#9,#11	
	Projects / Lab.					
	Report	1	10% (10)	14	All	
Summative Assessment	Midterm Exam	2 hr	20% (20)	8	Lo #1-#8	
	Final Exam	3hr	50% (50)	16	All	
Total assessment			100% (100 Marks)			
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Week 6	orthogonal trajectories, application physics
Week 7	Reduction the order of the second order differential equation to first order equation
Week 8	n – order differential equation
Week 9	linear non homogeneous D.E of order n
Week 10	Wronskian determinant
Week 11	An existence and unique theorem
Week 12	second order linear homogeneous D.E with constant coefficients,
Week 13	Laplace transforms, inverse Laplace transforms,
Week 14	solution of initial value problem by Laplace transforms
Week 15	definitions of partial and Fourier series.
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	non

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Differential Equations 1, MATB44H3F, Version September 15, 2011-1049.	yes
Recommended Texts	Ordinary Differential Equations a first course ,Freed Brauer and John A.Nothe1.1973.	yes
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
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Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR Measurements and Control

University Name: AlKarkh University of Sciences

College: Renewable Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information معلومات المادة الدراسية				
Module Title	Measurements and Control		Module Delivery	
Module Type	C	☒ L Theory ☐ L lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar		
Module Code	REE35025			
ECTS Credits	3			
SWL (hr/sem)	75			
Module Level	3			Semester of Delivery
Administering Department	REE	College	CRE	
Module Leader	Dr. Omar Kanaan Nori		e-mail	omareng27@gmail.com
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	PhD	
Module Tutor	NONE		e-mail	NONE
Peer Reviewer Name	NONE		e-mail	NONE
Scientific Committee Approval Date	20/6/2023	Version Number	1	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims

أهداف المادة الدراسية

1. Develop a Comprehensive Understanding: Provide students with a comprehensive understanding of the fundamental principles, theories, and concepts related to measurements and control in the energy domain. This includes knowledge of sensors, transducers, signal conditioning, data acquisition, control systems, and communication networks.
2. Foster Technical Skills: Develop practical skills in acquiring, analyzing, and interpreting data from various sensors and transducers used in energy systems. Enhance proficiency in signal conditioning, data acquisition, control system design, and troubleshooting techniques. Enable students to operate measurement and control equipment effectively.
3. Promote Critical Thinking and Problem-Solving: Cultivate students' ability to think critically and analytically when faced with measurement and control challenges in the energy sector. Enable students to identify problems, evaluate potential solutions, and make informed decisions based on data analysis and interpretation.
4. Encourage Safety and Reliability: Instill a strong emphasis on safety considerations in measurement and control systems, particularly within the energy sector. Raise awareness of potential hazards, risk assessment, and mitigation strategies. Develop an understanding of reliability analysis and maintenance practices to ensure system performance and uptime.
5. Foster Industry Relevance: Align the curriculum with current industry practices, standards, and emerging trends in measurement and control technologies. Equip students with the knowledge and skills needed to meet the demands of the energy sector, including smart grid technologies, automation, and digitalization.
6. Enhance Collaboration and Communication: Foster teamwork and collaboration skills through group projects, case studies, and laboratory exercises. Develop effective communication skills, both oral and written, to articulate measurement and control concepts, present findings, and collaborate with industry professionals.

	7. Encourage Ethical and Professional Conduct: Promote ethical behavior, professionalism, and responsible practices in measurement and control activities. Emphasize the importance of integrity, accuracy, and adherence to standards and regulations within the energy industry. 8. Facilitate Lifelong Learning: Instill a sense of curiosity and a passion for continuous learning and professional development in the field of measurements and control. Prepare students for further education, research, and adaptation to evolving technologies in the energy sector.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understand the principles and concepts of measurements and control systems in the energy sector. 2. Explain the importance of accurate and reliable data in energy systems and its impact on energy efficiency and performance. 3. Identify different types of sensors and transducers used in energy systems and select appropriate sensors based on application requirements. 4. Apply signal conditioning techniques to acquire and process sensor signals for accurate measurement. 5. Demonstrate proficiency in using data acquisition systems and instrumentation interfaces for acquiring and analyzing measurement data. 6. Perform measurements of various electrical parameters, temperature, pressure, flow, and level in energy systems. 7. Design and implement control systems using feedback control principles and algorithms such as PID control. 8. Program and configure programmable logic controllers (PLCs) for automation and control applications in energy systems. 9. Utilize supervisory control and data acquisition (SCADA) systems for remote monitoring and control of energy processes. 10. Understand communication protocols and networks used in measurement and control systems, and integrate them into energy systems. 11. Analyze measurement data using statistical techniques and interpret the results for energy system optimization and decision-making. 12. Identify safety considerations in measurement and control systems and implement appropriate safety measures. 13. Diagnose faults and troubleshoot measurement and control systems in energy applications. 14. Apply reliability analysis techniques to assess and maintain the performance of measurement and control systems in energy systems. 15. Work effectively in a laboratory setting, conduct experiments, and demonstrate proficiency in using measurement and control equipment. 16. Analyze real-world case studies of measurement and control systems in the energy sector, identify challenges, and propose solutions. 17. Stay updated with emerging technologies and trends in measurement and control for energy systems. 18. Communicate effectively, both orally and in writing, about measurement and control concepts, methods, and findings.

Indicative Contents المحتويات الإرشادية	Introduction to Measurements and Control: Overview of measurements and control systems in the energy sector Sensors and Transducers: Principles of operation for various types of sensors and transducers Techniques for signal conditioning and amplification: Analog-to-digital conversion and digital signal processing Measurement Techniques in Energy Systems: Measurement of electrical parameters (voltage, current, power) Control Systems and Feedback Control: Principles of feedback control systems Programmable Logic Controllers (PLCs) and SCADA Systems: Introduction to PLCs and their applications in energy systems Communication Networks in Measurement and Control: Overview of communication protocols (e.g., Modbus, Profibus) Data Analysis and Visualization: Statistical analysis of measurement data Safety and Reliability in Measurement and Control: Safety considerations in measurement and control systems Case Studies and Industry Applications: Analysis of real-world measurement and control systems in the energy sector Emerging Technologies and Future Trends: Exploration of advanced measurement techniques and sensors
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Lectures: Traditional lectures can be used to deliver theoretical concepts Case Studies: Presenting real-world case studies of measurement and control systems in the energy sector can provide students with practical insights. Group Projects: Assigning group projects related to measurement and control can encourage collaboration and peer learning. Problem-Based Learning: Presenting students with real-world problems or scenarios related to measurements and control can encourage critical thinking and problem-solving skills. Online Resources and Interactive Materials: Supplementing learning with online resources, interactive modules, and multimedia materials can provide additional learning opportunities.

	Continuous Assessment: Implementing regular assessments, such as quizzes, tests, or practical assignments, can help monitor students' progress and understanding of the measurement and control concepts. Communication and Presentation Skills: Incorporating activities that develop communication and presentation skills, such as report writing, oral presentations, or poster sessions, can help students effectively communicate their findings and analysis in measurement and control.
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Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w)	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	27	Unstructured SWL (h/w)	2
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
	Material Covered
Week 1	Introduction to Measurements and Control
Week 2	Sensors and Transducers
Week 3	Signal Conditioning and Data Acquisition
Week 4	Measurement Techniques in Energy Systems

Week 5	Control Systems and Feedback Control
Week 6	Programmable Logic Controllers (PLCs) and SCADA Systems
Week 7	Communication Networks in Measurement and Control
Week 8	Data Analysis and Visualization
Week 9	Safety and Reliability in Measurement and Control
Week 10	Laboratory Work and Hands-on Projects
Week 11	Case Studies and Industry Applications
Week 12	Emerging Trends and Future Directions
Week 13	Seminars part1 for students on recent developments in Measurement and Control
Week 14	Industry Engagement and Case Studies
Week 15	Seminars part2 for students on recent developments in Measurement and Control
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Karsilayan, A. (2019). Industrial Measurement and Control Systems: Principles and Concepts. CRC Press. Datta, S. (2015). Process Control and Instrumentation. PHI Learning Pvt. Ltd.	No
Recommended Texts	Eren, H. (2019). Measurement and Instrumentation Principles (3rd ed.). Butterworth-Heinemann.	No
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR BIO ENERGY

University Name: ALkarkh University of Sciences

College: Renewable Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information				
معلومات المادة الدراسية				
Module Title	Bio Energy		Module Delivery	
Module Type	C		☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	REE35026			
ECTS Credits	4			
SWL (hr/sem)	100			
Module Level	3	Semester of Delivery		5
Administering Department	REE	College	CRE	
Module Leader	Luma jamal abbas		e-mail	Luma.jamal@kuc.edu.iq
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	Ph.D
Module Tutor	NONE		e-mail	NONE
Peer Reviewer Name	NONE		e-mail	NONE
Scientific Committee Approval Date	20/6/2023	Version Number	1	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	The objective of the course is to apply energy efficiency concept in day to day life in order to save Money and Energy and thereby protect the Environment. By obtaining necessary knowledge and information on the main operating principles of devices/appliances that are in common use and information on which to make the right decision in selecting the most energy efficient and economical choice
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Knowledge and understanding: The student will be aware from a technical point of view of energy plants where biomasses and organic wastes are used. 2. Applying Knowledge and understanding: The student will be capable to apply the acquired knowledge to design biomass energy plants and to evaluate their performances. 3. Making judgments: The student will become capable to judge the different options available given the nature of the feedstock available (kind of biomass, kind of organic waste) and the technological opportunities to valorize it as bioenergy. 4. Communication skills: The student will be capable to efficiently communicate concerning bio-energy options, processes and plants. 5. Learning skills The student will be taught that significant bioenergy process advancements are in progress, and that he/she should keep him/herself updated on the last technological outcomes that face the bio-energy market.
Indicative Contents	

المحتويات الإرشادية

The course focuses on Bio-Energy and in particular on the exploitation of biomass and organic waste for energy recovery. The course encompasses thermochemical energy processes (combustion, gasification, pyrolysis, reforming, hydrothermal conversion), mechanical and chemical processes (oil extraction and trans-esterification), finally biochemical processes (fermentation and anaerobic digestion). Emphasis is given to thermochemical processes and anaerobic digestion.

The course provides chemical engineering tools applied to the analysis of energy conversion processes involving biomass and organic waste.

The student at the end of the course

- will be able to analyze the various technologies available to energetically valorize the various types of biomass and organic waste;

The course accounts for frontal lectures (50 hours), during which the lecturer will address both informative and formative topics. The informative activity will provide a comprehensive overview of the bio-energy sector. The training activity will be divided into a discussion of the theoretical topics and the development and solution of some "practical" problems, where the theory will be applied. The lecturer will use PowerPoint presentations, while the exercises will be held on the blackboard.

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies

The lectures will consist of interactive power point presentations, videos, handouts, and other educational materials. Students are responsible for the material covered in the course materials. The knowledge will be evaluated via homework assignments, short quizzes and take-home exams.

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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	٤٨	الحمل الدراسي المنتظم للطالب اسبوعيا	
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	٥٣	الحمل الدراسي غير المنتظم للطالب اسبوعيا	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	١٠٠		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5,10	1-5
	Assignments	2	10% (10)	2,12	5-10
	Projects / Lab.	1	10% (10)	continuous	
	Report	1	10% (10)	13	10-12
Summative assessment	Midterm Exam	2 hr	10% (10)	17	13-15
	Final Exam	2hr	50% (50)	16	16
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Bioenergy concepts – Introduction Systems thinking Biopower, bioheat Biofuels, advanced liquid fuels, drop-in fuels Biobased products
Week 2	Biomass, Bio-Energy and Bio-Refinery Basic concepts of circular economy based on organics

Week 3	Bio energy 1. Biogas generation and factors affecting bio digestion or generation of gas 2. Biomass and biochemical conversion to fuels 3. Biogas plants
Week 4	Environmental Laws Federal Environmental Statutes. Common Law Liabilities. International Treaties
Week 5	Environmental Economics, Politics, and Worldviews
Week 6	Biomass conversion: Physical conversion
Week 7	Dewatering, drying, size reduction, steam explosion, densification, pelleting, chipping, oil extraction.
Week 8	Biomass conversion: Chemical conversion
Week 9	Oil trans-esterification (biodiesel production).
Week 10	Hydrolysis.
Week 11	Biomass conversion: Biochemical conversion
Week 12	Anaerobic digestion (biogas production from organic waste and wastewater).
Week 13	Fermentation (bioethanol production)
Week 14	Chemical engineering tools for analysis and design of energy processes
Week 15	Reaction stoichiometry.
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الأسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Basic properties of nucleus, Springer, 2003. NUCLEAR FISSION AND FUSION, Welter Class publishing.	
Recommended Texts	NUCLEAR PHYSICS, of the European Physical Society October 2016	
Websites	https://www-nds.iaea.org/	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR SOLAR ENERGY SYSTEMS

University Name: AlKarkh University of Sciences

College: Energy and Environmental Sciences

Dept: Renewable Energies Sciences

Module Information				
معلومات المادة الدراسية				
Module Title	Solar energy systems		Module Delivery	
Module Type	C		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	REE35027			
ECTS Credits	6			
SWL (hr/sem)	160			
Module Level	3	Semester of Delivery		5
Administering Department	REE	College	CRE	
Module Leader	Dr. Mohammad AL dharob		e-mail	Dr.m.alldharob@kus.edu.iq
Module Leader's Acad. Title	LECTURER		Module Leader's Qualification	Ph.D.
Module Tutor	NONE		e-mail	NONE
Peer Reviewer Name	NONE		e-mail	NONE
Scientific Committee Approval Date	20/6/2023	Version Number	1	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	NONE	Semester	
Co-requisites module	NONE	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. Study solar energy systems 2. Distinguish between solar energy systems 3. How to choose parts of solar energy systems
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Known the main parts of solar energy system 2. Known the best design of solar cell system 3. Calculation of best power for parts of solar system. 4.
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدرايس المنتظم للطالب خلال الفصل	٧٩		
Unstructured SWL (h/sem) الحمل الدرايس غير المنتظم للطالب خلال الفصل	٧1		
Total SWL (h/sem) الحمل الدرايس الكلي للطالب خلال الفصل	1٥٠		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	introduction to solar energy systems
Week 2	Parts of solar energy systems
Week 3	Kinds of energy solar systems
Week 4	Solar inverters and their Kinds
Week 5	Solar Agriculture inverters
Week 6	Solar panels and their kinds
Week 7	Solar batteries
Week 8	Mid exam
Week 9	Off grid solar energy system
Week 10	

Week 11	On grid energy systems
Week 12	Microgrid energy systems
Week 13	
Week 14	Hybrid energy systems
Week 15	
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Measuring of solar voltage characteristics of solar energy system
Week 2	Measuring of solar power characteristics of solar energy
Week 3	The effect of direction of solar panels on the solar energy system
Week 4	The effect of slope of solar panels on the solar energy system efficiency
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Physics of solar cells Peter Wurfel	Not found
Recommended Texts	High Efficiency Solar Cells Xiaodong Wang Zhiming M. Wang	Not found
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Module Information					
معلومات المادة الدراسية					
Module Title	Energy Transmission & Storage		Module Delivery		
Module Type	Core learning activity		☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar		
Module Code	REE35028				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level		UGIII	Semester of Delivery		5
Administering Department		REE	College	CRE	
Module Leader	Dr. Ethar Yahya Salih		e-mail	ethar@kus.edu.iq	
Module Leader's Acad. Title		Dr.	Module Leader's Qualification		Ph.D.
Module Tutor	Dr. Ethar Yahya Salih		e-mail	ethar@kus.edu.iq	
Peer Reviewer Name		Name	e-mail		
Scientific Committee Approval Date		01/07/2023	Version Number	1.0	

Relation with other Modules				
العلاقة مع المواد الدراسية الأخرى				
Prerequisite module	None		Semester	None
Co-requisites module	None		Semester	None

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. This course is intended to provide students an overview on energy storage and transport schemes/devices with a major focus on electrochemical energy including fuel cells, ionic batteries and super-capacitors. This course is appropriate for engineering and natural science students interested in having an overview of electrochemical energy storage/transport schemes covering their basic operating principles, fundamental physics behind them and technological advantages/issues. 2. Basic theory behind different energy storage systems and working principles of all types of energy storage systems.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Determine the main parameters of a storage system by applying thermodynamics, heat and mass transfer and chemistry. 2. Able to evaluate the storage process (based on mass and energy balances, calculation of efficiencies). 3. Identify the optimal solutions to any potential energy storage application, whether in the electrical, heat or transport sector.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. <u>Part 1</u> Types of Energy & Basic Thermodynamics [6 hrs.]. <u>Part 2</u> Fuel Cell – Introduction & Open Circuit Voltage, Fuel Cell – Activation & Ohmic Losses, Fuel Cell – Mass Transport Loss, & Fuel Cell – Modeling, Types, Systems [12 hrs.]. <u>Part 3</u> Electrochemical Characterization – Polarization Curve, EIS, Ionic Batteries – Terminology & Principles, Phase Diagram, Ionic Batteries –Electrodes, Ionic Batteries –Modeling; Flow Battery [12 hrs.]. <u>Part 4</u> Super Capacitor – Principles & Operation, Electrochemical Characterization – Cyclic Voltametry, & Thermal and Mechanical Energy Storage [12 hrs.].

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	1. Visualization 2. Cooperative Learning 3. Differentiated Instruction 4. Using Technology to your Advantage 5. Student Centered Inquiry 6. Professional Development
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعياً	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعياً	3.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 11	LO #1, 2, 10 and 11
	Assignments	2	10% (10)	4, 13	LO # 3, 4, 6 and 7
	Seminar	1	10% (10)	Continuous	
	Report	1	10% (10)	13	LO # 5, 8 and 10
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-7
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week 1	Types of Energy
Week 2	Basic Thermodynamics
Week 3	Fuel Cell – Introduction & Open Circuit Voltage
Week 4	Fuel Cell – Activation & Ohmic Losses
Week 5	Fuel Cell – Mass Transport Loss
Week 6	Fuel Cell – Modeling, Types, Systems
Week 7	Review Session & Midterm Exam
Week 8	Electrochemical Characterization – Polarization Curve, EIS
Week 9	Ionic Batteries – Terminology & Principles, Phase Diagram
Week 10	Ionic Batteries –Electrodes
Week 11	Ionic Batteries –Modeling; Flow Battery
Week 12	Super Capacitor – Principles & Operation
Week 13	Electrochemical Characterization – Cyclic Voltametry
Week 14	Thermal and Mechanical Energy Storage
Week 15	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الأسبوعي للمختبر

	Material Covered
Week 1	NOT APPLICABLE
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Energy Storage, Robert A. Huggins, Springer	No
Recommended Texts	Fuel Cell Fundamentals, 2 nd Edition, Ryan et al., Wiley	No
Websites	https://abet.eng.ucmerced.edu/courses	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION OF MODELING OF RENEWABLE ENERGY

University Name: AlKarkh University of Sciences

College: Renewable Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information					
Module Title	Modeling of renewable energy		Module Delivery		
Module Type	C		☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar		
Module Code	REE35029				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		3		Semester of Delivery	5
Administering Department		RE	College	CRE	
Module Leader	Firas Abdulrazzaq Hadi		e-mail	Firas.A.Hadi@kus.edu.iq	
Module Leader’s Acad. Title		Asst. Prof.	Module Leader’s Qualification		Ph.D.
Module Tutor	NONE		e-mail	NONE	
Peer Reviewer Name		NONE	e-mail	NONE	
Scientific Committee Approval Date		20/6/2023	Version Number	1	

Relation with other Modules

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	• Develop a computer based tool to design an electricity generating system consisting of solar PV, WTGs, FFPPs and energy storage; • Use the tool to design an electricity generating system • Modeling and assessment of variable and constant renewable energy resources • Modeling renewable energy systems on a system level, such as solar photovoltaic and wind energy systems • Modeling energy demand and energy storage systems • Economic assessment of renewable energy systems with storage option • Integrating individual components/models of renewable energy systems for a complete system level model and its usage for design purposes or hybrid systems
Module Learning Outcomes	1. Developing, programming, and verifying/validating mathematical models; 2. Using the programmed models for parametric, simulation and what-if design studies 3. Post processing, visualization, and interpretation of results; 4. Written and oral communication of the design process and outcomes 5. Modeling and assessing renewable energy resources 6. Modeling renewable energy conversion process 7. Modeling energy storage and demand 8. Integrating individual models into a system level model and its application to design.
Indicative Contents	Design of a renewable energy system based on modeling and simulations. Development, programming, and verification of mathematical models for renewable energy resources, energy conversion processes, energy storage, energy demand, and environmental impact. Integration of models for system level modeling. Application of programmed models for simulation, parametric and what-if studies. Post processing, visualization, and interpretation of results.

Learning and Teaching Strategies

Strategies	1- Speaking 2- Discussion 3- Reports 4- Projects 5- Assignments
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Student Workload (SWL)

Structured SWL (h/sem)	V9	Structured SWL (h/w)	0
Unstructured SWL (h/sem)	V1	Unstructured SWL (h/w)	5.4
Total SWL (h/sem)	10.		

Module Evaluation

		Time/Nu mber	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5,10	
	Assignments	2	10% (10)	2,12	
	Projects / Lab.	1	10% (10)	-	
	Report	1	10% (10)	13	
Summative assessment	Midterm Exam	2 hr	10% (10)	7	
	Final Exam	2hr	50% (50)	16	
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to modeling systems
Week 2	Modeling of renewable energy system for a specific application
Week 3	Modeling of solar energy
Week 4	Modeling of wind energy
Week 5	Modeling energy demand and energy storage systems
Week 6	Economic assessment of renewable energy systems with storage option

Week 7	Measurements and resource assessment
Week 8	Post-processing and interpretation of results
Week 9	Integrating individual components/models of renewable
Week 10	Meteorological data analysis
Week 11	Analysis of energy storage systems and energy demand
Week 12	Economic metrics for energy systems
Week 13	Environmental aspects of renewable energy systems.
Week 14	Developing, programming and validating mathematical models using software such as MS Excel, Matlab, etc.
Week 15	Meteorological data analysis
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	learning how to install the modeling software
Week 2	Modeling and Simulating a Power System
Week 3	Using the programed models for parametric, simulation
Week 4	Use simulation software to model renewable energy
Week 5	Sizing of WTGs
Week 6	Sizing of PV energy systems.
Week 7	Design of WTG + PV energy systems

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	1. Energy Simulation in Building Design, J A Clarke, 2002 (2nd Edn) 1. 2001 ASHRAE Handbook: Fundamentals, IP or SI edition, hard copy or CD 2. Numerical Heat Transfer and Fluid Flow, S V Patankar, 1980 3. Solar Engineering of Thermal Processes, John A. Duffie, William A. Beckman, 1991 4. Design of Thermal Systems, W. F. Stoecker, 1998	
Recommended Texts	1- AJ Wood and BF Wollenberg: Power Generation, Operation and Control (John Wiley & Sons, New York, 1996). 2- Nick Jenkin, Janaka Ekavayake: Wind Energy Generation Modeling and Control (Wiley and Sons)	

Websites	1. SketchUp 2017. Either Sketchup Make or Sketchup Pro will work. http://www.sketchup.com/download/all 2. OpenStudio v2.20- Create a username and password to log in. https://www.openstudio.net Recommended Software Text Editor for PC: Notepad ++ https://notepad-plus-plus.org/ with the EnergyPlus syntax highlighting tool available at: http://energyplus.helpserve.com/Knowledgebase/List/Index/44/utilities Text Editor for Mac: Text Wrangler https://itunes.apple.com/us/app/textwrangler/id404010395?mt=12	



MODULE DESCRIPTION FOR HYDROELECTRIC ENERGY



University Name: AlKarkh University of Sciences

College: Energy and Environmental Sciences

Dept: Renewable Energies Sciences

Module Information					
معلومات المادة الدراسية					
Module Title	Hydroelectric Energy		Module Delivery		
Module Type	C		☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☒ Seminar		
Module Code	REE35030				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level		3	Semester of Delivery		5
Administering Department		REE	College	CRE	
Module Leader	Ammar w. saeed		e-mail	ammar.waleed@kus.edu.iq	
Module Leader's Acad. Title		Lecturer	Module Leader's Qualification		PhD.
Module Tutor	NONE		e-mail	NONE	
Peer Reviewer Name		NONE	e-mail	NONE	
Scientific Committee Approval Date		20/6/2023	Version Number	1	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	NONE	Semester	
Co-requisites module	NONE	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. Energy production, efficacy and efficiency of hydropower. 2. Economic structural design conditions for hydropower plants. 3. Calculate flow rate loads for dams. 4. Structural design and function of the various types of dams. 5. Structural design and dimensioning of spillways, slots, hydropower inlets, tunnels for operation and transmission, pipelines and concrete plugs. 6. Water hammer pressure surge and mass fluctuations, as well as installations to control them. 7. Structural design of hydropower plants. 8. Structure and function of the various types of turbines. 9. Regulations related to the various elements of a hydropower plant.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Perform cost-benefit analyses of hydropower plants. 2. Calculate flow rate loads of dams. 3. Select the right dam type according to local conditions. 4. Calculate structural design of dam for stability based on the regulations and accepted methods. 5. Calculate structural design of simple spillways, slots, hydropower intakes, tunnels for operation and transmission, pipelines and concrete plugs. 6. Select the right type of turbine. 7. Perform analysis of water hammer pressure surge and mass fluctuations and design of installations for controlling mass fluctuations.
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدرا يس المنتظم للطالب خلال الفصل	63		
Unstructured SWL (h/sem) الحمل الدرا يس غ ري المنتظم للطالب خلال الفصل	37		
Total SWL (h/sem) الحمل الدرا يس الك يل للطالب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	introduction to the concept of hydroelectric energy sources, types and types
Week 2	Energy production stations and their classification, types of water sources for these stations
Week 3	Solving mathematical problems related to turbines used in energy production
Week 4	Performing mathematical calculations to choose the appropriate turbine for power stations
Week 5	How the turbine works, with reference to models and diagrams of hydroelectric stations
Week 6	How the turbine works, with reference to models and diagrams of hydroelectric stations
Week 7	Mid exam
Week 8	Description of dams, their types, advantages and disadvantages of each type,
Week 9	Some necessary calculations for dams
Week 10	The construction of dams and their relationship to society and the environment and the resulting environmental damage
Week 11	
Week 12	Designing and conducting the necessary calculations for water drainage outlets in dams and conducting their calculations
Week 13	
Week 14	Solving mathematical problems related to dams
Week 15	
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	لا يوجد
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	P. K. Nag, Power Plant Engineering, Third Edition, the McGraw-Hill Companies, 2008.	Not found
Recommended Texts	Fundamentals of renewable energy N,S Rathore and N.L. Panwar	Not found
Websites	1. http://www.hydrolink.cz/en/pelton-turbines/ 2. https://www.slideshare.net/gauravhtandon1/gravity-dam	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية



Module Information

معلومات المادة الدراسية

Module Title	Application of Computer Science2	Module Delivery	
Module Type	B	☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code			
ECTS Credits	3		
SWL (hr/sem)	75		
Module Level	٣	Semester of Delivery	5
Administering Department		College	
Module Leader		e-mail	
Module Leader's Acad. Title		Module Leader's Qualification	
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	
Module Learning Outcomes	

مخرجات التعلم للمادة الدراسية	
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	

Student Workload (SWL) الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w)	2
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	27	Unstructured SWL (h/w)	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	75		

Module Evaluation تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10(10)		
	Assignments	2	10(10)		
	Projects	1	10(10)		
	Report	1	10(10)		
Summative assessment	Midterm Exam				
	Final Exam				
Total assessment					

Delivery Plan (Weekly Syllabus)

المناهج الاسبوعي النظري

	Material Covered
Week 1	Security and Networking: What is a network? Types of networks. Basic network components. Network Security Basics. Understanding network threats. Network Troubleshooting
Week 2	E-Commerce: Concepts of Electronic banking services this include online banking: ATM and debit card services, Phone banking. SMS banking, electronic alert, Mobile banking
Week 3	Computer Troubleshooting: Identifying and solving common hardware and software problems that computer users encounter. Basic troubleshooting techniques and tools for diagnosing and resolving issues
Week 4	Introduction to AI: Definition of AI, History of AI, AI Techniques and Approaches, Challenges and Ethical Considerations.
Week 5	AI in Our Daily Lives: AI in smartphones and virtual assistants like Siri or Google Assistant.)
Week 6	Applications of AI: Education, Healthcare, Finance, Transportation, Marketing and Advertising.
Week 7	
Week 8	Ethical Challenges in AI: (AI ethics, privacy and surveillance, the impact of AI on the job market.)
Week 9	The Future of AI (Future ture trends in AI, recent research and emerging technologies.)
Week 10	
Week 11	
Week 12	
Week 13	
Week 14	
Week 15	
Week 16	

Delivery Plan (Weekly Lab. Syllabus)

المناهج الأسبوعي للمختبر

	Material Covered
Week 1	Security and Networking: What is a network? Types of networks. Basic network components. Network Security Basics. Understanding network threats. Network Troubleshooting
Week 2	E-Commerce: Concepts of Electronic banking services this include online banking: ATM and debit card services, Phone banking. SMS banking, electronic alert, Mobile banking
Week 3	Computer Troubleshooting: Identifying and solving common hardware and software problems that computer users encounter. Basic troubleshooting techniques and tools for diagnosing and resolving issues
Week 4	Introduction to AI: Definition of AI, History of AI, AI Techniques and Approaches, Challenges and Ethical Considerations.
Week 5	AI in Our Daily Lives: AI in smartphones and virtual assistants like Siri or Google Assistant.)
Week 6	Applications of AI: Education, Healthcare, Finance, Transportation, Marketing and Advertising.
Week 7	
Week 8	Ethical Challenges in AI: (AI ethics, privacy and surveillance, the impact of AI on the job market.)
Week 9	The Future of AI (Future ture trends in AI, recent research and emerging technologies.)
Week 10	
Week 11	
Week 12	
Week 10	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts		

Recommended Texts		
Websites		

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				



MODULE DESCRIPTION OF PASSIVE SOLAR SYSTEMS

University Name: AlKarkh University of Sciences

College: Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information				
Module Title	passive solar systems		Module Delivery	
Module Type	C		☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☒ Practical ☒ Seminar	
Module Code	REE36031			
ECTS Credits	7			
SWL (hr/sem)	175			
Module Level	3	Semester of Delivery		6
Administering Department	REE	College	CRE	
Module Leader	Mohammed Ali Hassan GHlem		e-mail	Albeaty33@kus.edu.iq
Module Leader's Acad. Title	Lecture doctor	Module Leader's Qualification	Ph.D.	
Module Tutor	NONE		e-mail	NONE
Peer Reviewer Name		e-mail	NONE	
Scientific Committee Approval Date	2023/06/20	Version Number	1.0	

Relation with other Modules

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	1. Learn about passive solar buildings. 2. Types of passive solar energy systems 3. Identify the characteristics of sunlight and solar radiation. 4. Passive solar heating and cooling techniques 5. Maximum use of available solar energy and heat storage 6. How to maintain indoor air quality in an airtight home 7. Identify Energy efficient 8. Ways to use green building materials in a naturally conditioned home
Module Learning Outcomes	A- Cognitive objectives (after teaching the course, the student will be able to) 1. Know and understand the basic concepts of passive solar systems. 2. Understand the properties of sunlight and solar radiation. 3. Know and understand the importance of green buildings. 4. Knowledge of green building design mechanisms. 5. Estimating load quantities for heating and cooling buildings. B - The soft skills objectives of the course. (After teaching the vocabulary of the course, the student will be able to) 1. Knowledge of green building design mechanisms. 2. Estimating load quantities for heating and cooling buildings. 3. Know the design and efficiency limits of passive energy buildings.
Indicative Contents	Introduction to passive solar systems, Passive solar energy building Solar radiations and irradiance, Properties of solar radiations, Utilization of Passive Solar Technology, Passive solar design, Passive solar system (direct gain), Passive solar system(indirect gain), Passive solar system (isolated gain), Cooling Load Estimation, Heating load estimation .

Learning and Teaching Strategies

Strategies	Developing the study material according to the time period for updating the academic programs in the college.
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Student Workload (SWL)

Structured SWL (h/sem)	78		
Unstructured SWL (h/sem)	97		
Total SWL (h/sem)	175		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	20% (20)	2, 6, 10, 12	
	Assignments	2	5%(5)	2, 12	
	Projects	1	10% (10)	Continuous	
	Report	1	5% (5)	13	
Summative assessment	Midterm Exam	2 hr	10% (10)	8	
	Final Exam	2hr	50% (50)	16	
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to passive solar systems
Week 2	Passive solar energy building
Week 3	Solar radiations and irradiance
Week 4	Properties of solar radiations
Week 5	Utilization of Passive Solar Technology
Week 6	Passive solar design

Week 7	Passive solar system(direct gain)
Week 8	Midterm exam
Week 9	Passive solar system(indirect gain)
Week 10	Passive solar system(isolated gain)
Week 11	Cooling Load Estimation (1)
Week 12	Cooling Load Estimation (2)
Week 13	Heating load estimation (1)
Week 14	Heating load estimation (2)
Week 15	Preparatory Week
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	An Introduction to Passive Solar Buildings, J. Paul Guyer, P.E., R.A., Guyer Partners. 2017	yes
Recommended Texts	Thermal Analysis and Design of Passive Solar Buildings, A. K. Athienitis, Routledge. 2013	Yes
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR CLIMATE CHANGE

University Name: AlKarkh University of Sciences

College: Renewable Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information				
معلومات المادة الدراسية				
Module Title	Climate change		Module Delivery	
Module Type	S		☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☒ Seminar	
Module Code	Cre36032			
ECTS Credits	6			
SWL (hr/sem)	150			
Module Level	3	Semester of Delivery		6
Administering Department	REE	College	CRE	
Module Leader			e-mail	
Module Leader's Acad. Title			Module Leader's Qualification	
Module Tutor	NONE		e-mail	NONE
Peer Reviewer Name	NONE		e-mail	NONE
Scientific Committee Approval Date	20/6/2023	Version Number	1	

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	NONE		Semester
Co-requisites module	NONE		Semester

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. Know the concept of climate change 2- Know the physical bases affecting the concentration and distribution of pollutants 3- Know ways to reduce the effects of climate change and adapt 4- Identify the goals of sustainable development 5- Knowledge of sustainable cities
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Evaluation of the types of sources of pollutants 2. The most important weather phenomena that affect the increase and concentration of pollutants 3. There is a background on the most important ways to adapt to the effects of climate change 4. Knowledge of climate conventions 5. Knowledge of sustainable development goals
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدرا يس المنتظم للطالب خلال الفصل	63		
Unstructured SWL (h/sem) الحمل الدرا يس غ ري المنتظم للطالب خلال الفصل	87		
Total SWL (h/sem) الحمل الدرا يس الك يل للطالب خلال الفصل	150		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to the concept of the layers of atmosphere
Week 2	Boundary layer (definition and importance)
Week 3	Thickness of boundary layer
Week 4	sources of pollutants
Week 5	Stability and the pollutants
Week 6	The behavior of pollutants in chimneys and its relationship to atmospheric stability
Week 7	Review & exam
Week 8	climate change
Week 9	The effects of climate change
Week 10	Temperature, precipitation ,dust storm, Vegetation
Week 11	Climate change and biodiversity
Week 12	Adapting to climate change and Sustainable development goals
Week 13	climatic displaced
Week 14	sustainable cities and simens index
Week 15	climate agreements
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الأسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Handbook of climate change mitigation and adaptation	
Recommended Texts	Fundamentals of Atmospheric stability handbook	
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION

Of Meteorology

University Name: AlKarkh University of Sciences

College: Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information				
معلومات المادة الدراسية				
Module Title	Meteorology		Module Delivery	
Module Type	C		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	REE36033			
ECTS Credits	1			
SWL (hr/sem)	25			
Module Level	3	Semester of Delivery		6
Administering Department	REE	College	CRE	
Module Leader	Sura thamir nassir		e-mail	Sura.thamir91@kus.edu.iq
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	Msc
Module Tutor	NONE		e-mail	NONE
Peer Reviewer Name	NONE		e-mail	NONE
Scientific Committee Approval Date	20/6/2023	Version Number	1	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	● Provide a solid foundation in the principles and concepts of meteorology and its relevance to climate and weather. ● Following up and keeping abreast of the development of climate elements and their devices. ● Study the basics of weather and climate elements and phenomena ● Harnessing technology to develop education and presenting lectures via computer
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. This course description provides a necessary summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made the most of the available learning opportunities. It must be linked to the program description. 2. Studying climate elements and recent trends in the study of weather and climate, relying on advanced scientific programs and techniques, as well as using PowerPoint and climatic and weather devices available in the department's laboratories.
Indicative Contents المحتويات الإرشادية	1. Preparing students to practice the teaching profession after graduation. 2. Preparing students to obtain extensive information about weather and climate elements. 3. Developing the students' personality, as they will complete their studies to become teachers. 4. Contributing to addressing the problems facing students and guiding them professionally.

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	1. Teaching students how to teach this subject 2. Teaching students how to present the material using modern technologies such as data show. 3. Teaching students and developing their abilities to study different climatic conditions resulting from the different elements of weather and climate and their phenomena. 4. Teaching students the methods of measuring climatic and weather data and determining their accuracy. 5. Interest in studies that include the atmosphere and what happens in it. 6. Introducing students to weather and climate elements and their measurement devices. 7. Introduce students to weather and climate phenomena and their measurement devices. 8. Teaching students how to use climatic devices. 9. Develop students' ability to identify devices that can be used in the field. 10. Teaching students about modern global trends in the study of weather and climate.
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	18		
Unstructured SWL (h/sem) الحمل الدراسي الغير المنتظم للطالب خلال الفصل	7		
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	25		

Module Evaluation

تقييم المادة الدراسية

	Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2 10% (10)		
	Assignments	2 10% (10)		
	Projects / Lab.	1 10% (10)		

	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	The earth's atmosphere
Week 2	Warming the earth and the atmosphere
Week 3	Air temperature
Week 4	Humidity, condensation and clouds
Week 5	Cloud development and precipitation
Week 6	Air pressure and winds
Week 7	Atmospheric circulation
Week 8	Air Masses, Fronts, and Cyclones
Week 9	Weather forecasting
Week 10	Air pollution
Week 11	global climate
Week 12	Lights, colors, atmospheric optics
Week 13	Thunderstorms and tornados
Week 14	Hurricanes
Week 15	Energy and Temperature
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	

Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1. Renewable and Sustainable Energy Reviews. 2. Essential of meteorology, third edition	yes
Recommended Texts	all modern climatic sources and foreign research in the field of weather and climate	
Websites	www.elsevier.com/locate/rser	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required



MODULE DESCRIPTION OF HEAT TRANSFER

University Name: AlKarkh University of Sciences

College: Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information					
Module Title	HEAT TRANSFER			Module Delivery	
Module Type	C			☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☒ Seminar	
Module Code	REE36034				
ECTS Credits	7				
SWL (hr/sem)	175				
Module Level		3	Semester of Delivery		6
Administering Department		Renewable Energy	College	Renewable Energy and Environmental Science	
Module Leader	Ammar w. saeed		e-mail	ammar.waleed@kus.edu.iq	
Module Leader’s Acad. Title		Lecturer	Module Leader’s Qualification		PhD.
Module Tutor	none		e-mail	none	
Peer Reviewer Name		none	e-mail	none	
Scientific Committee Approval Date		20/06/2023	Version Number	1	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	FLUID FLOW	Semester	4
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	1. Knowing the most important scientific methods in addressing the problems facing the student, including the process of heat transfer. 2. Knowing the most important principles of heat transfer. 3. View the initial principles in the design of heat transfer equipment such as (solar heater). .The ability to solve problems related to heat transfer
Module Learning Outcomes	1. Knowledge of scientific terms. 2. Knowledge of the most important concepts and theories in the field of renewable energy. 3. Knowledge of modern methods and techniques. 4. Know the main heat and the basic components in the process of heat transfer. 5. Knowledge of the most important principles in the design of heat transfer equipment and devices.
Indicative Contents	

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	94		
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	81		
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week 1	Introduction -General concepts and definitions, Heat conduction , Convective heat transfer, Thermal radiation
Week 2	Conduction heat transfer (general equation) - General heat conduction equation - One-dimensional, steady state, conduction through plane wall
Week 3	Conduction heat transfer (1-D, steady State) -Composed wall -Cylinder, composed cylinder

	- Sphere, composed sphere
Week 4	Hollow cylinder - Sphere - Critical thickness of insulation
Week 5	Heat transfer through extended surfaces (fins) - General equation for temperature distribution - Very long fin - Short fin
Week 6	2-D, Steady state heat conduction - Analytical solution with different boundary conditions - Exact Solution with different boundary conditions
Week 7	MID EXAM
Week 8	Convective heat transfer - Fluid flow background - Laminar and turbulent flow - Boundary layer growth for external flow and internal flow
Week 9	Forced convection - Energy equation - Thermal boundary layer and temperature distribution and heat transfer
Week 10	- Empirical equation for cross flow for cylinder, sphere and tube bank - Empirical equation for turbulent flow
Week 11	Natural convection - General concepts - Grashof number
Week 12	Thermal radiation - Introduction to thermal radiation - The electromagnetic waves - The black body - The shape factor
Week 13	Thermal radiation between: Two parallel plates (gray) Two concentric cylinder
Week 14	Thermal radiation between more than two bodies
Week 15	Thermal resistance network - Radiation shields
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الأسبوعي للمختبر

	Material Covered
Week 1	Searle's bar method
Week 2	Calibration of Thermocouple
Week 3	Volumetric expansion of liquid
Week 4	Latent Heat of fusion of Ice
Week 5	Double pipe heat exchanger
Week 6	Forced convection
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Heat Transfer, by J. P. Holman, 10th Edition, McGraw-Hill, 2010	NOT FOUND
Recommended Texts	Heat Transfer: A Practical Approach by Y.A. Cengel, McGraw-Hill, 3rd Ed., 2007.	NOT FOUND
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جداً	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION OF STATICS

University Name: ALkarkh University of Science

College Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information				
معلومات المادة الدراسية				
Module Title	Statistic		Module Delivery	
Module Type	C		☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	REE36035			
ECTS Credits	٥			
SWL (hr/sem)	1٢٥			
Module Level	3	Semester of Delivery		6
Administering Department code	REE	College code	CRE	
Module Leader	Dr. Thamer Khalil Mohammed		e-mail	Thamer.197675@kus.edu.iq
Module Leader's Acad. Title	Asst. prof.		Module Leader's Qualification	PhD.
Module Tutor	None		e-mail	none
Peer Reviewer Name	None		e-mail	none
Scientific Committee Approval Date	20/6/2023		Version Number	No. 1

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1- وصف أساسيات الاحصاء 2- معرفة وتطبيق قوانين الاحصاء 3- فهم طرق الحل المتعددة 4- فهم الطلبة وزيادة وعيهم حول امكانية حل الجداول بانواعها 5- معرفة اهم الاسس العملية والنظرية لحل قوانين الاحصاء 6- التعرف على ان حل الجداول الاحصائية اهمية احدى الطرق الرئيسية لحل معظم المسائل الرياضية
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	أ- الأهداف المعرفية (بعد تدريس المقرر يكون الطالب قادر على) 1- يعرف الاحصاء بأنواعه 2- يعرف اهم انواعها 3- ان يكون قادر على حل جميع المشاكل الاحصائية 4- قادر على حل القيم بانواعه 5- يذكر اشكال وانواع الرسومات والبيانات 6- قادر على تحديد البيانات المبوبة وغير المبوبة
Indicative Contents المحتويات الإرشادية	ب - الأهداف المهاراتية الخاصة بالمقرر. (بعد تدريس مفردات المقرر يكون الطالب قادر على) ب1 - يفحص ويحلل ويختار نوع الحل ب2 - يجري حل سري••••ع شفهي لمعرفة الطريقة المناسبة ب3 - ايجاد العدد من الطرق لحل مسألة واحدة ب4- احصاء اهم انواع الطرق التي تساعد الطالب في الحل

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	-اللقاء 2- المناقشة 3- تجارب العرض 4- التجارب الفردية 5- البحوث والتقارير
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48		
Unstructured USWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	٧٧		
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	1٢٥		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	2	
	Assignments	2	10% (10)	2	
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)	2	
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الأسبوعي النظري

	Material Covered
Week 1	Introduction of statistic
Week 2	[definitions, descriptive, inferential]
Week 3	Date [tables, diagram]
Week 4	Measure of central [tendency]
Week 5	Measure of central [Mean]
Week 6	Measure of central [Median]
Week 7	Exam
Week 8	Measure of central [Harmonic Mean]
Week 9	Measure of Dispersion [absolute deviation]
Week 10	The semi-interquartile
Week 11	[rang deviation]
Week 12	The semi-interquartile
Week 13	The semi-interquartile [standard deviation]
Week 14	The semi-interquartile [variance]
Week 15	Exam
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	David M. Lane, et al. Introduction to statistic	
Recommended Texts	Introduction to mathematical statistic, Robert V.hogg , Allen T.Graig,1970	
Websites	مبادئ الإحصاء الرياضي - أمير حنا	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

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MODULE DESCRIPTION FOR PHOTOCHEMISTRY

University Name: AlKarkh University of Sciences

College: Renewable Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information			
معلومات المادة الدراسية			
Module Title	Photochemistry		Module Delivery
Module Type	E	☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	REE36036 E1		
ECTS Credits	٤		
SWL (hr/sem)	١٠٠		
Module Level	3		
Administering Department	REE	College	CRE
Module Leader	Al-Hamzah Dheyaa Hameed	e-mail	Alhamza.dheyaa@kus.edu.iq
Module Leader's Acad. Title	Lecturer	Module Leader's Qualification	PhD
Module Tutor	NONE	e-mail	NONE
Peer Reviewer Name	NONE	e-mail	NONE
Scientific Committee Approval Date	20/6/2023	Version Number	1

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	● Provide a solid foundation in the principles and concepts of photochemistry and its relevance to energy conversion and storage. ● Introduce students to the fundamental processes and mechanisms involved in photochemical reactions and energy transfer. ● Develop an understanding of the role of photochemistry in various energy systems, such as solar energy conversion, photocatalysis, and photovoltaics. ● Familiarize students with the experimental techniques and instrumentation used in studying and characterizing photochemical processes. ● Foster critical thinking and problem-solving skills to analyze and optimize photochemical energy systems. ● Explore emerging trends and advancements in photochemistry for energy applications. ● Promote awareness of the environmental and sustainability aspects of photochemical processes in energy production. ● Cultivate skills in data analysis, interpretation, and effective communication of photochemical concepts and findings. ● Encourage interdisciplinary thinking by integrating photochemistry with other energy-related disciplines. ● Nurture a passion for continuous learning and research in the field of photochemistry and its applications in energy.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Knowledge and Understanding: ● Demonstrate a comprehensive understanding of the principles and concepts of photochemistry in the context of energy conversion and storage. ● Explain the fundamental processes and mechanisms involved in photochemical reactions and energy transfer. ● Understand the role of photochemistry in various energy systems, such as solar energy conversion, photocatalysis, and photovoltaics. 2. Application and Analysis: ● Apply photochemical principles and concepts to analyze and solve complex problems in energy systems. ● Evaluate the efficiency and performance of photochemical energy conversion processes. ● Analyze and interpret experimental data related to photochemical reactions and energy transfer. 3. Design and Optimization:

	● Apply critical thinking and problem-solving skills to design and optimize photochemical energy systems. ● Develop strategies to improve the efficiency and performance of photochemical processes. ● Evaluate and optimize the parameters and conditions that affect photochemical reactions in energy systems. 4. Environmental and Sustainability Awareness: ● Recognize the environmental impact of photochemical processes and their implications for sustainable energy production. ● Identify strategies for minimizing waste and enhancing the sustainability of photochemical energy systems. ● Consider the ethical implications of utilizing photochemical processes in energy production. 5. Professional Development and Lifelong Learning: ● Demonstrate an awareness of emerging trends, technologies, and advancements in photochemistry for energy applications. ● Recognize the importance of continuous learning and staying updated with the latest developments in photochemical energy systems. ● Develop skills in research, critical thinking, and self-directed learning to enhance career readiness and adaptability in the energy sector.
Indicative Contents المحتويات الإرشادية	1. Introduction to Photochemistry: 2. Absorption and Emission of Light: 3. Photochemical Reactions: 4. Energy Conversion in Photochemical Systems: 5. Photocatalysis and Energy Applications: 6. Photothermal Energy Conversion: 7. Advanced Materials for Photochemistry: 8. Thermodynamics and Kinetics in Photochemical Processes: 9. Experimental Techniques in Photochemistry: 10. Energy Efficiency and Sustainability in Photochemical Systems: 11. Emerging Trends in Photochemistry and Energy Systems:

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Active Learning: Incorporate active learning techniques such as group discussions, problem-solving exercises, case studies, and hands-on experiments. Encourage students to actively participate in class and engage with the course material through interactive activities. Real-World Applications: Relate photochemistry concepts to real-world energy applications and industry examples. Show how photochemical reactions play a role in solar energy conversion, photocatalysis, photovoltaics, and other energy

	technologies. Connect the theoretical concepts to their practical significance and impact. Multidisciplinary Approach: Emphasize the interdisciplinary nature of photochemistry by integrating concepts from chemistry, physics, materials science, and engineering. Highlight the collaborative nature of research and development in energy systems involving photochemical processes. Technology-Enhanced Learning: Utilize technology tools and resources to enhance learning experiences. Incorporate multimedia presentations, simulations, virtual labs, and online resources to provide interactive and engaging learning opportunities for students. Research Projects and Case Studies: Assign research projects or case studies that require students to explore current research literature, analyze experimental data, and propose innovative solutions related to photochemistry in energy systems. This allows students to develop critical thinking, problem-solving, and research skills. Continuous Assessment: Implement regular assessments such as quizzes, assignments, and presentations to monitor student progress and reinforce learning. Provide constructive feedback to students to help them improve their understanding and application of photochemistry concepts. Discussion and Debate: Encourage open discussions and debates on controversial topics or emerging trends in photochemistry and energy systems. This promotes critical thinking, fosters creativity, and allows students to explore different perspectives.
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Student Workload (SWL)			
الحمل الدراسي للطالب			
Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w)	٣
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	٥٢	Unstructured SWL (h/w)	٣
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to Photochemistry: Basic principles of photochemistry and its relevance to energy systems Interaction of light with matter and energy transfer processes Photochemical reactions and their significance in energy conversion
Week 2	Photophysical Processes: Absorption and emission of light by molecules Fluorescence and phosphorescence phenomena Quantum yields and fluorescence lifetimes
Week 3	Photochemical Reactions: Primary photochemical processes (excitation, electron transfer, energy transfer) Secondary photochemical processes (radical reactions, isomerization, rearrangements) Photodegradation and photochemical stability of materials
Week 4	Principles of Solar Energy Conversion: Solar energy as a renewable energy source Overview of photovoltaic and solar thermal systems Role of photochemistry in solar energy conversion
Week 5	Photovoltaic Devices:

	Working principles of solar cells Types of photovoltaic materials (organic, inorganic, hybrid) Design considerations and efficiency enhancement strategies
Week 6	Photoelectrochemical Systems: Introduction to photoelectrochemistry Photoelectrochemical water splitting for hydrogen production Photocatalytic systems for energy storage and conversion
Week 7	Photocatalysis and Energy Applications: Principles of photocatalysis and its applications in energy conversion Photocatalytic degradation of pollutants and wastewater treatment Photocatalytic synthesis of fuels and chemicals
Week 8	Photothermal Energy Conversion: Principles of photothermal energy conversion Light-induced heat transfer and thermal energy storage Photothermal materials and applications in energy systems
Week 9	Advanced Materials for Photochemistry: Emerging materials for efficient light absorption and energy conversion Nanomaterials and nanostructures for enhanced photochemical processes Photonic structures and photonic crystals for energy applications
Week 10	Thermodynamics and Kinetics in Photochemical Processes: Thermodynamic aspects of photochemical reactions and energy transfer Kinetics of photochemical reactions and reaction mechanisms Energy diagrams and free energy changes in photochemical systems
Week 11	Experimental Techniques in Photochemistry: Measurement and characterization of photochemical reactions Spectroscopic techniques (UV-Vis spectroscopy, fluorescence spectroscopy) Photochemical reactor design and operation
Week 12	Energy Efficiency and Sustainability in Photochemical Systems: Energy efficiency considerations in photochemical processes Environmental and sustainability aspects of photochemical reactions Design principles for improving energy utilization and minimizing waste

Week 13	Emerging Trends in Photochemistry and Energy Systems: Advanced concepts and technologies in photochemistry for energy conversion Integration of photochemistry with other energy conversion technologies Future prospects and challenges in photochemical energy systems
Week 14	Preparatory week before the final Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	"Principles of Solar Cells, LEDs and Diodes: The Role of the PN Junction" by Adrian Kitai "Photochemistry and Photophysics: Concepts, Research, Applications" by Virender K. Sharma "Photovoltaics: Fundamentals, Technology and Practice" by Konrad Mertens "Photoelectrochemical Water Splitting: Materials, Processes and Architectures" edited by Hans-Joachim Lewerenz, Laurie Peter, Ferdi Schüth "Photocatalysis: Fundamentals and Perspectives" edited by Jenny Schneider, Detlef Bahnemann	No
Recommended Texts	"Photocatalytic Production of Energy-Rich Compounds" edited by Xinchun Wang, Can Li	No
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.

Module Description of Waste Recycling for Saving and Production Energy

Module Information				
معلومات المادة الدراسية				
Module Title	Waste Recycling for Saving and Production Energy		Module Delivery	
Module Type	E		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	REE36036 E2			
ECTS Credits	٤			
SWL (hr/sem)	١٠٠			
Module Level	3	Semester of Delivery		6
Administering Department	REE	College	CRE	
Module Leader	Hasan Mohammed Luaibi		e-mail	hasan.luaibi@kus.edu.iq
Module Leader's Acad. Title	Assistant Professor		Module Leader's Qualification	Ph.D
Module Tutor	None		e-mail	E-mail
Peer Reviewer Name	None		e-mail	E-mail
Scientific Committee Approval Date	20/06/2023		Version Number	1.0

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None		Semester
Co-requisites module	None		Semester

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives

أهداف المادة الدراسية

The main objectives of Waste Recycling for Saving and Production Energy module that covers the basics of Waste Recycling and how do we harness it to saving and production the energy (classical and renewable) , which include:

1. Understanding the students about the introducing to the concept of waste recycling and its great importance in the specialization of our college and department, and its relationship to saving energy and reducing its cost on the one hand, and its connection to the daily life of society on the other hand.
2. Understanding and mention the students about the types of waste, whether solid, liquid or gaseous, and the most important sources are natural or industrial, or resulting from the daily life of society on the one hand, and methods and methods of recycling or disposal, theoretically and practically, which are commensurate with the student's academic level, and also commensurate with the objectives of the cognitive department to which the student belongs.
3. Understanding and mention the methods of modern waste recycling for all types of waste and their symbols.
4. Understanding the students how to benefit from recycling waste to save the energy.
5. Understanding the students how to benefit from recycling waste to production the classical energy.
6. Understanding the students how to benefit from recycling waste to production the renewable energy.
7. Understanding and mention Modern methods for the disposal of waste that is not fully utilized.

Module Learning Outcomes

مخرجات التعلم للمادة
الدراسية

The students will be able to:

1. How can distinguishes between the types of waste, whether solid, liquid or gaseous, and the most important sources are natural or industrial.
2. How can applied to the methods of modern waste recycling for all types of waste.
3. How can reading the symbols of the recycling wastes.
4. Calculate the energy quantity that can be saved from recycling waste.
5. Calculate the energy quantity that can be production from recycling waste.
6. How can identify recyclable and non-recyclable waste.
7. How to determine the waste that disposal (landfill or burning).

Indicative Contents

المحتويات الإرشادية

Indicative content includes the following.

Theory:

- Introducing to the concept of waste recycling. [3 hrs.].
- The types of waste recycling [3 hrs.].
- The methods of modern waste recycling for all types of waste and their symbols. [6hrs]
- The benefits from recycling waste to save the energy. [9 hrs.]
- The benefits from recycling waste to production the classical energy. [9hrs.]
- The benefits from recycling waste to production the renewable energy. [12 hrs.]
- The modern methods for the disposal of waste. [3 hrs.]

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies

- 1. Lectures:** used to introduce and explain the concepts of waste recycling and its great importance in the specialization of our college and department, and its relationship to saving energy and reducing its cost on the one hand, and its connection to the daily life of society on the other hand, benefit from recycling waste to save and production the classical and renewable energy and the disposal from the waste.
- 2. Interactive discussions:** used to engage students in critical thinking and problem-solving questions related to methods of waste recycling in Iraq through group discussions, debates, case studies, and simulations.
- 3. Multimedia resources:** used to enhance student engagement and understanding of complex concepts related to the types of waste recycling through videos, and animations.
- 4. Assessment and feedback:** used to measure student learning and provide feedback on their progress through quizzes, exams, and projects.

Student Workload (SWL)

الحمل الدراسي للطلاب محسوب ل ٥١ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطلاب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطلاب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطلاب خلال الفصل	٥٢	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطلاب أسبوعيا	٣
Total SWL (h/sem) الحمل الدراسي الكلي للطلاب خلال الفصل	١٠٠		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1, #2 and #3, #6
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #5, #7
	Discussions	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #2, #3 and #5
Summative assessment	Midterm Exam	1hr	10% (10)	7	LO #1 - #5
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introducing to the concept of waste recycling.
Week 2	The types of waste recycling.
Week 3	The methods of modern waste recycling for all types of waste and their symbols.
Week 4	The methods of modern waste recycling for all types of waste and their symbols.
Week 5	The benefits from recycling waste to save the energy.
Week 6	The benefits from recycling waste to save the energy.
Week 7	The benefits from recycling waste to save the energy.
Week 8	Med term exam + The benefits from recycling waste to production the energy.
Week 9	The benefits from recycling waste to production the energy.
Week 10	The benefits from recycling waste to production the energy.
Week 11	The benefits from recycling waste to production the renewable energy.
Week 12	The benefits from recycling waste to production the renewable energy.
Week 13	The benefits from recycling waste to production the renewable energy.
Week 14	The benefits from recycling waste to production the renewable energy.
Week 15	The modern methods for the disposal of waste.
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1) The Energy and Resources Institute, 2014, Waste to Resources: A Waste Management Handbook. 2) RECYCLING AND REUSE OF MATERIALS AND THEIR PRODUCTS, 2012, BOOK.	No
Recommended Texts	1) Recycling and reuse of materials and their products, 2013, book. 2) Daniel Hoornweg and Perinaz Bhada-Tata , March 2012, No. 15, WHAT A WASTE A Global Review of Solid Waste Management, Urban Development Series Knowledge Paper, World Bank	No
Websites	Taken from http://www.epa.gov/epaoswer/non-hw/muncpl/reduce.htm .	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION OF SUSTAINABLE ENERGY UTILIZATION

University Name: AlKarkh University of Sciences

College: Renewable Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information					
Module Title	Sustainable Energy Utilization		Module Delivery		
Module Type	C		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☒ Seminar		
Module Code	REE36036 E3				
ECTS Credits	٤				
SWL (hr/sem)	١٠٠				
Module Level		3	Semester of Delivery		٦
Administering Department		REE	College	CRE	
Module Leader	Rafa Abbas Hasan		e-mail	Albaldawirafa@kus.edu.iq	
Module Leader's Acad. Title		Asst. Prof.	Module Leader's Qualification		Ph.D.
Module Tutor	NONE		e-mail	NONE	
Peer Reviewer Name		NONE	e-mail	NONE	
Scientific Committee Approval Date		20/6/2023	Version Number		1

Relation with other Modules

Prerequisite module	None	Semester	No
Co-requisites module	None	Semester	No

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	The course gives a broad description of different energy systems and deepened knowledge in some energy technology questions of importance, of current interest and related to research and development within the area. The course will give an understanding for and practical application of theories and models for analysis and planning of sustainable energy systems as well as development of the individual ability of the student in: written presentations, search for information, critical review of information, literature and other material.
Module Learning Outcomes	After completion of the course the student shall be able to: - apply theories and models to solve energy engineering problems - independently analyse and evaluate different heat to power conversion cycles from performance, economic and environmental point of view - independently design, analyse and evaluate energy systems based on renewable energy with focus on solar energy and bioenergy - independently and critically analyse performance and operation problems in real energy conversion processes - independently and critically analyse and evaluate energy distribution systems - integrate knowledge and handle complex information - discuss and consider scientific, society and ethical aspects related to energy systems
Indicative Contents	The course consist mainly of individual analysis and calculation assignments within sustainable energy systems such as thermal engineering, power systems, solar cells and solar collectors, biofuels, transmission/distribution and more.

Learning and Teaching Strategies

Strategies	1- Speaking 2- Discussion 3- Reports 4- Projects 5- Assignments
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Student Workload (SWL)

Structured SWL (h/sem)	48	Structured SWL (h/w)	3
Unstructured SWL (h/sem)	52	Unstructured SWL (h/w)	3
Total SWL (h/sem)	100		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5,10	
	Assignments	2	10% (10)	2,12	
	Projects / Lab.	1	10% (10)	-	
	Report	1	10% (10)	13	
Summative assessment	Midterm Exam	2 hr	10% (10)	7	
	Final Exam	2hr	50% (50)	16	
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Historical energy transitions; definition of sustainable energy;
Week 2	Introduction to energy systems;
Week 3	The outlook for global energy demand under existing policies; energy balances
Week 4	Climate change – science, impact and mitigation;
Week 5	sources of GHG emissions; global and per-capita carbon budgets
Week 6	Sustainable Development Goals and the role of energy;
Week 7	energy access, poverty and affordability
Week 8	Air pollution and energy links
Week 9	Energy security
Week 10	IEA Sustainable Development Scenario
Week 11	Systems analysis of sustainability
Week 12	sustainability indicators
Week 13	Market development and prospects for renewable electricity,
Week 14	Energy Efficiency – market and behavioural barriers to change – energy innovation
Week 15	Policy instruments – carbon tax, mandates and standards. Global agreements and targets
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	/
Week 2	/
Week 3	/
Week 4	/
Week 5	/
Week 6	/
Week 7	/

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	1- Bisio, Attilio, and Sharon Boots. Wiley Encyclopedia of Energy Technology and the Environment. Wiley-Interscience, 1996. ISBN: 9780471148272. 2- Twidell, John, and Tony Weir. Renewable Energy Resources. Taylor and Francis, 2005. ISBN: 9780419253303.	
Recommended Texts	Randolph, John, and Gilbert M. Masters. <i>Energy for Sustainability: Technology, Planning, Policy</i> . Island Press, 2008. ISBN: 9781597261036.	
Websites	McKay, David J. C. <i>Sustainable Energy – Without the Hot Air</i> . UIT Cambridge, Ltd., 2009. ISBN: 9780954452933. Deutch, John, Ernest Moniz, et al. <i>The Future of Nuclear Power</i> . Massachusetts Institute of Technology, 2009. Tester, Jefferson W., et al. <i>"The Future of Geothermal Energy: Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21st Century."</i> (PDF - 22.6MB) Massachusetts Institute of Technology, 2006.	



MODULE DESCRIPTION OF HYBRID ENERGY

University Name: AlKarkh University of Science

College Energy and Environmental Sciences

Department: Renewable Energy Sciences

Module Information					
Module Title	Hybrid Energy		Module Delivery		
Module Type	C		☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☒ Practical ☒ Seminar		
Module Code	REE47037				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		4			Semester of Delivery
Administering Department code		REE	College code	CRE	
Module Leader	Firas Abdulrazzaq Hadi		e-mail	Firas.A.Hadi@kus.edu.iq	
Module Leader’s Acad. Title		Asst. Prof.	Module Leader’s Qualification		Ph.D.
Module Tutor	Firas Abdulrazzaq Hadi		e-mail	Firas.A.Hadi@kus.edu.iq	
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date		20/6/2023	Version Number	1	

Relation with other Modules			
Prerequisite module	No	Semester	No
Co-requisites module	No	Semester	No

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	Energy services are critical for health, livelihoods, and enabling productive activities. However, more than a billion people around the world in rural areas and urban slums do not have access to modern energy. Hybrid renewable energy systems can deliver these energy services in a sustainable and cost-effectively way, but there are several challenges related to their design, and the integration of high penetration of renewables. During this course students will develop the skills and knowledge required for designing, sizing, and specifying hybrid renewable energy systems, and to develop control strategies to optimise their operation, with an emphasis on delivering designs based on understanding context, appropriate design and technology selection, implementation of models, and capacity building for sustainable projects. This course uses project-based learning to develop skills and knowledge for designing and specifying hybrid renewable energy projects, by working with a real target community and local partners. In this opportunity, the activities of the course will be focus on islands in the south pacific, and the development of projects for delivering energy services to the local community.
Module Learning Outcomes	1. Understand the technical characteristics of components in hybrid renewable energy systems, including loads, storage, and generation technologies. 2. Interpret a brief, present proposals for feedback and assessment in a range of written, oral, and visual formats individually and as part of a team. 3. Compare and prioritise energy access options according to the local context and energy service requirements. 4. Design, size and specify hybrid renewable energy systems using first principles and advanced simulations tools. 5. Optimise a hybrid renewable energy system and its control strategy using appropriate dispatchability principles and techno-economic analysis
Indicative Contents	Hybrid Energy Systems – Need for Hybrid Energy Systems – Solar-Wind-Fuel Cell-Diesel, Wind Biomass-Diesel, Micro-Hydel-PV– Classification of Hybrid Energy systems - Importance of Hybrid Energy systems – Advantages and Disadvantages – Environmental aspects of renewable energy – Impacts of renewable energy generation on the environment – Hydel Energy – Solar Photovoltaic (PV) and Fuel cells: Operating principles and characteristics.

Learning and Teaching Strategies

Strategies	1- Speaking 2- Discussion 3- Reports 4- Projects 5- Assignments
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Student Workload (SWL)

Structured SWL (h/sem)	78	Structured SWL (h/w)	5
Unstructured SWL (h/sem)	72	Unstructured SWL (h/w)	4.8
Total SWL (h/sem)	150		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5,10	LO #1,2 and 8,9,15
	Assignments	2	10% (10)	2,12	LO # 5,6,7,10
	Projects / Lab.	1	10% (10)	-	
	Report	1	10% (10)	13	LO #3,4,11,12,13,14
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-8
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Intro to Hybrid Renewable Energy Systems (HRES)
Week 2	Energy & sustainable livelihoods
Week 3	Electricity access to Hybrid Renewable Energy Systems
Week 4	Assessing and understanding loads for HRES
Week 5	Dispatchable energy for HRES
Week 6	Load curve for HRES
Week 7	RE resources for HRES
Week 8	Project planning and Storage for HRES
Week 9	Control and optimisation of HRES
Week 10	Energy transmission with HRES
Week 11	Energy distribution with HRES
Week 12	Energy monitoring with HRES
Week 13	Minigrid design
Week 14	Techno-Economic optimization with HRES
Week 15	Case Studies For Hybrid Renewable Energy Systems
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	/
Week 2	/
Week 3	/
Week 4	/
Week 5	/
Week 6	/
Week 7	/

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	<i>Stand Alone Power Systems, Design and Installation – GSES</i>	
Recommended Texts	<i>Solar/Diesel Minigrid Handbook – PowerWater Corporation</i>	
Websites	- UNSW Library website - https://www.library.unsw.edu.au/ - Australian Bureau of Meteorology - http://www.bom.gov.au/climate/ - NASA (weather data) - https://power.larc.nasa.gov/	



MODULE DESCRIPTION OF JOB ETHICS

Module Information					
Module Title	Job Ethics			Module Delivery	
Module Type	B			☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☐ Seminar	
Module Code	KUS47038				
ECTS Credits	3				
SWL (hr/sem)	75				
Module Level		4	Semester of Delivery		1
Administering Department code		REE	College code	CRE	
Module Leader	Maad Abdulla Hussein		e-mail	maad@kus.edu.iq	
Module Leader’s Acad. Title		Lecture	Module Leader’s Qualification		Ph.D.
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date		20/06/2023	Version Number	1.0	

Relation with other Modules			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Objectives أهداف المادة الدراسية	1. Application of academic programs Al-karkh University of sciences. 2. To understand the principles of the work ethics. 3. This course deals with the basic concept of job ethics. 4. Providing students with sound thinking methods (deductive thinking, scientific thinking, critical thinking, creative thinking,...) 5. Graduating specialists in the field of different sciences with the highest efficiency to deal with job problems and decision making.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understand and define the concepts of integrity and ethics. 2. Understand how to resolve ethical dilemmas. 3. Describe three major theoretical approaches in integrity and ethics. 4. Identify ethical dilemmas and apply different theoretical approaches. 5. Understand the concept of personal integrity in the context of this Module. 6. Understand how to apply social work ethics to professional decision-making.
Indicative Contents المحتويات الإرشادية	Module 1: Introduction and Conceptual Framework Throughout the Module, students will be introduced to concepts and thrown in at the deep end by being asked to make decisions on what they would regard as the most ethical solutions to dilemmas. Students will be guided through three major ethical theories and challenged to agree or disagree with them. Students should not be afraid to take a stance, as this will enhance their learning and enjoyment of the Module. Module 2: Ethics and Universal Values This Module explores the existence of universal human values, which are those things or behaviours that we believe should be privileged and promoted in the lives of all human beings. Module 3: Ethics and Society This Module explores the importance of ethics to society and the relationship between these two concepts. Module 4: Ethical Leadership We live in a world in which individuals, organizations, countries and societies are increasingly connected. Therefore, the impact of leadership - both good and bad - reverberates throughout entire political and economic systems. Module 5: Ethics, Diversity and Pluralism This Module explores the concepts of diversity, tolerance and pluralism. It examines ways in which the acceptance of diversity may be challenging but can be understood and accomplished by drawing on ideas and examples of ethical behavior. Module 6: Challenges to Ethical Living The Module seeks to help students understand some of the psychological mechanisms that can lead one towards unethical behavior in certain circumstances. Module 7: Strategies for Ethical Action This Module introduces practical strategies for taking ethical action in the workplace (in the public or private sectors), university, community and in life more broadly. Module 8: Behavioral Ethics Evidence from behavioral science research has shown that people are less consistent and less rational in their decisions than they would like to admit to themselves. Module 9: Gender Dimensions of Ethics This Module introduces the gender dimensions of ethics. Module 10: Media Integrity and Ethics

	This Module discusses the relationship between the concepts of ethics and media. It aims to facilitate introspective reflection on the ways in which all of us, as individuals, play a part in the creation and dissemination of media. Module 11: Business Integrity and Ethics This Module introduces students to the idea that integrity and ethics are key to sustainable business success. It examines the reasons why individuals in corporate entities should act with integrity and do business ethically. Module 12: Integrity, Ethics and Law Why is it that some actions are legal but not ethical, or ethical but not legal? This Module is designed to be used by lecturers in a variety of disciplines who wish to introduce their students to the ideas of integrity, ethics and law, including what these concepts stand for and how they are different. Module 13: Public Integrity and Ethics This Module examines methods and approaches to strengthening integrity in the public sector. Module 14: Professional Ethics Should a journalist publish very private information about someone to inform the public about an issue? Should a lawyer withhold confidential client information that would save someone's life? This Module is designed to introduce students to the nature, practices and importance of professional ethics.
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Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	1. Clearly distinguish between personal, theoretical and professional ethic. 2. Think critically about ethical issues, which are encountered first hand within a career, and apply personal, theoretical, and professional ethics to vexing moral decisions within specific professions. 3. Grasp the challenges posed by potential conflicts between role morality and personal morality, and consider ways of resolving those conflicts. 4. Understand the role of professional codes of ethics, the difference between aspirational and disciplinary codes of ethics, and how professional codes may apply in their career.
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Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ٥١ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	٣٣	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	٤٢	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3

Total SWL (h/sem)		٧٥			
الحمل الدراسي الكلي للطالب خلال الفصل					
Module Evaluation					
تقييم المادة الدراسية					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	20% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments	0	0% (0)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	0	0% (0)	Continuous	All
	Report	1	10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	2hr	20% (10)	7	LO #1 - #7
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		
Delivery Plan (Weekly Syllabus)					
المنهاج الاسبوعي النظري					
	Material Covered				
Week 1	Module 1: Introduction and Conceptual Framework				
Week 2	Module 2: Ethics and Universal Values				
Week 3	Module 3: Ethics and Society				
Week 4	Module 4: Ethical Leadership				
Week 5	Module 5: Ethics, Diversity and Pluralism				
Week 6	Module 6: Challenges to Ethical Living				
Week 7	Module 7: Strategies for Ethical Action				
Week 8	Module 8: Behavioural Ethics				
Week 9	Module 9: Gender Dimensions of Ethics				
Week 10	Module 10: Media Integrity and Ethics				
Week 11	Module 11: Business Integrity and Ethics				
Week 12	Module 12: Integrity, Ethics and Law				
Week 13	Module 13: Public Integrity and Ethics				
Week 14	Module 14: Professional Ethics				
Week 15	Preparatory week before the final Exam				

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Business Ethics Activity Book by Dr. Marlene Caroselli Released September 2003 Publisher(s): AMACOM ISBN: 9780814413203	No
Recommended Texts	The Work Ethic: Working Values and Values That Work	No
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR ENERGY MANAGEMENT



University Name: ALkarkh University of Science

College: Energy and Environmental Sciences

Department: Renewable Energy Sciences

Module Information

معلومات المادة الدراسية

Module Title	Energy management			Module Delivery	
Module Type	C			☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☒ Practical ☒ Seminar	
Module Code	REE47039				
ECTS Credits	7				
SWL (hr/sem)	175				
Module Level		4	Semester of Delivery		7
Administering Department Code		REE	College Code	CRE	
Module Leader	Mohammad Al Dharob		e-mail	Dr.m.alldharob@kus.edu.iq	
Module Leader's Acad. Title		lecture	Module Leader's Qualification		PH.D
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date		20/6/2023	Version Number	1	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module		Semester	
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. Understand the energy management process. 2. Understand the methods of energy management. 3. Understand the parameters of energy management.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Evaluate the cost efficiency for sustainable energy systems by applying appropriate economic methods. 2. understand how economic tools relate to practical aspects of energy economics and management 3. have acquired a clear understanding of the role of energy in the global economic system
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعياً	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	97	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعياً	6.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	175		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		

Total assessment		100% (100 Marks)		
Optimum performance of existing facilities Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري				
	Material Covered			
Week 1	Introduction: Energy and Energy Markets			
Week 2	Energy resources, Energy conversion processes and devices – Energy conversion plants – Conventional - Thermal, Hydro, Nuclear fission , and Non – conventional – Solar, Wind Biomass, Fuel cells, Magneto Hydrodynamics and Nuclear fusion. Energy from waste, Energy plantation.			
Week 3	Energy storage and Distribution ,.			
Week 4	Energy conversion plants for Base load , Intermediate load, Peak load			
Week 5	Energy Management program			
Week 6	Principles, technologies of Energy conservation			
Week 7	Mid exam			
Week 8	power generation			
Week 9	Energy strategies and energy planning			
Week 10	Impact of Energy on economy, development and environment, Energy policies			
Week 11				
Week 12	Energy strategy for future			
Week 13				
Week 14	Solving mathematical problems related to dams			
Week 15				
Week 16	Preparatory week before the final Exam			

Delivery Plan (Weekly Lab. Syllabus) المنهاج الاسبوعي للمختبر				
	Material Covered			
Week 1	لا يوجد			
Week 2				
Week 3				
Week 4				
Week 5				
Week 6				
Week 7				

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Amlan Chakrabarti, Energy Engineering and Management, Prentice Hall India, 2011. 2. Eastop T. D. and D. R. Croft, Energy Efficiency for Engineers & Technologists, Longman, 1990. 3. Albert Thumann P. E. and W. J. Younger, Handbook of Energy Audits, Fairmont Press, 2008. 4. Doty S. and W. C. Turner, Energy Management Hand book, 7/e, Fairmont Press, 2009. 5. Rao S. and B. B. Parulekar, Energy Technology, Khanna Publishers, 2005. 6. Rai G. D., Non-conventional Energy Sources, Khanna Publishers, 2011.	Not found
Recommended Texts		Not found
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR ENERGY EFFICIENCY



University Name: ALkarkh University of Science

College: Energy and Environmental Sciences

Department: Renewable Energy Sciences

Module Information					
Module Title	Energy Efficiency			Module Delivery	
Module Type	C			☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☒ Practical ☒ Seminar	
Module Code	REE47040				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level		4	Semester of Delivery		7
Administering Department Code		REE	College Code	CRE	
Module Leader	Mohammad Al Dharob		e-mail	Dr.m.aldharob@kus.edu.iq	
Module Leader’s Acad. Title		lecture	Module Leader’s Qualification		PH.D
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date		20/6/2023	Version Number	1	

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	NONE		Semester
Co-requisites module	NONE		Semester

Module Aims, Learning Outcomes and Indicative Contents	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Study the efficiency of the electrical stations 2. Study the efficiency of renewable energy systems. 3. Calculation of energy efficiency

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Evaluate the efficiency for normal and sustainable energy systems. 2. Compare between the efficiency of types of renewable energy 3. determine the parameters that effect of the efficiency of energy
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	78	Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال السووق	5
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	72	Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال السووق	4.8
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	150		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction: Energy efficiency
Week 2	Efficiency of fuel stations
Week 3	Efficiency of gas stations
Week 4	Efficiency of renewable energy stations
Week 5	Calculations of efficiency in stations
Week 6	Calculations of efficiency in distributions line
Week 7	Mid exam
Week 8	Calculations of efficiency in storage system
Week 9	energy efficiency policies
Week 10	Conditions effects on the energy efficiency
Week 11	
Week 12	Solar panel efficiency and solar thermal collector efficiency
Week 13	
Week 14	Solving mathematical problems related to dams
Week 15	
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	ل يوجد
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Kreith, F. and Goswami, D.Y., Handbook of Energy Efficiency and Renewable Energy,	Not found
Recommended Texts		Not found
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION OF FUEL AND HYDROGEN CELLS



University Name: AlKarkh University of Science

College: Energy and Environmental Sciences

Department: Renewable Energy Sciences

Module Information					
Module Title	Fuel and hydrogen cells		Module Delivery		
Module Type	E 1		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☒ Seminar		
Module Code	REE47042				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	4	Semester of Delivery			7
Administering Department		REE	College	CRE	
Module Leader	Marwah Mohammed Jasim		e-mail	Marwah.mohammed@kus.edu.iq	
Module Leader’s Acad. Title		Lecturer	Module Leader’s Qualification		Ph.D
Module Tutor	N.A		e-mail	N.A	
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date		20/06/2023	Version Number		1.0

Relation with other Modules			
Prerequisite module	None	Semester	_____
Co-requisites module	None	Semester	_____

Module Aims, Learning Outcomes and Indicative Contents
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	1. This course provides fundamental understanding of performance characteristics of fuel cell systems and their components. 2. It also outlines the design characteristics and operating issues for various fuel cells. Additionally, it discusses the design philosophy and challenges to make this system feasible. 3. To study various methods for production of hydrogen. 4. To study about safety, environmental impacts and economics of transition to hydrogen system. 5. To study principle, working, thermodynamics and kinetics of fuel cell process 6. To address the underlying concepts, methods and application of fuel cell technology. 7. The design and analysis emphasis will be mostly on the thermodynamics and electrochemistry. 8. To study about different parameters affecting the performance of fuel cell. 9. To study various applications and economics of fuel cell.
Module Aims	
	10. Fuel Cell Development Trends and Future Prospects.
Module Learning Outcomes	1. Objective: To impart knowledge on the fuel cell technology. 2. Objective: To understand the Fuel cell reaction kinetics 3. To learn the process of hydrogen production for fuel cell operation and its related components. 4. The student can identify different areas of fuel cell technology. 5. Apply know-how of thermodynamics, electrochemistry, heat transfer, and fluid mechanics principles to design and analysis of this emerging technology. 6. Have thorough understanding of performance behavior, operational issues and challenges for major types of fuel cells. 7. Identify, formulate, and solve problems related to fuel cell technology keeping in mind economic viability and sustainability. 8. Use the techniques, skills, and modern engineering tools necessary for design and analysis of innovative fuel cell systems. 9. Understand the impact of this technology in a global and societal context. 10. Develop enough skills to design systems or components of fuel cells. 11. Can find the applications of all the areas in day to day life.
Indicative Contents	FUEL CELLS includes concept, key components, physical and chemical phenomena in fuel cells, advantages and disadvantages, different types of fuel cells and applications, characteristics, Nernst equation, relation of the fuel consumption versus current output. HYDROGEN ENERGY contain introduction to hydrogen economy, production, storage and transportation systems, hydrogen from fossil fuels, electrolysis of water, thermo chemical cycles, transmission and infrastructure requirements, safety and environmental impacts, economics of transition to hydrogen systems. FUEL CELL DESIGN AND PERFORMANCE: Stoichiometric coefficients and utilization percentages of fuels and oxygen, mass flow rate calculation for fuel and oxygen in single cell and fuel cell. FUEL CELLS -APPLICATION AND ECONOMICS : encompasses Fuel cell usage for domestic power systems, large scale power generation, automobile, space applications, economic and environmental analysis on usage of fuel cell, future trends of fuel cells.

Learning and Teaching Strategies

Strategies	1. Establish Learning Objectives: Clearly define the learning objectives aligned with the program goals and industry requirements; Identify the specific knowledge, skills, and competencies students should acquire by the end of the course.
	2. Using the Internet to Enhance Students' Reading, Writing, and Information-Gathering Skills.
	3. Encourage initiative: Allow students to actively participate in the learning process with class discussions and exercises that support the initiative.
	4. Plan the Curriculum: Development a well-structured curriculum with a logical flow of topics, starting from fundamental concepts to more advanced applications.
	5. Utilize Technology: Utilizing educational technology tools, such as interactive simulations and modeling software.
	6. Engage Students Actively: Encouragement active learning by incorporating interactive activities, discussions, and problem-solving exercises.

Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال السوع	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال السوع	3.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	10% (10)	4,7,11	LO # 1,2,5,10
	Assignments	4	10% (10)	2, 5,7,12	LO # 4,6,9
	Projects / Lab.	N.A	N.A	N.A	
	Report	1	10% (10)	12	LO # 3,7,8,11
Summative assessment	Midterm Exam	2hr	10% (10)	8	LO # 1-7
	Final Exam	2hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	1. Introduction to Fuel Cell
Week 2	2. fuel cell operation
Week 3	3. Electrochemistry of fuel cells (Electro catalysts in fuel cell)
Week 4	4. Fuel Cell Thermodynamics

Week 5	5. Fuel Cells – Green Power
Week 6	6. hydrogen safety
Week 7	7. Hydrogen Property and Production.
Week 8	8 review and midterm exam + Fuel cell efficiency
Week 9	9. hydrogen comparison to conventional fuels
Week 10	10 Hydrogen Distribution
Week 11	11 Hydrogen Storage
Week 12	12. Hydrogen Conversion Technology : (I) Combustion and (II) Metal Hydrides and applications
Week 13	13. fuel cell types
Week 14	14. Fuel Cells as future of clean mobility: Market expectations and challenges
Week 15	15 fuel cell applications
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	Fuel Cell Fundamentals; 2016; by Ryan O'Hayre , Suk-Won Cha , Whitney Colella, Fritz B. Prinz; Publisher: Wiley.	NO
Recommended Texts	Fuel Cells: Principles, Design, and Analysis; 2014; by Shripad T. Revankar (Author), Pradip Majumdar; Publisher: CRC Press.	NO
Websites	https://www.twi-global.com/technical-knowledge/faqs/what-is-a-hydrogen-fuel-cell	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION OF TIDAL ENERGY



University Name: AlKarkh University of Science

College: Energy and Environmental Science

Dept.: Renewable energy

Module Information			
Module Title	Tidal Energy		Module Delivery
Module Type	E 2		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☒ Seminar
Module Code	REE47042		
ECTS Credits	4		
SWL (hr/sem)	100		
Module Level	4	Semester of Delivery	
Administering Department	REE		CRE
Module Leader	Amani Ibrahim		
Module Leader's Acad. Title	Assist. Prof.	Module Leader's Qualification	PhD
Module Tutor		e-mail	
Peer Reviewer Name		e-mail	
Scientific Committee Approval Date		Version Number	

Relation with other Modules			
Prerequisite module		Semester	
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents

Module Aims أهداف المادة الدراسية	1. Knowledge of the concept of Tidal Energy 2. Knowledge the physical principle of Tidal Energy 3. 4. Knowledge of the reality of renewable energy in Iraq 5. Knowledge of the principle of designing environmentally friendly sustainable cities
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Knowledge other forms of ocean energy, such as mechanical energy from waves, currents and tides, and chemical energy from salinity gradients.
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	84	Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الاسبوع	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	22	Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الاسبوع	3.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	1hr	10% (10)		
	Final Exam	3hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المناهج الاسبوعي النظري

	Material Covered
Week 1	Energy from Currents
Week 2	Horizontal Forces, Anchoring Systems
Week 3	Corrosion and Biological Fouling
Week 4	Cavitation, Large Torque
Week 5	Maintenance, Power Transmission
Week 6	Turbine Farms
Week 7	Review & exam
Week 8	Ecology
Week 9	Wave Energy
Week 10	Wave-Energy Converters
Week 11	Offshore Wave-Energy Converters
Week 12	The Velocity of Ocean Waves
Week 13	Wave Height
Week 14	Energy and Power
Week 15	Wavegen System (OWC)
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Fundamentals of Renewable Energy Processes	
Recommended Texts	Handbook on renewable energy source	
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION OF SUSTAINABLE BUILDINGS



Module Information				
Module Title	Sustainable Buildings		Module Delivery	
Module Type	E 3		☒ Theory ☐ Lecture ☐ Lab ☐ Tutorial ☐ Practical ☒ Seminar	
Module Code	REE47042			
ECTS Credits	4			
SWL (hr/sem)	100			
Module Level		4		
Administering Department		REE	College	CRE
Module Leader	Sura Thamir Nasir		e-mail	Sura.thamir91@kus.edu.iq
Module Leader’s Acad. Title		Lecture	Module Leader’s Qualification	
Module Tutor		None	e-mail	E-mail
Peer Reviewer Name		None	e-mail	E-mail
Scientific Committee Approval Date		20/06/2023	Version Number	1.0

Relation with other Modules			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Objectives أهداف المادة الدراسية	The main objectives of a Sustainable Buildings module that covers the basics of Sustainable Buildings and unwanted environmental impacts and limiting these impacts could include: 1. Understanding the basic principles of Sustainable Buildings: This objective would cover the fundamental principles of Sustainable Buildings, including site selection, materials and resources, energy use and air pollution, water use and quality, and indoor air quality. 2. Understanding Site Selection. In addition to the impacts housing developments have on the environment, project location can have an even greater impact if it is too distant from community services and infrastructure. 3. Understanding the Materials and Resources. Negative environmental impacts can be minimized through responsible and intentional use and application of green materials Products that contain a high percentage of rapidly renewable

	resources have a much lighter environmental footprint Materials that are locally mined, harvested and manufactured.
	4. Understanding the Green building and more energy-efficient planning and zoning regulations can result in significant reductions in energy use and atmospheric pollution Energy costs continue to soar and climate change effects are becoming more widespread, so creating stable and predictable operating costs for low- and moderate-income (LMI) homeowners and renters makes good economic sense and preserves long-term housing affordability. 5. Examining Water Use and Quality Buildings also significantly impact water usage and affect water quality through runoff and wastewater contamination Showers, sinks, dishwashers, washing machines and toilets all consume significant amounts of water The per capita water consumption in the Intermountain The region averages about 250 gallons per day. 6. Evaluating the Indoor Air Quality: This objective would cover Many modern building materials that contain dangerous chemicals that off-gas into the atmosphere. Green building addresses this serious health concerns by using materials fewer less chemical content and off-gassing potential Green building also incorporates proper home ventilation to provide an adequate supply of fresh outside air and monitoring for contaminants, such as radon and carbon monoxide.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Understand the fundamental principles of Sustainable Buildings, including site selection, materials and resources, energy use and air pollution, water use and quality, and indoor air quality. 2. Identify the Sustainable Buildings, including site selection, materials and resources, energy use and air pollution, water use and quality, and indoor air quality. Green Building Benefits the Environment. 3. Describe the process of Reducing Material Impacts, Increasing Energy Efficiency and Comfort. 4. Explain the Greenhouse Gas Emissions and Indoor Air Pollution. 5. Evaluate the advantages and disadvantages of Sustainable Buildings. 6. Understand the role that Sustainable Buildings may play in meeting future energy needs and reducing greenhouse gas emissions. 7. Apply critical thinking and problem-solving skills to evaluate complex issues related to Sustainable Buildings. 8. Communicate effectively about Sustainable Buildings concepts and issues with others.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Theory: Green Building Basics - Introduction - Green Building Benefits the Environment -Getting Started with Green Building [6 hrs] The Most Important Element: - The Efficient Use of Energy [6 hrs] The Reality of the Built Environment: - The Problem of Existing Buildings [6 hrs]

	Impacts of Conventional Buildings That Green Buildings Seek to Rectify
	- Energy Use in Buildings [6 hrs] - Greenhouse Gas Emissions and Indoor Air Pollution [6 hrs] - Building Water Use [6 hrs] Land Use and Consumption - Construction Materials - Construction, Operation, and Demolition Waste [6 hrs]

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	1. Lectures: used to introduce and explain key concepts related to Green Building. 2. Interactive discussions: used to engage students in critical thinking and problem-solving related to Green Building through group discussions, debates, case studies, and simulations. 3. Multimedia resources: used to enhance student engagement and understanding of complex concepts related to Green Building through videos, animations, and simulations. 4. Assessment and feedback: used to measure student learning and provide feedback on their progress through quizzes, exams, and projects.
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Student Workload (SWL)

الحمل الدراسي للطلاب محسوب لـ ٥١ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطلاب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطلاب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطلاب خلال الفصل	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطلاب أسبوعيا	3.5
Total SWL (h/sem) الحمل الدراسي الكلي للطلاب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1, #2 and #3, #6
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #5, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #2, #3 and #5
Summative assessment	Midterm Exam	2hr	10% (10)	7	LO #1 - #5
	Final Exam	3hr	50% (50)	16	All

Total assessment	100% (100 Marks)		
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Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Green Building Benefits the Environment
Week 2	Design Integration, Site Location and Selection, Realizing No Cost Measures Through Building Design
Week 3	Reducing Material Impacts, Increasing Energy Efficiency and Comfort, Material Resource Efficiency
Week 4	Building Systems that Reduce Material and Energy Impacts: Green Foundations, Autoclaved Aerated Concrete (Sidebar)
Week 5	Green Floor Framing Systems, Green Wall Systems (Standard Framing Alternatives), Natural Building (Sidebar)
Week 6	Green Roofing Systems, Raised Heel Truss (Sidebar), Green Roofs (Sidebar)
Week 7	Reducing Energy Use and Increasing Comfort: Insulation, Windows and Doors
Week 8	Super Performance Windows (Sidebar), Space and Water Heating, Affordable Radiant Heating Systems (Sidebar)
Week 9	The ENERGY STAR Program — Green Appliances and Lighting, Green Plumbing, Renewable Energy, Building Integrated Photovoltaic (BIPV) Shingles (Sidebar)
Week 10	Water Conservation, Greywater Systems (Sidebar), Improving Indoor Air Quality
Week 11	Recycled, Salvaged Materials and Waste Management
Week 12	Green Building Resources: Energy Efficiency, Building Systems, Foundation Systems
Week 13	Wall Systems, Windows, Composite Decking Materials
Week 14	Green Building Material Sourcing
Week 15	Recycling and Reuse, Renewable Energy
Week 16	Final Exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1- " GREEN BUILDING GUIDE Design Techniques, Construction Practices & Materials for Affordable Housing" by Craig Nielson, LEED AP. 2- " Overview of Green Buildings" by J. Cullen Howe.	No
Recommended Texts		No
Websites	None	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

University Name: ALkarkh University of Sciences

College: Renewable Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information			
معلومات المادة الدراسية			
Module Title	Wind energy		Module Delivery
Module Type	C		☒ Theory ☐ Lecture ☒ Lab ☐ Tutorial ☐ Practical ☒ Seminar
Module Code	REE48043		
ECTS Credits	6		
SWL (hr/sem)	150		
Module Level	4	Semester of Delivery	
Administering Department	REE	College	CRE
Module Leader	Amani Ibrahim Mohamed	e-mail	dr.amani_altmimi@kus.edu.iq
Module Leader's Acad. Title	Assist. Prof	Module Leader's Qualification	PhD
Module Tutor	None	e-mail	None
Peer Reviewer Name	None	e-mail	None
Scientific Committee Approval Date	20/ 6/2023	Version Number	1

Relation with other Modules			
العلاقة مع المواد الدراسية الأخرى			
Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. Describe the basics, principles and concepts of wind energy 2. 1- Describe the basics, principles and concepts of wind energy 3. Calculation of wind energy density 4. Selection of promising areas 5. Design Wind farm 6. Calculation the Efficiency
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Evaluation of wind energy sources 2. Wind farm design 3. Calculate the total productivity of a wind farm 4. Using computer programs for wind energy
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	٧٩		
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	٧١		
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	١٥٠		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction to the concept of renewable energy sources
Week 2	Wind (definition, composition, acting forces)
Week 3	The physical principle of wind power (derivatives)
Week 4	Statistical distributions applied to wind energy (definition and importance)
Week 5	Review & Exam
Week 6	Wind Energy and Weibull Distribution (Defining & Importance)
Week 7	Wind power density and Weibull distribution
Week 8	Wind turbines and power curve
Week 9	Energy efficiency
Week 10	Review & Exam
Week 11	Wind farm
Week 12	Wind farm design
Week 13	WAsP (WIND ATLAS ANALYSIS PROGRAM)
Week 14	
Week 15	
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الأسبوعي للمختبر

	Material Covered
Week 1	Wind rose
Week 2	contour lines of wind speed
Week 3	Persistence of wind direction
Week 4	Basic of Wasp software
Week 5	Basic of sigmaplot software
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	- WIND RESOURCE ASSESSMENT HANDBOOK - WIND ENERGY METEOROLOGY	
Recommended Texts	Fundamentals of renewable energy processes ALDO V.DA ROSA	
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION FOR Solar thermal energy systems



University Name: ALkarkh University of Science

College: Energy and Environmental Science

Dept: Renewable Energies

Module Information

معلومات المادة الدراسية

Module Title	Solar thermal energy systems		Module Delivery		
Module Type			☒ Theory ☐ Lecture ☒ Lab ☒ Tutorial ☐ Practical ☒Seminar		
Module Code	REE48144				
ECTS Credits	7				
SWL (hr/sem)	175				
Module Level		4			Semester of Delivery
Administering Department		REE	College	CRE	
Module Leader	Dr. Mohammad AL dharob		e-mail	Dr.m.aldharob@kus.edu.iq	
Module Leader’s Acad. Title		LECTURER	Module Leader’s Qualification		PHD
Module Tutor	NONE		e-mail	NONE	
Peer Reviewer Name		NONE	e-mail	NONE	
Scientific Committee Approval Date		20/6/2023	Version Number	1	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	REE35027	Semester	5
Co-requisites module		Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. Study solar radiation its (principles and characteristics) 2. Study heat transfer of solar energy system radiation 3. Study the solar heat collectors
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Calculate the solar heat radiation 2. Known the best design of solar heat system 3. Understand the principle of work of solar thermal system. 4. Understand of principle work of the solar heat collectors 5.
Indicative Contents المحتويات الإرشادية	

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students.
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدرا يس المنتظم للطالب خلال الفصل	94		
Unstructured SWL (h/sem) الحمل الدرا يس غ ري المنتظم للطالب خلال الفصل	81		
Total SWL (h/sem) الحمل الدرا يس الك يل للطالب خلال الفصل	175		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introduction of solar thermal energy
Week 2	solar radiation
Week 3	Solar radiation and energy conservation
Week 4	Angles of solar rotation
Week 5	Heat transfer of solar thermal energy
Week 6	Solar thermal power economies
Week 7	Solar thermal energy kinds
Week 8	Mid exam
Week 9	Solar thermal energy parts
Week 10	Solar thermal collectors (1)
Week 11	
Week 12	Solar thermal collectors (2)
Week 13	
Week 14	Active and passive solar heating system
Week 15	
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	Coating color effect of collectors of solar thermal energy
Week 2	
Week 3	Measuring of fluid properties for solar thermal energy
Week 4	
Week 5	The effect of direction and slope of solar thermal energy system
Week 6	
Week 7	Comparison between collector types efficiency

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Principle of solar engineering D.yogi Goswami	Not found
Recommended Texts		Not found
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION

Of Meteorology

University Name: AlKarkh University of Sciences

College: Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information

معلومات المادة الدراسية

Module Title	Meteorology			Module Delivery	
Module Type	C			☒ Theory ☐ Lecture ☐ Lab Tutorial ☐ Practical ☒ Seminar	
Module Code	REE٤٨.٤٥				
ECTS Credits	٤				
SWL (hr/sem)	1٠٠				
Module Level		٤	Semester of Delivery		
Administering Department		REE	College	CRE	
Module Leader	Sura thamir nassir			e-mail	Sura.thamir91@kus.edu.iq
Module Leader's Acad. Title		Lecturer	Module Leader's Qualification		Msc
Module Tutor	NONE			e-mail	NONE
Peer Reviewer Name		NONE	e-mail	NONE	
Scientific Committee Approval Date		20/6/2023	Version Number		1

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	• Provide a solid foundation in the principles and concepts of meteorology and its relevance to climate and weather. • Following up and keeping abreast of the development of climate elements and their devices. • Study the basics of weather and climate elements and phenomena • Harnessing technology to develop education and presenting lectures via computer
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. This course description provides a necessary summary of the most important characteristics of the course and the learning outcomes expected of the student to achieve, demonstrating whether he has made the most of the available learning opportunities. It must be linked to the program description. 2. Studying climate elements and recent trends in the study of weather and climate, relying on advanced scientific programs and techniques, as well as using PowerPoint and climatic and weather devices available in the department's laboratories.
Indicative Contents المحتويات الإرشادية	1. Preparing students to practice the teaching profession after graduation. 2. Preparing students to obtain extensive information about weather and climate elements. 3. Developing the students' personality, as they will complete their studies to become teachers. 4. Contributing to addressing the problems facing students and guiding them professionally.

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	1. Teaching students how to teach this subject 2. Teaching students how to present the material using modern technologies such as data show. 3. Teaching students and developing their abilities to study different climatic conditions resulting from the different elements of weather and climate and their
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phenomena.

4. Teaching students the methods of measuring climatic and weather data and determining their accuracy.
5. Interest in studies that include the atmosphere and what happens in it.
6. Introducing students to weather and climate elements and their measurement devices.
7. Introduce students to weather and climate phenomena and their measurement devices.
8. Teaching students how to use climatic devices.
9. Develop students' ability to identify devices that can be used in the field.
10. Teaching students about modern global trends in the study of weather and climate.

Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	٤٨		
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	٥٢		
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)		
	Assignments	2	10% (10)		
	Projects / Lab.	1	10% (10)		
	Report	1	10% (10)		
Summative assessment	Midterm Exam	2 hr	10% (10)		
	Final Exam	2hr	50% (50)		
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	The earth's atmosphere
Week 2	Warming the earth and the atmosphere
Week 3	Air temperature
Week 4	Humidity, condensation and clouds
Week 5	Cloud development and precipitation
Week 6	Air pressure and winds
Week 7	Atmospheric circulation
Week 8	Air Masses, Fronts, and Cyclones
Week 9	Weather forecasting
Week 10	Air pollution
Week 11	global climate
Week 12	Lights, colors, atmospheric optics
Week 13	Thunderstorms and tornados
Week 14	Hurricanes
Week 15	Energy and Temperature
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1. Renewable and Sustainable Energy Reviews. 2. Essential of meteorology, third edition	yes
Recommended Texts	all modern climatic sources and foreign research in the field of weather and climate	
Websites	www.elsevier.com/locate/rser	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 - 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required



MODULE DESCRIPTION OF NANOTECHNOLOGY



University Name: AlKarkh University of Sciences

College: Energy and Environmental Sciences

Department: Renewable Energy Sciences

Module Information					
Module Title	Material Science Nanotechnology			Module Delivery	
Module Type	C			☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☒ Seminar	
Module Code	REE48046				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level		4	Semester of Delivery		8
Administering Department		REE	College	CRE	
Module Leader	Marwah Mohammed Jasim		e-mail	Marwah.mohammed@kus.edu.iq	
Module Leader’s Acad. Title		Lecturer	Module Leader’s Qualification		Ph.D
Module Tutor	N.A		e-mail	N.A	
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date		20/06/2023	Version Number		1.0

Relation with other Modules			
Prerequisite module		Semester	—
Co-requisites module	None	Semester	—

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	1. The main objective of this course is to introduce and to brief the student about diverse aspects on Nanotechnology. In particular, this course will provide better insights about certain important theories, growth process of nanoparticles and their property with respect to their size effects. 2. provide a foundation semester in the general area of science of nanoscience and nanotechnology. 3. Use the fundamental science and engineering principles relevant to materials that include the relationships between nano/microstructure, characterization, properties, processing, performance and design of materials. 4. the objective of this course is to make the students familiar with the properties behavior and applications and implementation of nanotechnology. This will motivate the students to apply the concepts of Nanoscience and nanotechnology in various fields. The objective of the course is to make the students acquainted with the applications of nanotechnology in various fields such as nanoelectronics, industrial, biomedical and aerospace.
Module Learning Outcomes	Students who complete the course will have demonstrated the following: 1. Apply the students the essential role of Nanotechnology and Nanoscience. 2. Understand the classification nanostructured materials. 3. Understood the principles and Characterization Techniques. 4. Understand various Mechanical, chemical and physical methods for the synthesis of diverse types of nanomaterials (0D, 1D and 2D). 5. Decipher information on the specific details of both bottom up and top-down synthesis. 6. Understand the tools used for nanomaterials characterization, and nanomaterials applications. 7. End of this course, students will be able to hone their creative thinking and problem-solving skills, build synergistic teamwork and enhance their communication skills.
Indicative Contents	Nanomaterials science: Types of Nanomaterials, definition of nanoscale, surfaces and particle size, surface energy and surface tension and relation to size, phase transformation in nanomaterials, specific heat and heat capacity of nanomaterials, mechanical properties of nanomaterials, optical properties of nanomaterials, electrical and magnetic properties of nanomaterials. Synthesis Methods of Nanomaterials : Top down : Milling; Bottom up approaches – Synthesis of zero dimensional metal, metal oxides, semiconductor nanoparticles by different routes – Colloidal method, Sol-gel, Electrodeposition; Kinetically Confined Synthesis of Nanoparticles - Aerosol synthesis, Micellar growth, Spray pyrolysis, Template-based synthesis; Synthesis of one dimensional nanosystems by different routes. Properties of Nanomaterials : includes Electronic Properties, Magnetic and Dielectric properties, Optical Properties, Mechanical Properties. Nanomaterials for Energy System includes the fundamental concepts in energy systems, Nanomaterials for energy conversion systems and nanomaterials for photovoltaic solar energy conversion systems. Advanced Nanomaterials for Nanotechnology: includes Nanostructured Magnetism: Effect Bulk nanostructuring of magnetic property, Giant and colossal magnetic resistance, Nanomagnetic materials, Paramagnetism in metallic nanoparticles, Semiconduction quantum dots. Thermoelectric Materials: Concept of phonon, Thermal conductivity specific heat, exothermic and endothermic processes, Different types of thermoelectric materials. Applications of Nanomaterials : The applications of nanomaterials in environmental improvement are different from one another depending on the type of devices used, for example, solar cells for producing clean energy, nanotechnologies in coatings for building exterior surfaces, and sonochemical decolorization of dyes by the effect of nanocomposite, etc. (11 hrs)

Learning and Teaching Strategies

Strategies	1. Encourage initiative: Allow students to actively participate in the learning process with class discussions and exercises that support the initiative. 2. Using the Internet to Enhance Students' Reading, Writing, and Information-Gathering Skills. 3. Establish Learning Objectives: Clearly define the learning objectives aligned with the program goals and industry requirements; Identify the specific knowledge, skills, and competencies students should acquire by the end of the course. 4. Plan the Curriculum: Development a well-structured curriculum with a logical flow of topics, starting from fundamental concepts to more advanced applications. 5. Engage Students Actively: Encouragement active learning by incorporating interactive activities, discussions, and problem-solving exercises. 6. Utilize Technology: Utilizing educational technology tools, such as interactive simulations and modeling software.
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Student Workload (SWL)

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	63	Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال السوع Q4	4
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	37	Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الاسوع Q4	2.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	10% (10)	4,7,11	LO # 1,2,5,10
	Assignments	4	10% (10)	2, 5,7,12	LO # 4,6,9
	Projects / Lab.	1	N.A.	N.A	N.A
	Report	1	10% (10)	12	LO # 3,7,8,11
Summative assessment	Midterm Exam	1 hr	10% (10)	8	LO # 1-8
	Final Exam	3hr	60% (60)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to Nanotechnology
Week 2	Nanoscience and Nanotechnology
Week 3	Classification of Nanomaterials
Week 4	Types of Nanoparticles (NPs)
Week 5	nanocomposite and nanomaterials
Week 6	Sources of nanoparticles in the environment
Week 7	Design and Synthesis of Nanomaterials
Week 8	Midterm exam + Review
Week 9	Carbon-Based Nanomaterials.
Week 10	Properties Nanomaterials
Week 11	Nanomaterials for Energy System
Week 12	Computational Nanotechnology
Week 13	Characterization Techniques of Nanomaterials
Week 14	Advanced Nanomaterials for Nanotechnology
Week 15	Applications of nanotechnology in renewable energies
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	1. Advances in Nanotechnology and the Environment, Juyoung Kim, CRC Press, Taylor and Francis Group.). 2. Ghuzang G.Cao, Nanostructures and Nanomaterials: Synthesis, properties and applications, Imperial College Press, 2004. 3. C. C. Koch, —Nanostructured Materials: Processing, Properties and Applications, 2nd Edition, Ed.: 2007 4. G. Cao, Nanostructures and Nanomaterials – Synthesis, Properties and Applications, Imperial College Press 2006	NO
Recommended Texts	1. Nanomaterials – An introduction to synthesis, properties and applications, D. Vollath, Wiley-VCH, Second Edition. 2. Processing & properties of structural nanomaterials - Leon L. Shaw, Nanochemistry: A Chemical Approach to Nanomaterials, Royal Society of Chemistry, Cambridge UK 2005	NO
Websites		

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقوول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.



MODULE DESCRIPTION OF ECONOMICS OF ENERGY

University Name: ALkarkh University of Science

College: Renewable Energy and Environmental Sciences

Dept: Renewable Energy Sciences

Module Information					
Module Title	Economics of energy		Module Delivery		
Module Type	C		☒ Theory ☒ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☒ Seminar		
Module Code	REE48147				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level		4	Semester of Delivery		8
Administering Department		REE	College	CRE	
Module Leader	Firas Abdulrazzaq Hadi		e-mail	Firas.A.Hadi@kus.edu.iq	
Module Leader’s Acad. Title		Asst. Prof.	Module Leader’s Qualification		Ph.D.
Module Tutor	Firas Abdulrazzaq Hadi		e-mail	NONE	
Peer Reviewer Name		NONE	e-mail	NONE	
Scientific Committee Approval Date		20/6/2023	Version Number	1	

Relation with other Modules			
Prerequisite module	REE47039	Semester	7
Co-requisites module	No	Semester	No

Module Aims, Learning Outcomes and Indicative Contents

Module Aims	This course aims to familiarize students with the economics of energy markets and the associated environmental policies. It will help students in developing the tools to examine the energy markets and to assess the effectiveness of environmental regulations.
Module Learning Outcomes	Professional Development: Graduates will embody a general awareness of issues in agricultural and natural resource management and their implications in a larger societal context. Students will begin to develop a network of personal and professional connections which will foster an understanding of the culture surrounding professional expectations and conduct. Communication Skills: Graduates will demonstrate proficiency in oral and written communication in terms of substance, organization, mechanics, documentation, and synthesis. Proficient students will have the ability to clearly communicate findings, critically and analytically, at a professional level within their chosen career.
Indicative Contents	This course examines energy and environment issues from an economics perspective. The course begins by discussing fundamental concepts in energy economics. We examine the structures of oil, natural gas and electricity markets, and policies regarding renewables, transportation, and climate change. We also cover the topics of pollution and sustainable economic growth. We discuss the effectiveness of environmental policies such as mandated technologies, taxes, subsidies and pollution permit trading. This course incorporates the issue of climate change in the economic analysis, as it is now acknowledged as an important constraint and policies are aimed at decarbonizing the economy

Learning and Teaching Strategies

Strategies	1- Speaking 2- Discussion 3- Reports 4- Projects 5- Assignments
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Student Workload (SWL)

Structured SWL (h/sem)	63	Structured SWL (h/w)	4
Unstructured SWL (h/sem)	62	Unstructured SWL (h/w)	4.1
Total SWL (h/sem)	125		

Module Evaluation

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5,10	LO #1,2 and 8,9,15
	Assignments	2	10% (10)	2,12	LO # 5,6,7,10
	Projects / Lab.	1	10% (10)	-	
	Report	1	10% (10)	13	LO #3,4,11,12,13,14
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-8
	Final Exam	2hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Overview of Energy Economics, Energy Statistics, Energy
Week 2	Economic Foundations of Energy Demand
Week 3	Empirical Analysis of Energy Demand
Week 4	Energy Demand Management
Week 5	Energy Efficiency
Week 6	Economics of Non-renewable Energy Supply
Week 7	Economics of Renewable Energy Supply
Week 8	Energy Markets
Week 9	History of Oil Industry and the International Oil Market
Week 10	Economics of Environment Protection
Week 11	Environmental Protection and Pollution
Week 12	Climate Change Economics
Week 13	Environmental Effects
Week 14	Economics of RE
Week 15	Economics of Non-RE
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	/
Week 2	/
Week 3	/
Week 4	/
Week 5	/
Week 6	/
Week 7	/

Learning and Teaching Resources

	Text	Available in the Library?
Required Texts	Handbook of Global Energy Policy by Andreas Goldthau	
Recommended Texts	1- Energy Trading and Risk Management by Iris Mack 2- There is no textbook for this course. However, we will be assigning a few sections from Pindyck, R., and D. Rubinfeld (2005) primarily for review purposes:	
Websites	https://economics.colostate.edu/wp-content/uploads/sites/7/2018/03/ECON-444.001-Syllabus-SP18-Burkhardt.pdf	



MODULE DESCRIPTION FOR

Nuclear energy

University Name: Alkarkh University of Science

College: Renewable Energy and Environmental Sciences

Dept: renewable energy Sciences

Module Information

معلومات المادة الدراسية

Module Title	Nuclear Energy			Module Delivery	
Module Type	Elective			☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	REE480 E2				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level		4	Semester of Delivery		1
Administering Department		REE	College	CRE	
Module Leader	Luma jamal abbas		e-mail	Luma.jamal@kus.edu.iq	
Module Leader’s Acad. Title		Lecturer	Module Leader’s Qualification		Ph.D
Module Tutor	NONE		e-mail	NONE	
Peer Reviewer Name		NONE	e-mail	NONE	
Scientific Committee Approval Date		20/6/2023	Version Number	1	

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Aims أهداف المادة الدراسية	1. To have knowledge about nuclear technologies. 2. To have knowledge about radiation, radiation units, usage areas. 3. To have knowledge about radiation safety. 4. To have knowledge about nuclear energy production 5. To be familiar with the terminology of nuclear technologies. 6. To have basic knowledge about energy production by nuclear fission. 7. To know the formation and results of nuclear reactions
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Fundamentals of Nuclear Power is a course in which the main topics of nuclear energy education such as reactor physics, reactor technology, reactor safety, health physics, radiation physics and technology are all considered as parts of a whole and aims to provide students with a general nuclear engineering formation.
Indicative Contents المحتويات الإرشادية	1. Reactor physics and theory and technology of nuclear power plant. Topics • Reactor Physics. Introduction to Nuclear Power • Nuclear stability and radioactive decay • Nuclear reactions • Nuclear fission, fission products • Nuclear reactor fuels • Different types of nuclear reactors by: fuel and coolants • Thermal reactors: PWR, BWR • Nuclear PP major Components for Thermal reactors • Components of the reactor vessel • Core, Shield • Heat Exchanger • Condenser • Coolant, moderator • Control materials: Control Rods, Liquid materials, Installed poisons • Creating Electricity

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The lectures will consist of interactive power point presentations, videos, handouts, and other educational materials. Students are responsible for the material covered in the course materials. The knowledge will be evaluated via homework assignments, short quizzes and take-home exams..
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Student Workload (SWL)

الحمل الدراسي للطالب

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	الحمل الدراسي المنتظم للطالب اسبوعيا	
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	الحمل الدراسي غير المنتظم للطالب اسبوعيا	
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5,10	1-5
	Assignments	2	10% (10)	2,12	5-10
	Projects / Lab.	1	10% (10)	continuous	
	Report	1	10% (10)	13	10-12
Summative assessment	Midterm Exam	2 hr	10% (10)	17	13-15
	Final Exam	2hr	50% (50)	16	16
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Nuclear properties
Week 2	Mass of nucleus
Week 3	Charge of nucleus
Week 4	Nuclear density
Week 5	Binding energy
Week 6	Spin and parity of the nucleus

Week 7	energy, work, and power of the body
Week 8	Statics Energy separation
Week 9	Nuclear decay Nuclear fuel
Week 10	Gamma decay Alpha decay Nuclear fusion
Week 11	Beta decay Nuclear fission
Week 12	Interaction radiation with matter
Week 13	Interaction of photons
Week 14	Elastic scattering and inelastic scattering
Week 15	Compound nucleus
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الأسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Basic properties of nucleus, Springer, 2003. NUCLEAR FISSION AND FUSION, Welter Class publishing.	

Recommended Texts	NUCLEAR PHYSICS, of the European Physical Society October 2016	
Websites	https://www-nds.iaea.org/	

Grading Scheme مخطط الدرجات				
Group	Grade	التقدير	Marks (%)	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required
Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.				



Module Description of Impact production energy on the environment

Module Information

Module Title	Impact production energy on the environment			Module Delivery	
Module Type	E			☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	REE48048 E2				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level		4	Semester of Delivery		8
Administering Department		REE	College	CRE	
Module Leader	Hasan Mohammed Luaibi		e-mail	hasan.luaibi@kus.edu.iq	
Module Leader's Acad. Title		Assistant Professor	Module Leader's Qualification		Ph.D
Module Tutor	None		e-mail	E-mail	
Peer Reviewer Name		None	e-mail	E-mail	
Scientific Committee Approval Date		20/06/2023	Version Number		1.0

Relation with other Modules

العلاقة مع المواد الدراسية الأخرى

Prerequisite module	None	Semester	
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents

أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

Module Objectives أهداف المادة الدراسية	The main objectives of impact production energy on the environment module that covers the basics of production energy and how it effects on the environment , which include: 1. Understanding the students to the concept of the effects of production of energy on the environment and the laws and legislation that have been developed to reduce them and its great importance in the specialization of our college and our department and its relationship to providing alternative, clean and renewable energy instead of energy production that leads to environmental pollution and its significant effects on climate change and community health. 2. Understanding the students to the difference between non-renewable energy types and their sources and renewable energy types and their sources, which are commensurate with the student's academic level, and also commensurate with the cognitive objectives of the department to which the student belongs. 3. Understanding the students to most important international and local laws and regulations to reduce environmental pollution resulting from the production of non-renewable energy.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The students will be able to: 1. How can discover the effects of production of energy on the environment. 2. How can to distinguish between non-renewable energy types and their sources and renewable energy types and their sources. 3. How can reading important international and local laws and regulations to reduce environmental pollution resulting from the production of non-renewable energy.
Indicative Contents المحتويات الإرشادية	Indicative content includes the following. Theory: - Introducing to the concept of the effects of production of energy on the environment. [6 hrs.]. - The types of production the non-renewable energy. [3 hrs.]. - The sources of the non-renewable energy. [3hrs] - The types of production the renewable energy. [6 hrs.] - The sources of the non-renewable energy. [3hrs.] - Environmental reality in the world as a result of conventional energy production [9 hrs.] - Global warming phenomena. [3 hrs.] - Using the renewable energy as alternative of the non-renewable energy. [9 hrs.] - The important international and local laws and regulations to reduce environmental pollution resulting from the production of conventional energy. [3 hrs.]

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies

- 1. Lectures:** used to introduce and explain the concepts of the effects of production of energy on the environment and the laws and legislation that have been developed to reduce them and its great importance in the specialization of our college and our department and its relationship to providing alternative, clean and renewable energy instead of energy production that leads to environmental pollution and its significant effects on climate change and community health, and what the difference between non-renewable energy types and their sources and renewable energy types and their sources, which are commensurate with the student's academic level, and also commensurate with the cognitive objectives of the department to which the student belongs, in addition to most important international and local laws and regulations to reduce environmental pollution resulting from the production of non-renewable energy.
- 2. Interactive discussions:** used to engage students in critical thinking and problem-solving questions related to using the renewable energy as alternative of the conventional energy in Iraq through group discussions, debates, case studies, and simulations.
- 3. Multimedia resources:** used to enhance student engagement and understanding of complex concepts related to the effects of production of energy on the environment through videos, and animations.
- 4. Assessment and feedback:** used to measure student learning and provide feedback on their progress through quizzes, exams, and projects.

Student Workload (SWL)

الحمل الدراسي للطالب محسوب لـ ٥١ اسبوعا

Structured SWL (h/sem) الحمل الدراسي المنتظم للطالب خلال الفصل	48	Structured SWL (h/w) الحمل الدراسي المنتظم للطالب أسبوعيا	3
Unstructured SWL (h/sem) الحمل الدراسي غير المنتظم للطالب خلال الفصل	52	Unstructured SWL (h/w) الحمل الدراسي غير المنتظم للطالب أسبوعيا	3.5
Total SWL (h/sem) الحمل الدراسي الكلي للطالب خلال الفصل	100		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5 and 10	LO #1, #2 and #3, #6
	Assignments	2	10% (10)	2 and 12	LO #3, #4 and #5, #7
	Discussions	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #2, #3 and #5
Summative assessment	Midterm Exam	1hr	10% (10)	7	LO #1 - #5
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج الاسبوعي النظري

	Material Covered
Week 1	Introducing to the concept of the effects of production of energy on the environment.
Week 2	Introducing to the concept of the effects of production of energy on the environment.
Week 3	The types of production the non-renewable energy.
Week 4	The sources of the non-renewable energy.
Week 5	The types of production the renewable energy.
Week 6	The types of production the renewable energy.
Week 7	The sources of the non-renewable energy.
Week 8	Med term exam + Environmental reality in the world as a result of conventional energy production
Week 9	Environmental reality in the world as a result of conventional energy production
Week 10	Environmental reality in the world as a result of conventional energy production
Week 11	Global warming phenomena.
Week 12	Using the renewable energy as alternative of the non-renewable energy.
Week 13	Using the renewable energy as alternative of the non-renewable energy.
Week 14	Using the renewable energy as alternative of the non-renewable energy.
Week 15	The important international and local laws and regulations to reduce environmental pollution resulting from the production of conventional energy.
Week 16	Final Exam

Delivery Plan (Weekly Lab. Syllabus)

المنهاج الاسبوعي للمختبر

	Material Covered
Week 1	
Week 2	
Week 3	
Week 4	
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	1) John P. Holdren and Kirk R. Smith, energy the environment and health, chapter three, 2015. 2) The Energy and Resources Institute, 2014, Waste to Resources: A Waste Management Handbook.	No
Recommended Texts	1) Most federal environmental laws and regulatory agencies weakened since 2000.	No
Websites	1) NATO's Smart Energy Team (SENT) final report, (2015) http://www.natolibguides.info/ld.php?content_id=18110194 . 2) Taken from http://www.epa.gov/epaoswer/non-hw/muncpl/reduce.htm .	

Grading Scheme

مخطط الدرجات

Group	Grade	التقدير	Marks %	Definition
Success Group (50 - 100)	A - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	FX – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.